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INDEX.

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WESTERN ELECTRICIAN

EVERY SATURDAY

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Lichtenberg Gas-engine Central Station.

By Frank C. Perkins.

Some of the German central stations in small towns and villages are provided with internal-combustion engines instead of steam engines, this type of prime mover being considered economical for small plants, particularly where illuminating gas can be obtained as a fuel at low prices, as is the case in many sections of that country.

A number of the smaller cities have installed gas-engine-driven central stations, using gas producers of the suction type to good advantage. The accompanying illustration shows such a station at Lichtenberg, near Berlin. This city has a population of 43,370 and is supplied with electric current for light and power service from a three-wire system of direct-current mains with a pressure of 2 × 220 volts. A storage-battery plant is utilized in connection with the gas-engine installation for regulation and for caring for the peak of the load.

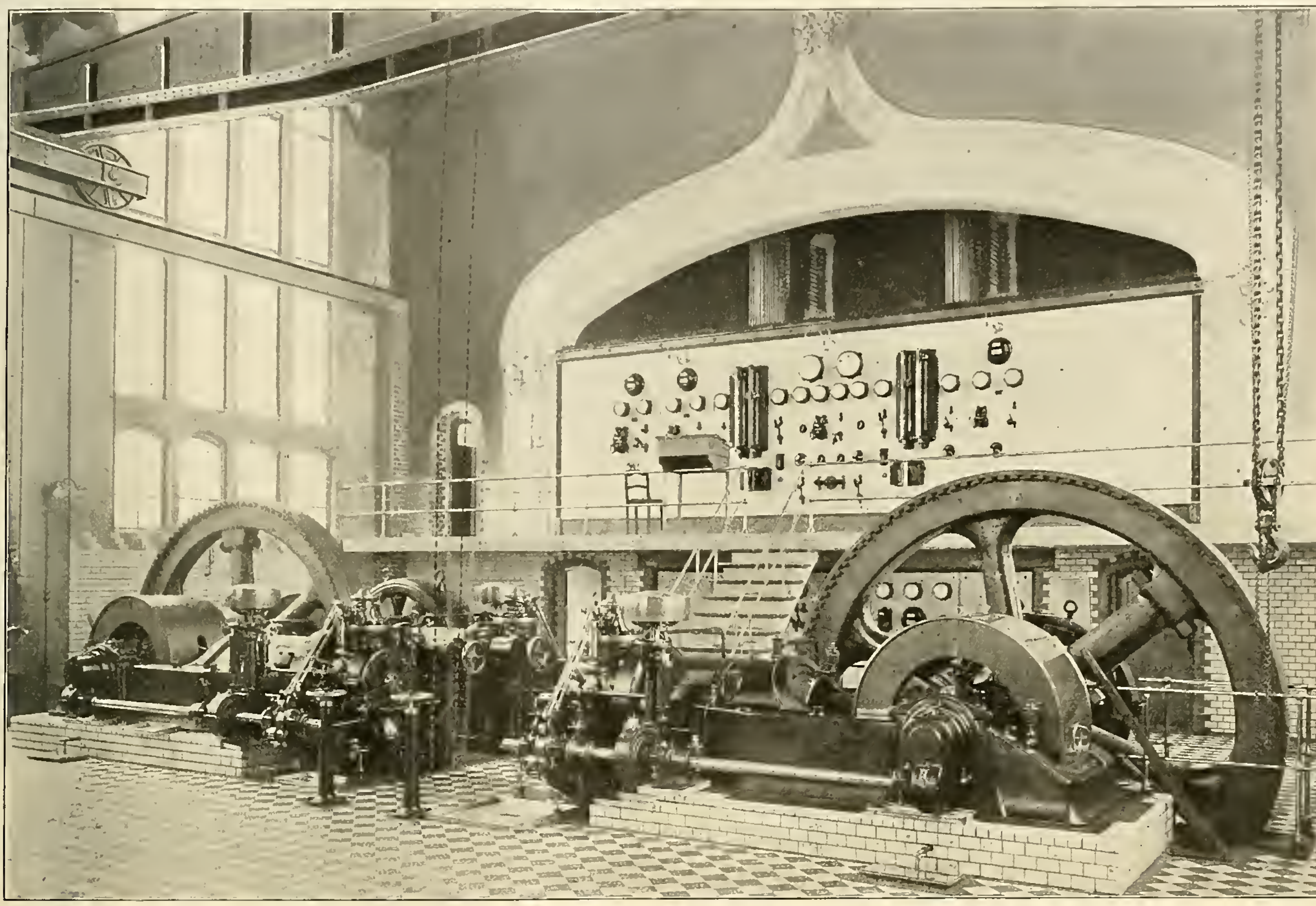
In the power house, as noted in the picture, there are two units of 300 horsepower each, directly coupled to direct-current dynamos of 220 volts. The end-cell switches of the storage-battery installation are mounted on the switchboard in the gallery shown in the background, together with the generator switches, rheostats and measuring instruments necessary for such a plant. There are nine marble panels in this board, six of which are already equipped with electrical instruments and switches for the present plant, the others being held in reserve for an extension of the power equipment.

The two 300-horsepower gas engines are supplied with fuel from a gas-producer plant of 500-horsepower capacity, this being a double-acting Nuremberg gas generator which will carry a load of considerably above the normal rating.

The Lichtenberg gas engines are so arranged that they may be operated either from producer gas or from illuminating gas, as desired, the necessary connections being made so that in case of an emergency illuminating gas may be employed at a moment's notice.

The storage-battery plant has a capacity of 65 kilowatt-hours at normal discharge rate, and during light load the engines and generators are storing current to be employed during the peak of the load when both the engine plant and the storage battery are working together.

On the lighting circuits there are 800 incandescent lamps of 50 watts each, connected together with 48 arc lamps of 10 amperes each, while the power service includes a large number of small motors having a total capacity of 872 horsepower.



GAS-ENGINE-DRIVEN CENTRAL STATION AT LICHTENBERG, NEAR BERLIN, GERMANY.

The plant cost about 675,000 marks ($162,000) and is said to have given an excellent account of itself in the past year. The rate charged for lighting service is 40 pfennig (9.6 cents) per kilowatt-hour, and for power service 11 pfennig (2.64 cents) up to 5,000 kilowatt-hours; above this the charge being reduced to 10 pfennig (2.4 cents) per kilowatt-hour.

It is maintained that the gas engine in its present state of development with the modern gas producer is an ideal prime mover for small electric-lighting stations in towns and villages as well as the smaller cities ranging up to 50,000 inhabitants.

Impregnation of Poles.

William L. Hall, chief of the United States Forest Service, says that while the work of impregnating poles by the open-tank or brush treatment has been too recent to permit the decay of the poles in any event, he is nevertheless prepared to say without hesitation that the increase in life of the poles will be more than sufficient to repay the cost of treatment. He adds: "It is well known that a thorough impregnation with a good grade of creosote will render wood immune to decay for a long term of years, and judging from the condition of the butts of the poles after treatment by the open-tank process and from our knowledge of the antiseptic qualities of the preservative, there can be little doubt as to the securing of a decided increase in life."

Transformer Peak Loads.

An important problem in the operation of central-station service is the selection of the proper size of transformers in relation to the peak load anticipated. If too low capacity is selected on the one hand, great danger of burnouts is liable to result at a time when the majority of the company's consumers demand the best service.

In electric-railway work it is not a very serious matter if the voltage in the rush hours drops off somewhat below the average on the lines during the hours of lighter traffic, but in central-station practice the conditions are radically different. In the former case schedules may be slowed down a little and the lamps in the cars may not give quite as satisfactory light. It is a question of the increased cost of extra feeders balanced against the expense of a few more minutes' layover allowance at the ends of the lines, including the expense of "setback" cars. Reduced voltage on residence lighting circuits, however, appears at once in poor illumination, and as many rooms are lighted with but one or two 16-candlepower lamps at a time the fall in potential at the lamp, due to inadequate transformer capacity, is much more serious in its effect on the lighting of the individual room.

Too high capacity in the individual transformer means excessive core and primary resistance losses, with unduly high interest and depreciation charges. While circumstances in a general way limit the desirable size in each particular case, it is fair to assume with transformers of reliable make that each unit is good for from 25 to 50 per cent. overload during the hours of peak consumption. To quite an extent the ratio depends upon the length of time the peak load is on. If the peak lasts about half or three-quarters of an hour at the outside the capacity of the transformer can be safely figured at from 50 to 60 per cent. of the maximum. If the load consists of lights only, the connected capacity can be close to the peak value. If small motors and lights are run off the same transformer it is seldom wise to allow the connected capacity to greatly exceed 50 per cent. more than the peak load.

It is advantageous to determine the actual maximum load on the individual transformer after it is placed in service, in order to be sure that no unknown factors have entered the operating situation. Probably the best way to do this is to install temporarily a Wright demand meter on the primary side of the transformer. It was pointed out in the 1907 National Electric Light Association Question Box that some electric manufacturing companies make a current transformer of the split-ring type, which can be clamped around a wire without cutting into it. These instruments are insulated for use on 2,300-volt circuits and are furnished with leads and portable ammeters, the sizes being 125 and 250 amperes in two cases.

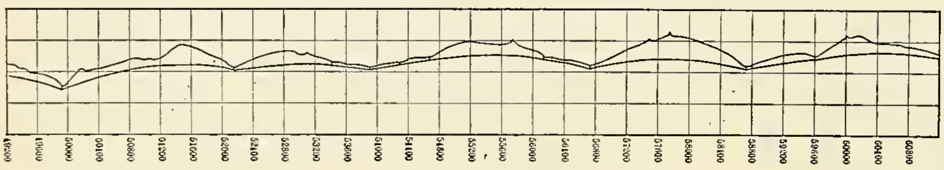
The load on the primary side of a transformer can be readily measured in this way, though small transformers can be conveniently checked by measuring the secondary current. The great advantage of the Wright demand meter for this work, however, is its continuous record of the maximum current consumption, regardless of the time of day or night at which it occurs. Approximations are therefore avoided. Mr. F. C. Sargent of the Malden (Mass.) Electric Company uses for this purpose a plug made with a cable attachment, the plug being a duplicate of the plug used on the cut-out of the transformer. By removing the transformer plug and inserting the cable plug, the cable being attached to a Wright demand meter, and leaving it in circuit three days to a week, the maximum load can be easily determined. The meter goes in series with one primary lead.

H. S. K.

Some Power Transmission Economics.[1]

By Frank G. Baum.

In designing power transmission systems it is always well to bear in mind that the ultimate development of the art and of the country has not yet been reached. The wise manager or engineer builds to meet existing conditions, looking into the future as far as he can. It may not be as difficult to determine the proper power station and line to build when unlimited capital and ideal power conditions exist as when there is restricted capital, limited revenue and low-priced power at the consumer's end.



Distances in feet.

FIG. 1. PROFILE OF MOUNTAIN POLE LINE.

To illustrate the necessity of doing things in inexpensive ways in the early development of an art, a business or a country, some examples are given of the work done on the system of the California Gas and Electric Corporation. Along some of the lines where the load is small, one wire only is run to the sub-station, an inexpensive building, and one transformer, with ground return, is installed. One-phase motors are used. For larger stations, sometimes up to 500 kilowatts, two wires are run to the sub-station, and by using ground return on the primary and open delta on the secondary, three-phase motors are operated. Loads as large as 1,500 kilowatts have been carried to a distance of 100 miles on two transformers Y-connected on the primary, with grounded neutral, and open delta on the secondary. Neither the power consumer nor the power-house operator has noted anything unusual.

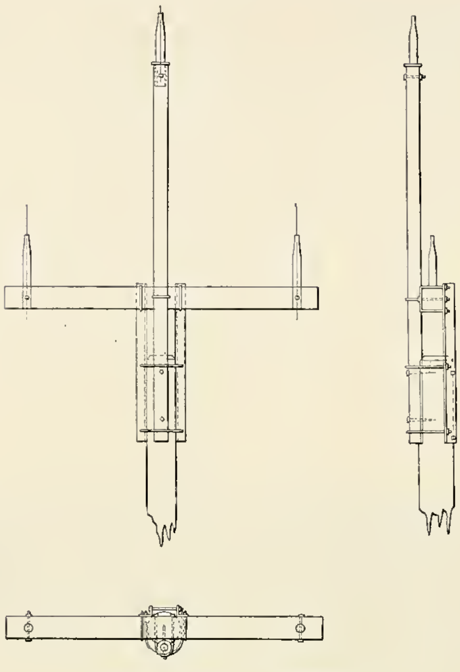


FIG. 3. POLE-TOP EXTENSION.

For larger sub-stations a single three-phase transmission line supplies the load, even where the length is 50 miles or more. The consumer cannot afford to pay for a duplicate line when the output per year of the factory is practically unaffected by interruptions. Interruptions amounting to one hour per month would be one-seventh of one per cent. of the total time, and the power company that has an average of an hour's interruption per month is certainly giving very bad service. It is evident that the construction of a duplicate pole-line for such service is entirely unwarranted.

As to the construction of pole lines, it has been found that in some parts of the West where cedar poles may be purchased at a low price, this class of pole lines is still the most economical, and everyone must admit that this type of construction has proved remarkably effective. Of course under certain conditions tower lines only would be considered, but two wooden pole lines entering a city by two different routes will give greater reliability than any two-circuit tower line that can be built. The cost of a two-circuit tower line would be as great as that of two pole lines. A line using tower construction requires a private right-of-way, and in a new country it may not be possible to pay from the earnings the interest on the increased cost of the right-of-way as well as on the tower construction. The engineer, of course, always prefers the best construction, but he must consider the net revenue to be derived from an enterprise in a given number of years. In mountain sections the economies of line construction lie in the use of the hills for the structures and in using long spans. In some cases the amount saved in clearing, in poles, insulators and labor will amount to 50 per cent.

Fig. 1 shows a profile of a line recently constructed, the middle section of which consists of a series of spans varying in length from 700 to 2,700 feet. It will be seen that by taking advantage of the hills to form the greater part of the height of the structure great economy results. A span of 3,000 feet, with an allowable sag of 300 feet, would, if on the level, require towers over 300 feet high, while in this line on similar spans simple wooden pole strctures 30 feet high are all that is necessary. The profile of a line of this kind is first determined, and the span-length and structures designed so that the wires clear the ground sufficiently. This gives an economical and satisfactory line.

On long spans the wires are spread at the structures as shown. In addition the top or middle wire is given 10 to 40 feet less sag (depending on the span) than any of the others. One of the outside wires is also given 5 to 20 feet less sag than the other. In this way there is obtained a vertical separation at the middle of the span; and 10 feet of vertical separation is better than 20 feet of horizontal, because the wires then cannot come together, even when acted upon by gusts of wind having a tendency to lift the wires. Spans greater than 2,000 feet are not installed except in certain cases where it can scarcely be avoided. Spans of 600 to 1,500 feet give the best line.

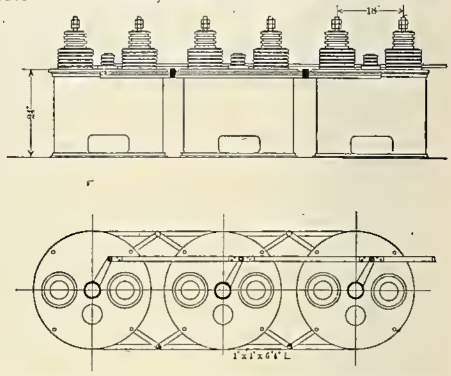
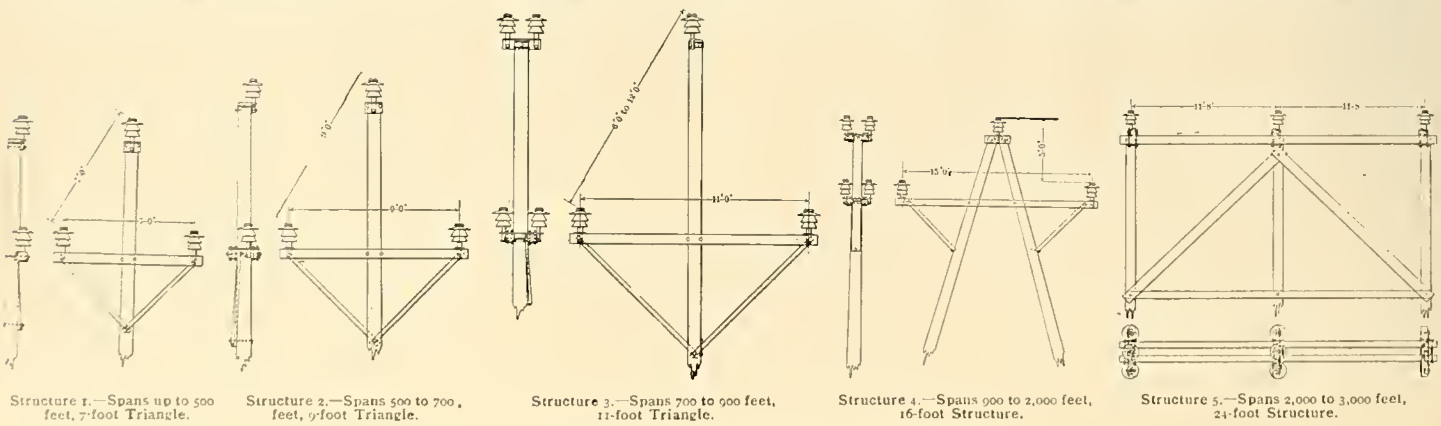


FIG. 4. THREE POLE GROUPING OF OIL SWITCHES.

Fig. 2 shows standard types of pole structures used on some of the mountain lines recently constructed in California. Structures of this kind are also sometimes used for river crossings where the cost of steel towers is prohibitive, or the time too short to install them. These are sometimes over 100 feet high.

Referring to old lines which were constructed 10 or even five years ago, nearly all the lines were built with 40 poles to the mile, using 35-foot poles. Now the tendency is to use longer spans on account of the lower cost and the reduced number of insulators or weak points in the line. Some of these old lines have later to be reconstructed for a higher voltage, and in order to obtain a reasonably good line and also to reduce the cost for insulators and future line maintenance it is advisable in reconstructing to reduce the number of poles. To do this the supporting points of the wires must be raised higher above the ground. In order to accomplish the result of reinsulating and reconstructing several hundred miles of line (which would have kept all the insulator factories busy for two years furnishing insulators for the old type of construction), the pole-top extension shown in Fig. 3 was used. This has proved effective. By using this pole-top extension, every other pole is taken out, with a saving of $9 per pole for new insulators, with the additional salvage of the old poles, arms, pins and insulators. Where sufficient height can be obtained by putting the arm below the top of the pole this construction may be simplified in the fastening of the arm and pipe to the pole.



Structure 1.—Spans up to 500 feet, 7-foot Triangle. Structure 2.—Spans 500 to 700, feet, 9-foot Triangle. Structure 3.—Spans 700 to 900 feet, 11-foot Triangle. Structure 4.—Spans 900 to 2,000 feet, 16-foot Structure. Structure 5.—Spans 2,000 to 3,000 feet, 24-foot Structure.

FIG. 2. STANDARD TYPES OF POLE STRUCTURES USED IN CALIFORNIA.

1. Abstract of a paper read at the convention of the American Institute of Electrical Engineers, Niagara Falls, N. Y., June 26, 1907.

Another important adjunct of the transmission line is the switches, oil and disconnecting. It will be found that the same arguments regarding economical line construction apply to switches. In selecting switches and structures for high-tension lines it is well to bear in mind that the ultimate development has not yet been reached. In solving our switch problem this was kept in mind at all times.

The first high-tension oil switches were made as inexpensive and as simple as possible. These operated so satisfactorily that we became convinced of the success of the type and soon changed to a more substantial form. They are generally installed for hand operation. Although we have more than 100 of these switches on our lines, and nearly 1,000 miles at 60,000 volts all tied together, and over 50,000 kilowatts in generators operating

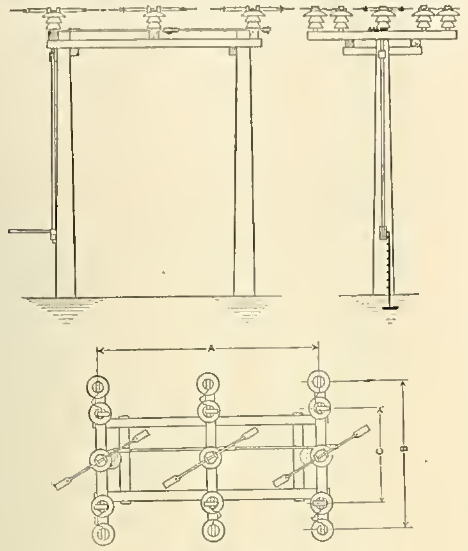


FIG. 5. OUTDOOR TWO-BREAK AIR SWITCH.

on the lines at all times, the switches, although cheaply constructed, have given excellent results. All line switching is done on these high-tension switches, and the plants and lines are separated thereby in case of trouble. The stations are synchronized at sub-stations, which are 100 to 150 miles from any power station.

We have now adopted two-break switches for the ordinary station and four-breaks in each tank for the heavy service. These switches are grouped in three-pole arrangement as shown in Fig. 4.

For small sub-stations and for line-sectionalizing switches and for disconnecting from bus-bars, switches of the type shown in Figs. 5 to 8 are used. In handling the high-tension lines these switches are used as much as the oil switches.

The California Gas and Electric Corporation's

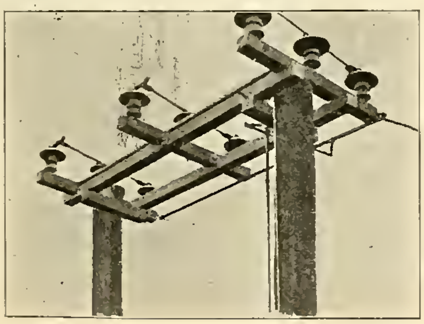


FIG. 6. OUTDOOR SWITCH.

high-tension lines are also practically distributing lines, as loads are taken off at a great many points. We have more than 100 sub-stations on our lines. Such a system is, of course, much more difficult to operate than a straight away line with a power station at one end and a load at the other.

On the hydraulic construction and also on the power-house and sub-station installation and construction the engineer is required to devise something that will pay the largest net income in a given number of years.

I have given these examples of line and switch construction to show that the best solution of a problem may be one which accomplishes the pur-

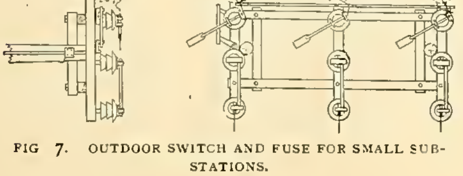


FIG 7. OUTDOOR SWITCH AND FUSE FOR SMALL SUB-STATIONS.

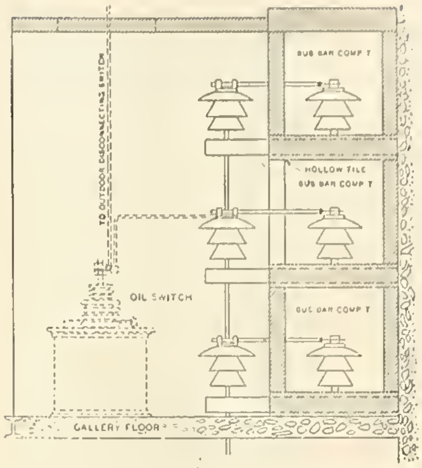


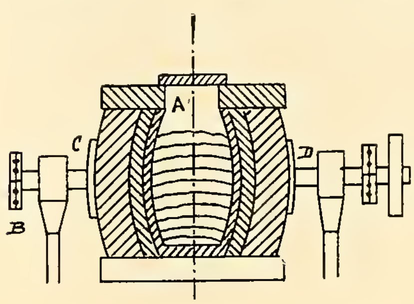
FIG. 8. SIDE VIEW OF OIL SWITCH IN COMPARTMENT, SHOWING DISCONNECTING SWITCHES.

pose satisfactorily with the least amount of money on account of the changes in design which become apparent as our experience is broadened and as the industry develops. That there will be further advances is certain, but as far as high-tension work is concerned, little of the present apparatus—transformers, insulators, switches—need be thrown away; for should the line voltage be forced up, the present apparatus may be used on the lower voltage lines. And, too, the high-tension transformer is so flexible in its operating voltage connections that use can always be found for it. It is very probable that in time higher voltage trunk lines will be built which will feed into the present lower pressure (60,000 volts) lines at various points, using the present 60,000-volt lines for the primary distribution, stepping down to about 11,000 for the regular factory distribution. An example of work of this kind is shown by our system. A great many miles of comparatively low-tension lines—10,000 to 23,000—have been changed to higher voltage, but all the old line material, switches, insulators, transformers, etc., have been again utilized.

The saving in conducting capacity and the improvement in the service and the salvage have well paid for all the changes. No doubt a part of the future work of the electrical engineer will be to redesign and reconstruct the high-tension systems for the economies to be gained. The ease by which the change to the higher voltage may be made as necessity arises is encouraging alike to the transmission engineer and to the investor.

Electric Furnace for Producing Ferro-vanadium.

In France the preparation of different metals and alloys on a commercial scale by the electric-furnace process is being actively carried on in many large establishments which have been erected for the purpose during a recent period. The accompanying diagrams illustrate a newly designed furnace which is used to produce an alloy of iron and vanadium. This product, which is known as ferro-vanadium, is now employed in considerable



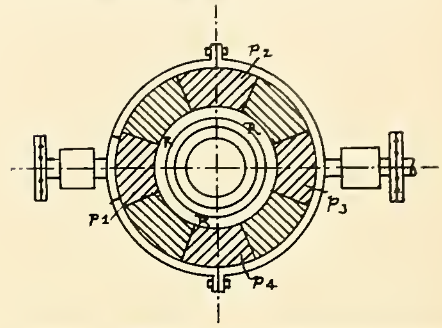
SECTIONAL VIEW OF ELECTRIC FURNACE FOR PRODUCING FERRO-VANADIUM.

quantity in the different metallurgical industries.

Professor Moissan, in his first researches, succeeded in forming iron and vanadium alloys in varying proportions in his tube electric furnace, and also pure vanadium, mixed with carbon in different percentages. Thus he obtained ingots of the metal which contained from nine to 10 per cent. of carbon by mixing 20 parts carbon and 100 parts vanadic anhydride and submitting the whole to the heat of an arc which worked at 900 amperes and 50 volts. After continuing the heat for five minutes or more, the anhydride is reduced, and the metallic vanadium is formed in the tube of the furnace. It is found that the metallic mass, when it can be obtained with but five per cent. carbon, has a white color and a brilliant metallic fracture. It is not oxidized in the air, but burns with a bright glow when heated to redness in oxygen.

A commercial form of electric furnace has been brought out within a recent period by a prominent French electrical engineer, M. Girod, after considerable experience in this work. It is now in operation at the electro metallurgical works at Albertville and is said to give a very good yield of ferro-vanadium. As will be noticed in the sectional view of the furnace, it is of the type known as peripheric resistance and the material under treatment is placed in the crucible (A), which is made of graphite or of refractory matter. The resistance which causes the heating of the electric furnace is formed of a mass (R) placed, as shown in the plan, in the annular space between the furnace walls and the crucible, this being made up of graphite in the granular or powdered state, or even agglomerated, and mixed with metallic or mineral powders. By a judicious use of these materials the desired resistance to the current can be obtained, and therefore the temperature which is needed to give the reaction.

Current is brought to the mass by the two positive poles (p_1) and (p_2), and goes off by the two negative poles (p_3) and (p_4). Between the poles are placed refractory brick, which keeps the current from passing. Even while the current is kept on the furnace it can be swung about upon the horizontal shafts (D). Two plate supports hold the trunnions against the body of the furnace,



PLAN VIEW OF ELECTRIC FURNACE FOR PRODUCING FERRO-VANADIUM.

while a current coupler (B) serves to take the ends of the cables.

To start up the furnace, the poles can be connected across by fine iron wires passing from (p_1) to (p_3) and from (p_2) to (p_4), and they become heated to redness by the passage of the current, thus causing the graphite mass to heat up. Or a higher voltage can be used at the beginning of the heat, about 70 or 80 volts, for instance, while for the usual working but 20 or 25 volts are needed for the reduction. The furnace is easily handled and it allows of reaching a very high temperature, which is also constant. A ferro-vanadium of very good quality is now being produced in this type of furnace.

Engineering Features of London Electricity Supply Bill.

London, June 22.—The London County Council has now reached the engineering details of its supply scheme and has placed these before the committee of the House of Commons which is considering the bill. Briefly put, it is the intention, should the bill pass, to erect a 120,000-kilowatt station at Barking, on the banks of the River Thames, some considerable distance to the east of the area of supply and from there feed by duplicate mains 21 sub-stations. The area under the scheme comprises 451 square miles, of which 117 miles is within the County of London and 334 in the districts around. Of the sub-stations 13 will be inside the county and eight outside.

The generating station will be built in five sections, two at once, and the remaining three as the demand occurs. The cost of the first two sections, which will have an aggregate capacity of 48,000 kilowatts, is estimated at nearly $3,500,000, including the whole cost of the land. Turbo-alternators are to be installed of 12,000 kilowatts each. The complete station is estimated to cost £12.26 per kilowatt, taking the normal rating of the station, or £9.81 per kilowatt upon the basis of the overload capacity.

The generating pressure is to be 15,000 volts and the periodicity 50. Under the bill, electrical energy is to be supplied to the numerous existing authorized distributors and also to power users direct, the latter being possible under a clause which first makes it incumbent upon the County Council or its lessee to demonstrate to the Board of Trade that the existing supply authority is not doing its duty.

Engineering details have been worked out by Mr. Rider, Mr. H. F. Parshall, Mr. R. Hammond and Mr. J. F. C. Snell. G.

A Proposed Lightning-arrester Test.[1]

By N. J. Neall.

It is generally recognized that the worst disturbances to an electrical transmission system from lightning are due to the unbalancing of the circuit elements after the passage to ground of the initial lightning charge.

In the development of lightning arresters provision must be made not only to discharge freely any atmospheric disturbances which take place near by, but to prevent, as far as possible, any short-circuit on the system, which might thereby arise should two legs of the line be simultaneously discharged. From this it follows that lightning arresters in the very act of relieving the line introduce other conditions of potentially great destructiveness, such as short-circuits, sudden grounds and oscillations.

Since it is impossible to predict where any given

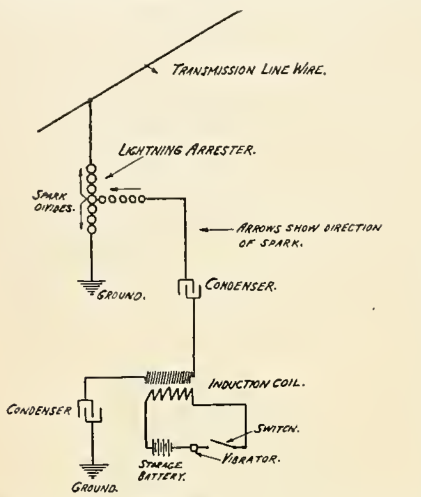


FIG. 1. PRINCIPLE OF LIGHTNING-ARRESTER TEST.

lightning disturbance will arise on a transmisson line, the assumption is made here that this is ordinarily of no consequence if it is not at the lightning protective apparatus. Any source of disturbance other than lightning which causes the lightning arresters to operate may, however, properly be included here.

Fig. 1 shows the elements of the test. A spark from an induction coil is made to pass over all the gaps of the lightning arresters under test. This forms a bridge for either a short-circuit by line current (provided two legs of the line are simultaneously discharged) or for the passage of charging current from the stored capacity of the system, as the case may be.

The apparatus required consists of an induction coil operated from several cells of a storage battery by means of a mechanical vibrator. A small

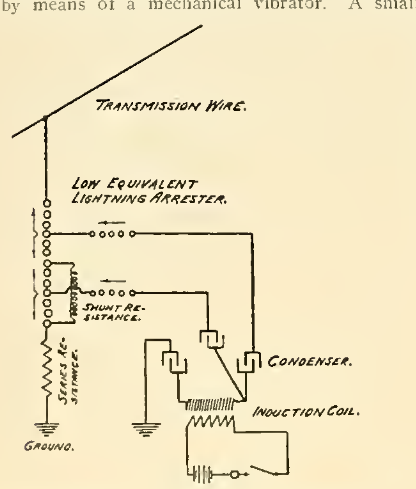


FIG. 2. SPECIAL APPLICATION TO LOW-EQUIVALENT LIGHTNING ARRESTER FOR INITIAL DISCHARGE OVER ALL GAPS.

switch in series therewith enables the discharge to be controlled at will. A condenser is placed in series with each terminal of the induction coil, the one being grounded and the other being led through spark-gaps to such a point of the series of the lightning-arrester gaps that the spark from the coil will divide and pass over them simultaneously in the direction of line and ground, respectively.

Special gaps should be inserted in the induction-coil spark circuit before connecting to the arrester under test to prevent a decrease in insulation strength to ground of the arrester itself.

Figs. 2, 3, 4 and 5 are self explanatory. It will be seen from the diagrams that the required insulation strength of the condensers thus used in

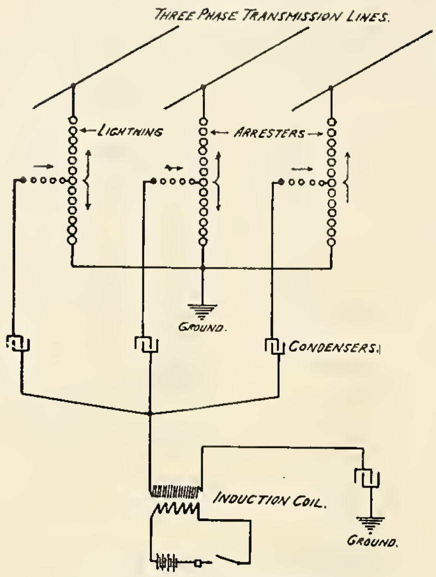


FIG. 3. CONNECTION FOR TESTING LIGHTNING-ARRESTER GROUP ON THREE-PHASE SYSTEMS.

testing any polyphase system is only half the nominal voltage between legs, for two condensers are always in series. Thus, for a test of a 50,000-volt line only 25,000-volt condensers are required.

With the exception of several laboratory tests, made first in Minneapolis in September, 1906, on a 2,300-volt circuit to prove the elements of the method, no trials have been made of this method on transmission lines. There is no apparent reason why it should not be used, save that when the possibilities of the method are realized most transmission operators will undoubtedly be afraid to try it lest it may demonstrate itself too successfully.

There are undoubtedly plants in this country, and perhaps abroad, whose operators would be glad to avail themselves of any such method of generating their own "lightning"—to employ a late application of this term—and the ideas contained herein are therefore presented with the hope that they may pave the way to increased knowledge of lightning disturbances and protection against them.

The following ideas have been suggested in this connection:

1. The apparatus must be adjusted in size and connection to individual requirements.

2. The effect of a disturbance can be measured positively by the simultaneous use of tell-tale papers at all known points where discharges take place to ground.

3. The tests may be varied to suit any requirements, namely, short-circuits, grounding, phase to phase, etc., and may be made simultaneously at extreme points of a line with a duplicate test set if desired.

The following characteristics have been noted and should be allowed for:

1. The coil must give a fat spark of considerable length. Such a coil as is used in wireless telegraphy is well suited to this.

2. The condensers need not be of great capacity. They may be of heavy glass coated with tin-foil and immersed in oil in stone jars.

3. There is apparently a definite limit to the number of gaps over which line voltage will break

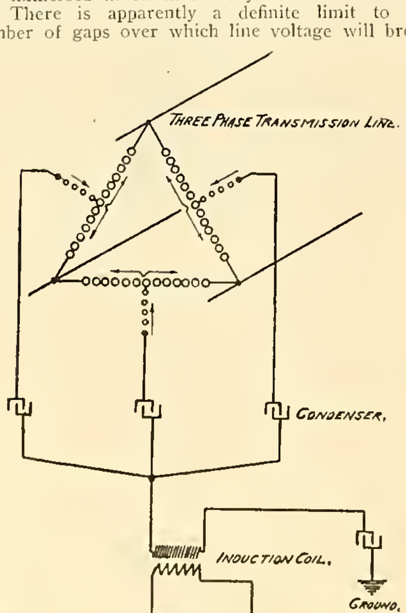


FIG. 4. A SUGGESTED METHOD OF TESTING PHASE TO PHASE.

simultaneously with a given static discharge. This has been noted in several cases and is quite marked. Any increase in the number of gaps, while apparently not affecting the spark, will prevent the arc.

4. Cells of storage battery permit the set to become portable and thus enable field tests easily to be made.

5. The apparatus may be made quite rugged. In case of high voltage the exciting-circuit knife-switch may be opened and closed by an insulating handle to protect the operator against possible breakdowns of insulation between line and ground.

6. The advantage in this method lies in its readiness for operation when required; its simplicity, and the fact that the induction-coil spark does not coat the cylinders or gaps with any metallic fumes.

7. It may be used for any lightning protective

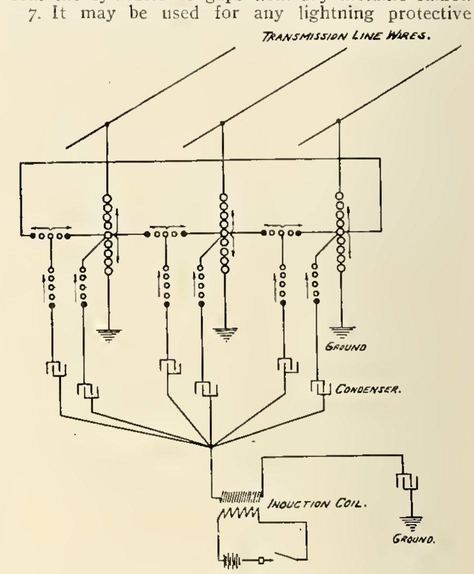


FIG. 5. TESTING THE MULTIPLEX PRINCIPLE ON A THREE-PHASE SYSTEM.

apparatus consisting of air-gaps between line and ground.

8. It is a method of as great value to the operator of the line as it is to the manufacturer of lightning arresters, because it gives him the best possible method of determining how successful the lightning apparatus is in meeting the demands which he deliberately produces.

9. Its intrinsic value rests on the importance of knowing as far as possible how great these disturbances may be, how efficient is any given system of protective apparatus to handle them, and of discovering to what degree any given transmission system contains in itself elements of length, arrangement and character of apparatus tending to prolong or increase the disturbances once initiated.

[1] A paper presented at the convention of the American Institute of Electrical Engineers, Niagara Falls, N. Y., June 25, 1907.

Interurbans Not an Additional Servitude upon City Streets.

The Indiana Supreme Court has rendered a decision in a case involving the right of interurban companies to operate their cars upon the streets of a city under a franchise from the city and over the tracks of a local system by contract or agreement. In this case a property owner on College Avenue, Indianapolis, brought an action against the Union Traction Company to test the right of such company to use the streets upon which to operate its cars without compensation to abutting property owners. In its opinion the court said: "The majority of the court, however, have reached the conclusion, and so hold, that under the facts averred in the complaint and the law applicable thereto, appellee's railroad does not constitute an additional burden or servitude upon any of the public streets of Indianapolis; that the complaint states a cause of action in favor of appellant only for the recovery of the special damages which she has sustained, as shown by the facts alleged."

Telegraph Strike Still Confined to San Francisco.

The expected strike of all union telegraph operators of the Postal and Western Union companies has not yet been called. The strike of the operators in San Francisco and Oakland has been made complete. A limited force of non-union operators has been recruited and officers of each of the companies state that they have about one-third of a full force at the main offices. Local business men are not cut off entirely from the outside world. The San Francisco strike is a local matter which happened to come at a time when a general walk-out was talked of to enforce the union demands. The discharge of an operator in Chicago because he was said to be acting as a wire spy for the union has made the situation more serious and trouble seems certain, at least in Chicago. The more conservative heads of the union have checked the strike movement for further negotiation, but the outcome cannot be predicted.

Protection of the Internal Insulation of a Static Transformer against High-frequency Strains.[1]

By Walter S. Moody.

Most forms of lightning arresters, especially of the multigap type, protect transformers against high-frequency even better than against low-frequency strains so far as these strains exist between either the high or the low-potential windings, or between either of these windings and any other part of the transformer, because the high-frequency causes a greater condenser charging current to flow across the gaps at the line end of the arresters, thereby reducing the resistance of these gaps. They do not, however, always prevent strains far in excess of normal being thrown upon the adjacent turns and layers of the windings, because, although the high-frequency strain may be less than the working voltage, the frequency, and consequently the wave-length, may be, and generally is, such as to concentrate this strain on a relatively small portion of the turns at the end of the windings connected to the line.

There is a wide range in the frequency of the oscillations that may be set up in a given circuit under varying conditions due to atmospheric disturbances, partial grounds, switching, etc., this

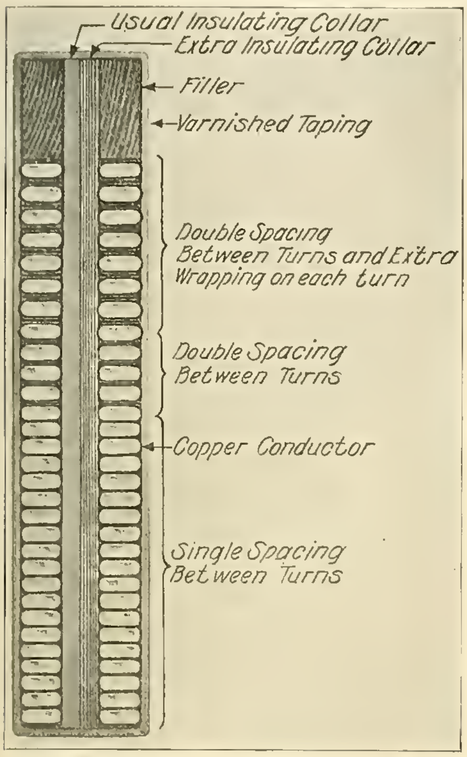


FIG. 1. CROSS SECTION OF TRANSFORMER COIL SHOWING REINFORCED INSULATION.

range easily extending from normal to several hundred thousand cycles. In the effort to impede all or a greater part of the high-frequency disturbances that try to penetrate the transformer windings, it has been quite common practice to place reactance coils between the lightning arresters and the transformers. While such coils are undoubtedly advisable and are quite effective, their use is attended with some objections.

A wide range is found in the size of such coils employed by different authorities, varying from, say, 10 feet of conductor wound in a small diameter open spiral to several hundred feet wound in forms more difficult to insulate. Evidence of more or less effectiveness of any of the different forms is usually forthcoming, inasmuch as sooner or later there are sure to be conditions that will generate very high voltages and frequencies.

If, however, the reactance is such as to be effective against moderately high-frequency oscillations it must, since it is connected between lightning arrester and transformer, offer a very high impedance to the high frequency of the oscillatory currents which will usually be set up within the transformer itself, when a bound charge within it is released by a stroke of lightning relieving some

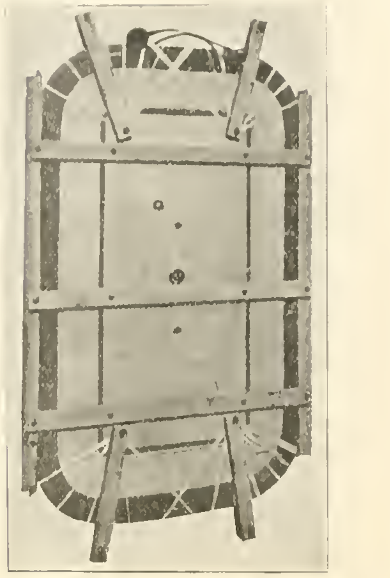


FIG. 2. SIDE VIEW OF TRANSFORMER COIL SHOWING EXTRA INSULATION ON THE FIRST TURNS.

overhanging cloud. Under such conditions it is almost as bad to hold back the charge in the transformer as to keep a wave from entering under other conditions.

It is not my intention to add anything to what has been so ably said by Mr. Percy Thomas, Dr. Steinmetz and others regarding the theoretical considerations involved in this problem. I simply wish to explain how a theory, that very little preventive reactance is necessary to protect the winding of a transformer whose outer turns are heavily insulated, has been carried out and tested on a large scale during the last four years.

The idea was naturally first put into practice in connection with large high-voltage transformers, but it has been gradually extended (although not so thoroughly) to smaller units operating on pressures as low as 10,000 volts. Thin coils, wound with one turn per layer of flat conductor, such as are commonly used in all the better sort of large transformers, are best adapted to such re-enforcement of the insulation between turns.

It is practicable to re-enforce a considerable portion of the turns of a large transformer coil so that it will withstand from 2,000 to 20,000 volts per turn without greatly decreasing the space factor of the winding or causing any considerable increase in cost. It is not practical to use as heavy insulation as this in smaller units, but as the size decreases the length of a turn also decreases, so that the difference of potential between two turns due to a given high-frequency wave is correspondingly less. One should aim, therefore, to have, not a given insulation strength per turn in this re-enforced portion of a winding, but a given strength per foot. In like manner it is desirable to re-enforce, not the same percentage of the total length of conductor in all cases, but more nearly the same total length, since a given wave will penetrate about the same linear distance into a transformer winding whatever the total length of conductor may be.

In large transformers wound for 75,000 volts or less, it is practicable to resist a high-frequency wave whose magnitude is equal to the working voltage in some hundred feet or less of conductor. This means that a wave-length of 200 feet or more, corresponding to a frequency of, say, 5,000,000 cycles, could be taken care of by such a transformer. If, in addition to this re-enforcement the transformer has external reactance of some 50 feet in length a very considerable reduction of potential between the first few turns will result.

Figs. 1 and 2 show a coil of a 2,000-kilowatt 60,000-volt transformer, in cross-section and side view, respectively, which has such tapered re-enforcements of the insulation between the outer turns. The cross-section clearly shows the three different thicknesses of spacing insulation between turns, and the side view of the coil, on the form on which it was wound, shows the extra insulating on the very first turns where the voltage is likely to be more than could be economically insulated against by spacing insulation only.

The evident desirability of limiting the re-enforced insulation to as short a length of the end portions of the winding as will accomplish the desired results, indicates the need of a different location of tap connection than usual. Few transformers for transmission work are made without taps to admit of operation with different ratios of transformation. Frequently such taps cover a range anywhere from 10 to 30 per cent. of the winding, and if they are located so as to cut out the end portion of the turns, one must re-enforce the insulation well within the inside tap or perhaps some 40 per cent. of the total winding.

It has been our practice for some years, therefore, so to locate tap connections that they will cut out centrally located turns instead of end turns, thereby not only placing them in an essentially safer position but also avoiding the necessity of any more re-enforcement than is required when all the winding is in service. Fig. 3 is a diagram of transformer winding showing taps for different voltages brought out near the ends of the winding. Fig. 4 shows taps brought out near the center and re-enforced insulation at ends.

Some 750,000-kilowatt capacity of transformers embodying these ideas ranging in size from 300 to 7,500 kilowatts and wound for 5,000 to 80,000 volts have been built in both airblast and oil-immersed types. Most of these have been installed with a small protective reactance, but many without such protection; and not one of these transformers has yet failed from any weakness of the internal insulation, although a considerable proportion of the transformers has been installed for three years.

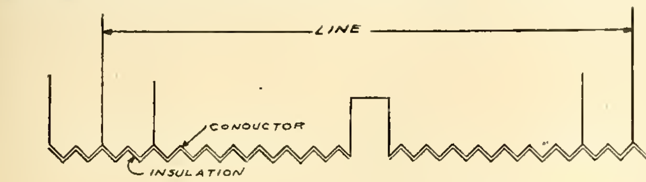


Fig. 3. Taps brought out near ends of winding.

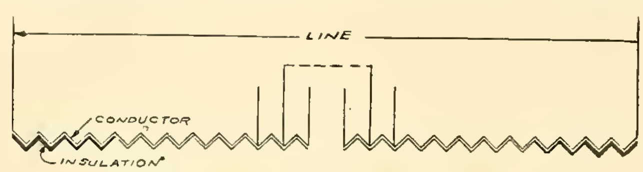


Fig. 4. Taps brought out near center; reinforced insulation at ends.

DIAGRAMS OF TRANSFORMER WINDINGS SHOWING DIFFERENT LOCATIONS OF TAPS.

1. A paper presented at the convention of the American Institute of Electrical Engineers, Niagara Falls, June 26, 1907.

Before the Days of Wiring Tables.

At a dinner of the Engineers' Club in Manchester, England, recently, Ph. A. Lange, manager of works of the Westinghouse company, gave some interesting reminiscences of the early days of the electrical industry when the following process was adopted by the Edison Company in laying out the wiring for lighting New York city:

"A huge map was prepared, showing the location of the streets and the position of the houses where current was to be supplied. On this map a spool of german-silver wire was located wherever a house was to be supplied with lights. Each spool had a resistance proportional to the resistance of the lamps in the house. Wires corresponding to the feeders to be actually used were stretched along the streets, and the german-silver spools were connected to these wires. Current was obtained from a small Daniell battery, and distributed to the different spools through the wires. A professor then sat in front of the map and measured with a galvanometer the drop along each of the wires. From his measurements the proper wires for running along the streets of the city could be determined.

"After this system had been in use for two years or more, Mr. F. J. Sprague joined the Edison forces. He was the first man among us with a technical education who had made a special study of electricity. He quickly showed how to calculate the drop in feeders without laying out a whole city in miniature, determining in a few hours or minutes results which had previously required weeks of experimental work and a considerable financial outlay."

Abatement of the Smoke Nuisance.

The special smoke abatement commission appointed by Mayor Busse of Chicago has already made a report, and based upon the report an ordinance has been introduced in the City Council providing for the establishing of an elaborate smoke inspection bureau. The plan provides for the following: A chief smoke inspector, to be named by the mayor, at a salary of $4,000 a year; an assistant chief smoke inspector, to be named by his chief, at a salary of $3,000 a year; a commission of eight members, to be named by the mayor, to advise in the matter of smoke abatement; a board of engineers of three members at $10 a day to advise the commission, which is to advise the mayor; as many deputy smoke inspectors and clerks as the council may determine is necessary, their pay to be fixed by the council.

The International Association for the Prevention of Smoke closed its convention in Milwaukee on June 28th. Charles Poethke of Milwaukee was elected president, and R. C. Harris of Toronto, Canada, was re-elected secretary-treasurer. Cleveland was selected as the place for meeting in 1908. It was expected that resolutions would be adopted declaring for uniform state legislation on the prevention of smoke, but the subject was not taken up.

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CORRESPONDENCE relating to electricity or any of its practical applications is cordially invited, and the co-operation of all electrical thinkers and workers earnestly desired. Clear, concise, well written articles are especially welcome; and communications, views, news items, local newspaper clippings, or any information likely to interest electricians, will be thankfully received and cheerfully acknowledged.

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CONTENTS OF THIS NUMBER.

DEPARTMENTS.

DATES AHEAD.

Vermont and New Hampshire Independent Telephone Association (fifth convention), Bradford, Vt., July 9th and 10th.

National Electrical Contractors' Association (seventh annual convention), New York city, July 17th, 18th and 19th.

Illuminating Engineering Society (first annual convention), Boston, July 30th and 31st.

International Association of Municipal Electricians (twelfth annual convention), Norfolk, Va., August 7th to 9th.

Ohio Electric Light Association (annual convention), Toledo, August 20th to 22d.

Canadian Electrical Show, Power Building, Montreal, September 2d to 14th.

TWENTY YEARS old! That is the age of the Western Electrician in this year of grace 1907, for the first issue of this journal bore date of July 2, 1887.

A score of years is but all too short in the life of a man; it may seem, in retrospect, a comparatively brief period in the slow growth of a great nation. But what a truly marvelous development has been shown by the electrical industries during the twenty years that has elapsed since the first number of the Western Electrician was published!

In 1887 the telegraph, dating back to 1844, had been, of course, long established. But even the telegraph, the slowest in improvement of all the great electrical inventions, has greatly extended its influence in the last twenty years, particularly by the introduction of more rapid methods of sending, the striking increase in the number of code messages, the substitution of dynamos for batteries and the great extension of submarine cables, the Pacific having been spanned only within the last few years.

The telephone was just passing out of the earlier or Bell promotion era in 1887. Here the advance has been tremendous. Roughly, it may be said that there were 150,000 telephone subscribers' stations in the United States twenty years ago, whereas there are 7,000,000 today. And the improvement in the design and construction of exchanges has been revolutionary. Long-distance telephony, as we recognize it today, was unknown twenty years ago. The great "Independent" movement, also, is a characteristic of this period.

The electric light was a popular wonder still when the Western Electrician was started. Central stations were comparatively small and few in number. The art of building dynamos was truly in its infancy. Electrical men of 1887 were an enthusiastic lot of fellows, but if one of them had been told that twenty years later a generator would be in operation in Chicago with a maximum capacity of supplying 150,000 incandescent lamps of 16 candlepower each he would have deemed the story merely a wild stretch of fancy, worthy of Baron Munchausen. And if he were further informed that the generator would be driven by a steam turbine it would add to his bewilderment. The enclosed arc, the Nernst lamp, the mercury-vapor lamp, the flaming arc and all the new high-efficiency lamps are products of the last twenty years.

And think of the advance in wiring and construction, the National Electrical Code, the introduction of scientific testing, the rise of illuminating engineering, the adoption of the 450-watt standard for street arc lamps and its very recent abandonment, the great improvement in reflectors and globes, switching apparatus, power-house design, transformers—everything, in fact—and the appearance of the sub-station. Truly the advance in the art of electric lighting has been amazing in twenty years.

For all practical purposes the electric railway is entirely a creature of the period of time under consideration, for Sprague's pioneer line in Richmond was not a demonstrated success until 1888. A mighty electric-railway industry has grown up since then—how large one hardly realizes until confronted with some figures. For instance, the gross earnings of the companies operating electric railways in the United States were perhaps $320,000,000 in the year 1906. In Chicago a careful inquiry has fixed the value of the property of a street-railway company with old equipment at about three times a year's gross earnings. Applying this ratio—a very low one—to the whole country would make the electric-railway properties of the United States worth $960,000,000. This is exclusive of steam-railroad electrifications.

Practically all applications of the electric motor have been made since 1887. There was no "electric drive" then; it is one of the most important features of electrical development today. The electric motor, industrially, was at hand twenty years ago, but it had hardly "arrived."

Power transmission by electricity, now such an important feature of industrial life in many countries, was unknown in 1887.

Electric heating and cooking, which at present are receiving so much attention, had no place in the central-station work of the earlier day.

"Wireless," in its various phases, was undreamed of. So was the electrical production of music, while electric welding, if known in principle, had no practical application. The X-ray had not been discovered.

The very conception of electricity has undergone a radical change, for the theory of electrons was not broached until within the last five or six years.

Of the principal societies in the United States devoted to the electrical arts, the American Institute of Electrical Engineers is three years older than the Western Electrician. The National Electrical Light Association and the Association of Edison Illuminating Companies were founded in 1885, and the American Street Railway Association (for many years devoted to animal and mechanical traction) in 1882. All of the other national organizations in the electrical field, including the American Electrochemical Society, American Electrotherapeutic Association, Electrical Salesmen's Association, International Association of Municipal Electricians, Illuminating Engineering Society, International Independent Telephone Association, National Electrical Contractors' Association and Underwriters' National Electric Association have been established since 1887.

This backward glance will show how completely modern electrical development is contemporaneous with the Western Electrician. And it goes without saying that the central and western states of this country have taken a conspicuous part in this development. The Western Electrician has been identified with the electrical expansion of the West, and it is fitting, therefore, that its twentieth anniversary should not be allowed to pass without some special recognition.

We take much pleasure in announcing, then, that a special Twentieth Anniversary Number of this journal will be issued at the beginning of the busy fall season in September, in conjunction with the Annual Fall Trade Number. This issue, we hope, will prove a veritable history of the electrical development of the West. It will be freely illustrated, with many special articles and features, and we shall endeavor to make it worthy of the occasion and of the great industry which the Western Electrician represents.

TWO OF THE particularly notable features of the annual convention of the American Institute of Electrical Engineers which was held at Niagara Falls last week were the approval of a Code of Ethics and the adoption of a revision of the standardization rules. The new Code is given in full in this issue. It is of considerable interest, for while the professional ethics of electrical engineers as a class has been of a high grade, and is in no great need of reform, it is nevertheless well, with the growth of the society and the greatly increased number of persons who profess to be electrical engineers, that there should be a code of written rules of professional conduct which may serve as a standard to emphasize the dignity and responsibility of the electrical branch of the engineering profession. The rules, of course, will have no binding force (unless, indeed, in some grave breach of decorum or morality, they should be appealed to as a reason why a member should be expelled from the society); but they appeal to the honor of the individual engineer and should have a moral effect, with the added advantage of setting up a written standard, to which reference may be had on occasion.

The revised standardization rules of the Institute are too long to be published in full in the Western Electrician. They are divided into five divisions, with numerous classes and sub-classes. These general divisions are "Definitions and Technical Data," "Performance Specifications and Tests," "Voltages and Frequencies," "General Recommendations" and "Appendices and Tabular Data."

It is needless to say that these standardization rules are of great value. Further reference to the present revision will be made in this journal. In the meantime it may be noted that the voltages of alternating-current transmission circuits recommended are 6,600, 11,000, 22,000, 33,000, 44,000, 66,000 and 88,000. Two standard frequencies are given, 25 cycles and 60 cycles.

AMERICAN INSTITUTE OF ELECTRICAL ENGINEERS.

The twenty-fourth annual convention of the American Institute of Electrical Engineers was held in the Cataract House, Niagara Falls, N. Y., beginning on Tuesday, June 25th, and ending Friday, June 28th.

The meeting was called to order by President Samuel Sheldon of New York city and after the formal handing over of the keys of the city of Niagara Falls in a brief address by Mayor Douglass, the business and papers of the convention were taken up.

The registration for the first day's session was rather light, but before the end of the convention nearly 500 had registered, making this one of the largest conventions in the history of the Institute.

Entertainments and Excursions.

The local committee is to be praised for its part in making this convention a success, both in the work pertaining to the meetings and in providing excellent entertainment for the visiting engineers.

A large reception committee, consisting of the members living in the vicinity of Niagara Falls, was at the train to meet incoming delegates, and aided greatly in helping them to get acquainted and catch the spirit of the convention.

Many members were accompanied by ladies, and the wives of the members of the local committee did not spare themselves in adding to their comfort and entertainment.

On Tuesday afternoon a trolley ride was taken through the Niagara Gorge. The entire afternoon was set aside for this and for such sightseeing as the members were individually inclined. On Wednesday afternoon the factory of the Natural Food Company was visited, and afternoon tea was served by the company. On Thursday morning an automobile trip was arranged for the ladies of the convention, and on the evening of that day the members and their ladies were tendered a reception at the Cataract House, which was largely attended. At the invitation of the local committee the Institute took a "searchlight trip" on Friday evening over the Gorge Route to the Whirlpool Rapids and a considerable number took advantage of this novel feature for their entertainment.

While no excursions to the different electrical generating and transmission plants were planned, yet the local committee made arrangements so that all who desired could visit these plants. Small parties were made up at any time members desired to go, and someone familiar with the installations conducted parties through, the convention badge admitting the wearer to any of these plants, both on the American and Canadian sides. This method of showing the visiting members through the various plants proved to be more satisfactory than any other method could have been.

Relation of Local Branches.

On Thursday evening the officers of the Institute and the representatives of the various branches dined at the International Hotel, Mr. Paul Spencer of Philadelphia presiding. Topics concerning the relation of the branches to the Institute were discussed. The constitution recently adopted has served to place the branches on a much better footing than formerly. About half the total membership of the Institute is now connected with some branch, and it is hoped that during the year more branches will be organized, so that a much larger percentage of the membership may enjoy the privileges and benefits of the branch meetings. Mr. Charles F. Scott of Pittsburg remarked that whereas he had hoped that at least 50 per cent. of these branches might be successful, he had been surprised to find that all had so far proved so.

The New Code of Ethics.

Another important step taken by the Institute at this convention was the approval of a "Code of Ethics" which was referred to the board of directors for revision and final action. This code was prepared by a committee appointed a year ago at the Milwaukee convention, consisting of Dr. Schuyler Skaats Wheeler of Ampere, N. J., chairman, Dr. Charles P. Steinmetz of Schenectady and Harold W. Bulk of New York. This is probably the first code of ethics ever approved by an engineering body and will undoubtedly go far toward directing the engineer in his decision for right or wrong in his relationship to his employer, his client, his fellow engineer and the public. While these rules are not all that every engineer had hoped, they will serve as a basis on which to build each year by careful revision. For the young engineer these rules will be particularly important. The Code of Ethics is given in full on a succeeding page.

Programme of Papers.

The following papers were read and discussed at the meetings:

Tuesday Morning.

Address of Welcome.

President's Address, "The Properties of Electrons," by Samuel Sheldon.

"The Heating of Copper Wires by Electric Currents," by A. E. Kennelly and E. R. Shepard.

"Interaction of Synchronous Machines," by Morgan Brooks.

"Power-factor, Alternating-current Inductive Capacity, Chemical, and Other Tests of Rubber-covered Wires of Different Manufacturers," by Henry W. Fisher.

Tuesday Evening.

"Protective Apparatus Engineering," by E. E. F. Creighton.

"Practical Testing of Commercial Lighting Arresters," by Percy H. Thomas.

"A Proposed Lightning Arrester Test," by N. J. Neall.

"Inductive Disturbances in Telephone Lines," by Louis Cohen.

Wednesday Morning.

"Choke Coils Versus Extra Insulation on the End Windings of Transformers," by S. M. Kintner.

"Protection of the Internal Insulation of a Static Transformer Against High-frequency Strains," by Walter S. Moody.

"Transmission Line Towers and Economical Spans," by D. R. Scholes.

"Lightning Rods and Grounded Cables as a Means of Protecting Transmission Lines Against Lightning," by Norman Rowe.

"Notes on Transformer Testing," by H. W. Tobey.

Wednesday Evening.

"The Transmission Plant of the Niagara Lockport and Ontario Power Company," by Ralph D. Mershon.

"Location of Broken Insulators and Other Transmission-line Troubles," by L. C. Nicholson.

"A New Type of Insulator for High-tension Transmission Lines," by E. M. Hewlett.

"Some New Methods in High-tension Line Construction," by Harold W. Buck.

"Switchboard Practice for Voltages of 60,000 and Upward," by S. Q. Hayes.

Thursday Morning.

"Deflocculated Graphite," by E. G. Acheson.

"Single-phase versus Three-phase Generation for Single-phase Railways," by A. H. Armstrong.

"The Choice of Frequency for Single-phase Alternating-current Motors," by A. H. Armstrong.

"Twenty-five Cycles versus 15 Cycles for Heavy Railway Service," by N. W. Storer.

Thursday Afternoon.

"Commutating-pole Direct-current Railway Motors," by E. H. Anderson.

"The Attitude of the Technical Schools Toward the Profession of Electrical Engineering," by H. H. Norris.

"The Concentric Method of Teaching Electrical Engineering," by Vladimir Karapetoff.

Report of the Committee on a Code of Ethics (report adopted).

Standardization Rules. The proposed revision of the Standardization Rules was reported by the Standardization Committee and was adopted.

Friday Morning.

"Regeneration of Power with Single-phase Electric Railway Motors," by William Cooper.

"Fractional Pitch Windings for Induction Motors and Alternators," by C. A. Adams, W. K. Cabot and G. Æ. Irving, Jr.

"The Vector Diagram of the Compensated Single-phase Alternating-current Motor," by W. I. Slichter.

"Zigzag Leakage of Induction Motors," by R. E. Hellmund.

Friday Afternoon.

"Track-Circuit Signaling on Electrified Roads," by L. F. Howard.

"Some Power Transmission Economics," by F. G. Baum.

"One-phase High-tension Power Transmission," by E. J. Young.

Lightning Protection.

The registration on Tuesday was not as heavy as had been expected, and in consequence the papers scheduled for that morning were not as well discussed as those later on in the meeting when more members were present and more interest aroused.

The papers on lightning protection and lightning-arrester testing brought forth many favorable criticisms of the steps in advancement along these lines which this year has brought. Accurate data on the frequency and character of lightning discharges have not yet been obtained, so that design in this direction is as yet more or less speculative. An adequate test on a lightning arrester must be one which shall cause a spark to pass over the arrester with an opportunity for the full power of the machine to follow. This, of course, is impossible unless made at the point of installation, and would then be destructive to the apparatus under test. Much hope is expressed for the electrolytic arrester now under the process of development.

Use of Choke Coils.

The papers on the transmission of power extended over into Wednesday morning, when the question of the use of choke coils and the increase of insulation on the end turns of transformers, as a protection against lightning and high-frequency surges, was brought up. It seemed to be the consensus of opinion of the engineers discussing the papers that, whereas the increased insulation on the end turns of transformers for high potential was necessary, an extra protection could and should also be secured through the proper use of choke coils.

The choke coil should be used to prevent the rush of current to ground from the transformer over the lightning arrester or static discharger, but should not be of a size to produce resonance with the capacity of the wiring of the station at the ordinary frequencies of lightning discharges, and thus set up resonant voltages which will break down the insulation of the apparatus it is designed to protect.

The proper place for installing the choke coil was not agreed upon. Suggestions ran from placing it inside the transformer case, in order to reduce the capacity of the wiring between the coil and the transformer, to that of placing it outside of the station, in order to reduce fire risks due to arcing over turns on the coil when the line discharges.

The coil should be designed to fit the particular station it is to protect. In some cases it may even be necessary to use two sets of lightning arresters, one on each side of the choke coil. The fact was also brought out that some stations for high voltage are operating at present without the use of choke coils, relying upon the extra insulation on the end turns of the transformers for protection.

A New Link Type of Insulator.

The papers creating the most attention Wednesday evening were those by E. M. Hewlett of Schenectady and H. W. Buck of New York upon a new type of high-voltage insulator and its use. The insulator, as shown, consists of units which are each capable of withstanding 20,000 to 30,000 volts. These units may be connected in series by links of cable or loops of wire, so as to form the insulator for the required voltage in the form of a chain with the links insulated from each other. The insulator is then suspended by one end to the cross-arm, and the high-tension wire or cable fastened to the other. Sufficient room is allowed so that in high winds the high-tension wire will not swing against the pole or tower. The principal advantages asserted for this type of insulator are that, if broken, the insulator is easily repaired, a new unit being inserted, thus reducing the cost of repair; also the voltage on a line may be increased and the same posts used by merely inserting the proper number of additional units. A strain insulator is also made up in a similar manner.

Alternating-current Railway Practice.

The meeting of Thursday morning in which the questions of alternating-current traction and the proper frequency for the same was brought up in the papers by A. H. Armstrong of Schenectady and N. W. Storer of Pittsburg, proved to be the most interesting of the whole convention. The principal discussion centered around the choice of frequency for the best results.

The single-phase alternating-current motor seems to give the best promise for use in the future electrification of the steam roads. This motor is at present in use as essentially a low-frequency motor. On account of troubles from sparking, this frequency should be lowered below that of 25 cycles, the lowest at present in commercial use. The introduction of a new frequency, and especially one which is too low for most other purposes, is not looked upon with satisfaction by the leading engineers and manufacturers.

As brought out by Dr. Steinmetz in the discussion, each class of alternating-current machines has a critical frequency at which it is most economical to manufacture. For induction motors this frequency is 40; for transformers much higher than we are now using; for synchronous converters, 25 cycles, and for the alternating-current series motor now in use, as low as possible, zero frequency or continuous current being the best. For this reason the type of machine must be changed to reduce the sparking at 25 cycles, or the frequency lowered for this purpose. The development of the series motor should be to lower the current produced in the short-circuited segments, by the introduction of resistance or an inductance, or to lower the counter-electromotive force produced in the leads between the segments.

The question again resolves itself into the manner in which the power for operating the roads is to be produced. If each road produces its own power, or if the power for operating these roads be produced independent of power for other purposes, and with no reserve from present companies operating within transmission distance, then a frequency different from those used at present does not affect the problem so largely.

P. Junkersfeld of Chicago brought out the interesting fact from recent estimates for the coming year, on the passenger traffic entering Chicago for a distance of 25 miles, that if these roads be electrified, the total load could be furnished by the present generating companies in the city and be but 20 to 25 per cent. of their total load. Also for the next five years the proportion would be much less, due to the fact that power requirements for industrial and lighting purposes are increasing so much faster than those for passenger traffic. The power for freight traffic cannot be so easily estimated, owing to the tendency toward the removal of the switch yards out from the center of the city, where more and cheaper land may be secured.

With this and other data at hand, it would not appear such a stupendous undertaking from the point of view of the power producer, to electrify the steam roads.

Again, with the use of alternating-current motors for railway operation, what has 15 cycles to offer which cannot be duplicated by 25 cycles or some other frequency? The present gauge of railroads and the diameter of car wheels limit the size of the motor to be used, and any increase in output for a given size of motor is an important consideration from an engineer's point of view. It is said in Mr. Storer's paper that with the alternating-current series motor as at present designed, the output may be increased from 30 to 40 per cent. for a given weight of motor by decreasing the frequency from 25 to 15 cycles. The next point arises in the questions: Will not a still further decrease in frequency be still more advantageous; and are there not other factors entering which affect this consideration?

The next problem to be met is the generation of power at this lower frequency. Twenty-five cycles offers considerable difficulty to the turbo-generator designer in the number of poles and the high speeds required for good practice in this direction. As two poles is the smallest number which may be used on a generator, the speed of the machines would then be 900 revolutions per minute, which is higher than the practice at present for large-size units. Bipolar design also introduces many difficulties to the generator designer.

Mr. Stillwell said that the problem of electrification of steam railroads is much different from that of the introduction of lighting by electricity, due to the fact that the men at the head of these companies are men trained to look at things broadly. Any new plan which they are to adopt must result in increased traffic and increased profits. As pointed out in the paper recently presented by Messrs. Stillwell and Putnam before the Institute, a saving of about 15 to 25 per cent. could be made in the operation of railroads by the use of the single-phase system today in existence. The large amount of power required for the operation of trunk lines and the long distances to be transmitted make alternating current at a voltage not lower than 6,000 the only feasible plan to be adopted.

Charles F. Scott said that the main question must not be lost sight of in the discussion of the details. The question is an engineering one, which cannot be answered by "yes" or "no," definitely, without having specific conditions stated. As in the past, the design of railway equipment must center around drawbar pull and the locomotive.

Twelve years ago, when the Institute met at Niagara Falls, the first of the 25-cycle generators had just been put into commission. This was the first commercial use of 25 cycles and was looked upon with considerable disfavor by many engineers. Now the greater part of all electricity generated for power use in this country is at this frequency. Are we not at the point of a similar step to another frequency somewhat lower for use on our railways? What will we think 12 years hence when we look back on the deliberations of today? A step of this character should be undertaken only after due deliberation and consideration of all the factors attending, but if the step seem proper, let it be taken.

In regard to generating and feeding power, which may be purchased from lighting companies, to smaller alternating-current railway systems, the power can best be generated three-phase, but in this case the single-phase power at low power factors unbalances the voltages on the three-phase system so as to make the regulation poor for lighting loads. This may be remedied in several ways. P. M. Lincoln of Pittsburg suggested that the machines may be given an initial unbalancing in the opposite direction, and that at the change of load the balance will automatically be adjusted.

Dr Steinmetz contributed the following to the discussion of the paper relative to this subject, presented by Mr. Armstrong.

"Underloaded induction motors operating on the system present the best method of balancing the voltage. Rotaries installed with heavy reactances in the leads would take care of themselves in the same manner under any ordinary unbalancing. The main difficulty comes in the lighting load. It will be noticed that in this unbalancing one phase remains almost constant, while the other two vary. If the lighting be small it may be carried upon this phase. In the case of power being furnished the railways by large companies, the use of single-phase machines is prohibitive, and hence some such scheme must be resorted to or very high rates charged for the power.

"The problem of electrification of steam roads is still a problem of the future. Along what lines it will develop cannot be predicted at this time. The advent of the series alternating-current motor in the last few years has given a new turn to the problem, and brought in many new factors for solution. Among these is the proper frequency. It is still to soon to predict what the next few years may show for development along this line."

Another point in this design brought out in the paper by William Cooper of Wilkinsburg, Pa., on the "Regeneration of Power with Single-phase Electric-railway Motors" is the fact that this type of machine permits of the returning to the line on down grades of part of the power used by the motors in climbing the upgrades. On roads having very steep grades this not only reduces the amount of power necessary, but, as brought out by Mr. Stillwell, reduces the wear and tear on the rolling stock. This expense alone costs the steam roads in the United States $100,000,000 per annum. Of this, one-half is due to runaways and wear and tear caused by the brakes. Curvature of the track is the limit to speed on any portion of the road, and if the maximum speed be predetermined by the operating department, this form of braking will add to the safety of operation of trains and leave the ordinary form of brakes for emergencies.

Technical Education.

Thursday afternoon was devoted to the consideration of two papers on the education of students for the electrical engineering profession. These were presented by Prof. H. H. Norris of Cornell and Prof. U. Karapetoff of the same university. The paper of Professor Karapetoff was a plea for a change in the system of teaching, giving the student a taste of the profession before reaching his junior or senior year. The two papers brought forth considerable discussion for and against their arguments. As a result of this discussion the president was empowered to appoint a committee on education, subject to the approval of the board of directors.

Other Papers.

Friday morning's session was taken up in the consideration of various points in the design of alternating-current motors.

The paper by L. Frederick Howard of Pittsburg on "Track Circuit Signaling on Electrified Roads," Friday afternoon, brought forth little discussion, primarily, according to C. F. Scott and H. G. Stott, because very few people really understand this branch of electrical work. The paper brought out the fact, however, that this line of work was complicated, difficult and called for the employment of a great deal of engineering skill.

The papers by F. G. Baum and E. J. Young brought out considerable discussion but few points of especial interest, as many members had already left the convention.

At the close of the discussion of these papers H. G. Stott of New York moved that the Institute offer a vote of thanks to the following companies for their courtesies to the Institute: The Bell Telephone Company, Cataract Power and Conduit Company, Niagara Falls Power Company, Niagara Falls Hydraulic Power and Manufacturing Company, Ontario Power Company, Niagara, Lockport and Ontario Power Company, General Electric Company, Westinghouse Electric and Manufacturing Company, Electrical Development Company of Ontario and the Canadian Niagara Power Company, and also moved a special vote of thanks to the local committee and friends who had made special efforts for the comfort and entertainment of the visiting members and guests. Both of the above motions were unanimously carried.

President Sheldon then declared the "technical and academic" sessions of the twenty-fourth annual convention closed.

Altogether, it may be said that this convention of the Institute has been one of the most profitable and enjoyable yet held.

Among those in attendance from points west of Buffalo and Pittsburg were L. A. Ferguson, P. Junkersfeld, R. F. Schuchardt, John D. Nies, P. B. Woodworth, H. R. King, A. A. Radtke, F. A. Sager, A. L. Rice, A. Lowenstein, Julian Roe, George B. Springer, C. A. S. Howlett, D. R. Scholes, Chicago; H. H. Humphrey, J. H. Finney, St. Louis; C. E. Magnusson, Seattle; A. C. R. Yuill, Winnipeg; E. P. Burch, G. W. Record, W. P. Cowles, Minneapolis; H. A. Holdredge, Omaha; A. W. Berresford, Milwaukee; J. A. Thaler, Bozeman, Mont.; L. D. Nordstrum, Fort Wayne; Morgan Brooks, J. M. Bryant, F. G. Willson, T. Jensen, T. H. Amrine, Charles F. Brooks, Urbana, Ill.; W. P. Ambos, C. W. Ricker, J. A. Lincoln, Charles H. Kerr, J. R. Wilson, A. C. Eastwood, G. B. Dusinberre, Cleveland; Adolph Shane, F. A. Fish, Ames, Iowa; V. Brigham, Lafayette, Ind.; C. E. Delafield, George A. Mead, F. S. Denneen, Mansfield, Ohio; W. E. Richards, Toledo; H. B. Shaw, Columbia, Mo.; George O. Mallett, Hammond, Ind.; H. L. Kirker, Port Huron, Mich.; A. H. Ford, Iowa City, Iowa; D. A. Chandler, St. Paul; L. A. Marlow, R. J. Feather, Columbus, Ohio; G. W. Patterson, Ann Arbor, Mich.; William N. Miller, Detroit.

The members of the local committee were P. B. Barton, E. G. Acheson, Niagara Falls, N. Y.; H. B. Alverson, F. B. H. Paine, Buffalo; W. N. Ryerson, Niagara Falls, Ont. J. M. B.

Railway Telegraph Superintendents.

The annual meeting of the Association of Railway Telegraph Superintendents in Atlantic City on June 19th, 20th and 21st brought out a large amount of profitable information contained in a variety of good papers. The use of the telephone in railroad work and the use of concrete telegraph poles were two live subjects which were discussed. It was decided to hold meetings quarterly hereafter.

President E. A. Chenery opened the meeting and, after routine business, H. C. Pope read a paper on the examination of telegraph operators for railway work. In the discussion it was brought out that the Erie road maintains a school where a number of branches of railway work are taught. "The Superintendent of Telegraph" was the subject of an interesting paper by F. E. Bentley. John D. Taylor of the General Electric Company and W. C. Stowell of the Chicago and Alton read papers on the subject of inductive disturbances of telegraph wires by parallel high-tension lines.

The subject of telephones in railroading was taken up on the second day, S. L. Van Akin, Jr., describing the organization of the telegraph and telephone service on the New York Central lines. The company has a direct New York-Chicago circuit connected into nine private-branch exchanges, and at each of these points the line is bridged with 2,500-ohm bells; and, to operate Morse over the New York-Buffalo section, the line is equipped with six No. 37-A repeating coils. The impedance offered by each of these coils is equal to about 40 miles of No. 8 B. W. G. open copper line metallic circuit. It was said in the discussion of Mr. Van Akin's paper that the underground telephone cable between New York and Philadelphia has not proved economical. Pupin coils are used in this cable.

G. A. Cellar of the Pennsylvania Lines spoke on concrete poles, describing some of those his company has put up. Reinforced concrete has great possibilities. The rapid movement toward better protected rights-of-way will hasten the use of shorter poles, a point in favor of the concrete kind.

Dry batteries for use in short block-signal circuits are highly economical, according to the paper of U. J. Fry of the St. Paul road. R. L. Logan of the Kansas City Southern outlined his company's practice in connection with error sheets received from the telegraph company. G. W. Dailey read a paper on "Opportunities in the Telegraph Service." He held up high ideals of efficiency to telegraph employes.

The election of officers resulted as follows: President, E. P. Griffith of New York, Erie; vice-president, W. J. Camp of Montreal, Canadian Pacific; secretary and treasurer, P. W. Drew of Milwaukee, Wisconsin Central. Charles Selden, L. B. Foley and A. B. Taylor were appointed to have charge of quarterly meeting in the East, and E. A. Chenery, John L. Davis and C. S. Rhoads in the West.

E. H. Grace of Chicago read the report of the committee on wire crossings, and J. L. Davis of Chicago reported on uniform transfer blanks. L. M. Jones read the last paper on the programme, an instructive treatment of the subject of wire testing. The next annual meeting will be held in Montreal on June 24, 1908.

ELEMENTS OF ELECTRICAL ENGINEERING.

By Geo. R. Metcalfe.

XXIII.—Central Stations.

Hydraulic Plants.

While the power for operating most central stations is derived from burning coal under the boilers, there are a number of other methods employed in central-station work. Among these may be mentioned hydraulic plants, gas engines and oil engines, all of which have been successfully applied in central-station practice within the last few years. Hydraulic plants have been developed to a very large extent recently, especially in the neighborhood of Niagara Falls, and in some of the western states. In many cases the natural waterpower may be used very cheaply, but it is not always, as would appear at first sight, cheaper than a steam plant to operate.

The question of economy in connection with the waterpower depends entirely upon the amount of investment required to utilize the power of the water in the central station. Where a natural reservoir exists, which contains an unfailing water supply, and located so as to provide a sufficient head of water, the development of the plant may be comparatively inexpensive, so that power can be very cheaply produced. On the other hand, if very large dams must be built, involving expensive masonry construction, in order to secure sufficient volume and head of water, interest on the expense of construction may easily be more than the cost of coal for supplying the same amount of power.

Owing to recent developments in the transmission of power over large distances by alternating current, it is no longer necessary that the power house be located near the place where the power is to be consumed, and waterpowers may therefore be utilized at a distance of 100 miles or more from where the power is to be applied. This has led to a noticeable increase in the number of hydraulic plants during the last few years.

Some form of turbine waterwheel is very generally used at present. For low heads of water the parallel outward or inward-flow turbine is preferable. The impulse type of turbine is used for higher heads of water. The efficiency of waterwheels of various types ranges from 70 to 85 per cent. or more.

The supply of water for the wheels is generally carried in wooden flumes or riveted steel pipe. It makes practically no difference whether the turbine is placed near the top or bottom of the waterfall. The water is led into the turbine through a pipe and escapes through another pipe, and in this way the force of the full head of water in the pipe is transmitted to the wheels either by the pressure of water above the wheel, or the reduction of the pressure of the water below the wheel, or both.

As a constant speed is necessary in driving electrical machinery, a very important feature of hydraulic-plant systems is the governing mechanism. The head of water operating the wheel tends to change constantly, and the function of the governor is to maintain a constant speed of the waterwheel either under change of head or change of load. There are a number of waterwheel governors which give very satisfactory results in electrical plants, and some of these governors are electrically operated.

Steam Engines.

The selection of steam engines for a generating plant depends upon a number of factors, among which are the size of the station, the number and size of the generating units, the character of the load, etc. There have been several very marked changes in steam-engine practice since the introduction of electric generating stations. When electric generators were first introduced, the units were of comparatively small sizes, and at that time small high-speed engines were comparatively unknown, and the earliest practice consisted of belting one or more generators to large slow-speed engines.

To obtain necessary speed, a great difference in the diameter of the driving and driven pulleys was necessary. Countershafts were not uncommon, and the very small pulleys which were necessarily used on small generators permitted considerable slipping of belts and interfered correspondingly with good regulation of the current.

The next step in central-station development was the introduction of high-speed engines, and the electric generator was undoubtedly the cause of the remarkable development which has taken place in the small high-speed engines. These engines were sometimes belted direct to generators, without the introduction of countershafts, but were more often direct-connected to the generators by means of a coupling. These small direct-connected sets are still largely in vogue, especially for exciters or alternating-current generators.

The next step in the progress of central station practice was the development of large slow-speed multipolar generators, and with the introduction of these machines, the high-speed engine largely disappeared and practice practically reverted to slow-speed engines of the Corliss type. These units are generally used at the present time for direct-current generating plants, and to some extent for alternators. During the last few years, however, the steam turbine has been very widely introduced into central stations. This being a very high-speed machine, it involved another change in generator design, namely, the production of smaller and lighter generators running at comparatively high speeds.

At the present time, therefore, the best practice for large central stations may be said to be large horizontal engines of the Corliss type for direct-current generators and steam turbines for alternating-current generators.

Considering the number of generators for use in any station, the character of the load should be very carefully studied. In ordinary electric-lighting and electric-railway stations, the load is very variable for different portions of the day, as well as for the different seasons of the year.

Take the case of an ordinary electric-light plant. The load begins in the winter time very early in the morning, and rises to the maximum at about seven o'clock. It then falls off and continues to be very light until four or five o'clock in the afternoon, when it again increases, and reaches its highest point probably between six and seven o'clock in the evening. It falls off but very little until 10 or 11 o'clock, after which it drops quite suddenly, and continues very light all night until the morning load again commences. If this load is represented in the form of a curve, the curve will be found to contain two decidedly high peaks, one in the morning and the other in the evening, while during the rest of the 24 hours it is comparatively level.

While it is the object of every central-station manager to increase his day load so as to make the work of the central station more uniform, there are probably no stations which do not have decidedly heavier loads in the morning and in the evening than at any other time. These peak loads, as they are called, dictate the capacity of the machinery. In order to carry peak loads, a capacity in engines and generators must be installed which is usually several times what would be required for the average load. In order to have the engines and generators operate efficiently, it is also necessary that they operate at or near their full-load capacity, as the efficiencies of both the generator and the engine are much higher at full load than at 50 or 60 per cent. of the full load.

The selection of engines and generators for a load such as described, might, for example, consist of three units, one small one for carrying the light load after midnight, and two larger machines, either of which could carry the average day load, and both of which together would be sufficient to operate the peak load. This would leave the small engine in reserve for any unusually heavy loads which might be thrown on the station, although in case of accident to either of the larger generators, the other two would be considerably overloaded during the time of heavy load. This latter consideration might lead to the selection of three generators of equal capacity, notwithstanding the lower efficiency at which the unit carrying the light load would operate.

Generators of good design have considerable flexibility in regard to their ultimate capacity; that is, they can carry overloads of 125 per cent. of their normal rated capacity continuously, and for short periods of for an hour or so are generally guaranteed to carry 150 per cent. overload. This overload capacity gives considerable aid in carrying the plant through the peak-load period, and it also modifies the selection of the engine to some extent. As engines are not usually guaranteed for any such overload capacities, it is necessary to select the normal capacity of the engines somewhat in excess of that of the generator.

Steam engines may be divided into several classifications.

The single-acting engine takes steam only on one of the two strokes comprising a revolution, and operates by the inertia of its flywheel through the return stroke. The double-acting engine takes steam both on the forward and reverse stroke, having, therefore, double the number of impulses of the single-acting engine. The simple engine is one having a single steam cylinder, while the compound engine has two cylinders, a high and low-pressure cylinder, and the steam, after having done its work in the high-pressure cylinder, passes to the low-pressure cylinder, where it acts on the engine again, by still greater expansion. Similarly, in a triple-expansion engine, three cylinders are provided, in each of which the steam enters successively and works by greater and greater expansion. Triple-expansion engines are, however, very little used in central-station work.

Compound engines may be of either what are known as tandem compound or cross compound. In the tandem-compound engines the two steam cylinders are located in a straight line, one in front of the other, and act on two pistons connected to the same rod. In this style of engine the steam generally passes from the high cylinder to the low-pressure cylinder directly, whereas in the cross-compound engine the cylinders are side by side, and act on two independent pistons and cranks. In these engines, especially in the cross-compound engine, it is necessary for smooth operation that the low-pressure cylinder be enough larger than the high-pressure cylinder so that equal amounts of work are done in each. In the cross-compound engines the steam, after exhausting from the high-pressure cylinder, passes into a reservoir located between the two cylinders, and from this reservoir to the low-pressure cylinder.

From what has been said, it is obvious that where compound or triple-expansion engines are used, it is necessary to use very much higher steam pressures than can be used with simple engines. From 75 to 125 pounds per square inch is the usual pressure for simple engines, whereas for compound engines from 160 to 180 pounds is commonly used, and in some cases even considerably higher pressures lend much to the economy of the station, and are also necessary where the steam is worked to a high degree of expansion.

[*To be continued.*]

Note.—This series of articles, intended to survey, briefly, the whole field of applied electricity for light, power and heat, was begun in the Western Electrician of February 2, 1907.

Contracts for Power from McCall's Ferry.

Although it will be more than a year before the McCall's Ferry power dam in the Susquehanna River will be completed, the power company is entering into contracts to furnish electricity to adjacent cities and towns. A contract was executed a few days ago by which the McCall's Ferry Power Company will furnish electric current for the United Railways and Electric Company of Baltimore, Md., as soon as the plant is completed. The United Railways company proposes using the electric current generated by the river as an adjunct to its city power houses. Recently the Consolidated Gas, Electric Light and Power Company of Baltimore contracted for the exclusive use of the current in the Baltimore territory, with the exception of that required by the United Railways.

About fifty members of the York (Pa.) Manufacturers' Association took a trip to the McCall's Ferry dam a few days ago for the purpose of inspecting the plant. This journey, it is said, is of some significance, and contracts will likely be entered into in the near future for the furnishing of power to the industries of York by the plant now in the course of erection.

Chicago Street-railway Situation.

Arrangements have finally been completed for the turning over of all the properties of the Union Traction Company and its underlying companies in Chicago to the Chicago Railways Company. The new company will own and operate the lines, taking them out of the hands of receivers, and be in a position to carry out the terms of the traction settlement ordinance passed by the council last fall. Judge Grosscup and Prof. John Gray of Harvard Law School were the arbitrators who induced the stockholders of the five companies interested to turn over their stock to a trust company in order to carry out the plan. The same gentlemen will hear arguments and decide how the new stock shall be distributed for the holdings deposited.

SELLING ELECTRICITY.

Under this heading will appear, from time to time, articles, suggestions and examples which will be of assistance in the constant effort to increase the existing demand for electric current and to create new demands.

Methods of Securing Power Business.[1]

By Geo. N. Tidd.

It seems to me that our attitude toward the power problem should be, that there is no reason why our plants should not furnish all the power used by manufacturers and others in the city, with possibly the exception of those manufacturers who use a larger amount of steam or heat in their process of manufacture; notably paper mills, who steam their pulp and use their engines simply as reducing valves.

An examination of the steam plant of the average manufacturer will show many examples of poor steam engineering and a high cost of energy delivered for actual production. One will usually find they are using comparatively expensive coal and frequently teaming the coal in and the ash out. They are probably purchasing their water from the city and feeding it to the boilers with injectors. The boilers are frequently poorly set and operating at poor efficiency. The engines are probably of inferior design, old and in poor condition; usually slide-valve or high-speed automatic, and in many instances either over or under loaded.

The frictional load of shafts and belts frequently will represent 20 to 50 per cent. of the power produced. Their labor cost will be high when considering the amount of power actually consumed in producing useful work. It would, therefore, appear, with our high-efficiency generating plants, methods of burning low-grade fuels, low labor costs (due to large outputs and labor-saving devices), together with the savings we can secure by the elimination of a larger portion of the frictional line losses due to motor drive, that we should take over all the power business of the district, and not confine ourselves to a comparatively few short-hour, low-load-factor class of consumers.

As to some of the methods of attaining this desired end, I would suggest:

First—Secure the services of a good operating engineer for the work, a man, if possible, who has been in charge of a central-station plant, and one who can appreciate quickly the points involved in good and poor steam engineering. This man should be a good salesman, and, with one or more assistants, can cover a good deal of ground by devoting his entire attention to the work.

There are many men operating the smaller plants who are admirably adapted for the work. The varied experiences secured by such men in operating these plants, with the numerous difficulties encountered and overcome every day, make them particularly resourceful and valuable for the work. I take my hat off, every time, to the man in charge of the average small central-station plant.

Second—Canvass of District.—Have your power man make a thorough investigation of every power-producing plant in the district, no matter how large or small. Keep a systematic record of every case along lines suggested in a plant data sheet. A thorough study of each power problem should be made, which, supplemented with a study of the process of manufacture, will develop business that at first sight would be deemed impracticable to secure, owing to steam or fuel conditions. This analysis prepares the representative to meet the owner or manager, in a measure, upon his own ground, and having a close approximation to the total costs of the plant, conditions of operation and load factors, puts him in a position where he can talk and argue most effectively. His grasp of the situation is tremendously increased. These records are invaluable, as in some instances it is not possible to close a prospect until he has a breakdown, and when it comes all the data are instantly available.

Third—Secure a Large Representative Installation.—The first large customer comes hard. After the ice is broken, others have more confidence in your proposition and are easier to handle. It will, therefore, be of great aid to secure one of these customers to whom you can send and take prospects. The customer should, if possible, be one of the leading manufacturers. There are always one or more manufacturers in a district who are naturally the leaders, and others are very apt to consider whatever they do the proper thing. Make the most important manufacturer your friend and a booster; make his installation a model one, and you will find his aid invaluable. There is nothing so effective in arousing the interest and desire of a prospect as having him examine and see a large installation in operation, and talk with the owner or manager on the many advantages over the old steam drive.

Fourth—Trial Demonstration.—We frequently meet prospects who are dubious as to the advantages of central-station drive in their particular business or conditions. They admit it is good for their neighbor, but for this reason or that, it is not suitable for them. In other words, they are from Missouri and "need to be shown." In these cases, I would install the complete equipment and furnish current to operate for 60 or 90 days' trial. Usually they will agree to pay a nominal sum, representing their acknowledged costs for the service, and in many instances will further agree to provide the motor foundations and belts. Under these conditions the expense of such a trial is merely nominal, as all the apparatus can be removed and used elsewhere. There are many advantages in such a trial.

First: The organization of the local steam plant will deteriorate, and in some instances vanish, so it is hard to get together another gang; the inertia of a change has been overcome, and you have it on your side in finally closing.

Second: It demonstrates much better than you can tell the advantages of close speed regulation, with its consequent increase in output, the freedom from plant troubles and worries, the flexibility and cleanliness, and, above all, gives you an accurate determination of the actual amount of power required to drive the plant under favorable conditions.

It has been the writer's experience that fully 95 per cent. of these trial installations are finally closed.

Fifth—Methods of Selling.—Be liberal with your prospects in regard to terms of payment for the motors. In many instances it is advisable to sell upon the installment plan and allow one or two years to pay for the installation. The small manufacturer especially needs the money in his business and cannot afford to make the necessary outlay in cash for the proper installation. By taking a lease upon the apparatus and insuring it against fire, you are pretty well protected. In some instances it may be necessary to install a motor free, if it secures a particularly favorable business. The rate per kilowatt-hour can be easily increased enough to cover the cost of the motor. In other words, allow nothing to stand in the way in the line of a reasonable investment in securing good motor business.

Sixth—Remember that every power prospect, especially if it be a large one, must be considered largely as an individual proposition. You cannot make a hard-and-fast system of rates which will apply to all cases. Do not be afraid to go down on high-load-factor business, simply because your present cost with its low load factor is higher than perhaps you will be called upon to quote. I would suggest dividing your costs up into readiness-to-serve and output expense; dividing the connected load into the total readiness-to-serve expense, and the output expense by manufactured current. This will give an indication of the value of high-load-factor business and what it can be sold for. Therefore, do not be afraid to go down on the long-hour business.

Off-peak Business.

This class of business does not seem to have been given the consideration it deserves. Many stations believe it is not possible to secure any amount of this character of business. If, however, every power prospect be carefully analyzed and working hours studied, it will astonish you to find how much business can be secured on this basis. Wherever a manufacturer works two shifts it is usually possible to so arrange the hours that they will avoid your six o'clock overlapping peak. The proposition requires care in presenting to the manufacturer, for at first thought he will say that it is not possible, but if your man has his conditions thoroughly in mind (and he should not talk until he has) he can in many instances persuade the prospect to shorten the noon hour, start one-half hour earlier in the morning and shut down early enough during the winter months to avoid the overlap. For instance, flour mills can easily shut down during overlapping peak hours, foundries by getting out their iron somewhat earlier, and many others are in the same class. Flat rates in connection with this off-peak business work in very advantageously. I am aware of the prejudice of all central stations against flat rates, and to some extent I share this for unlimited flat-rate lighting. However, I do not believe flat-rate power business is in the same class. The manufacturer will not pay for labor or wear and tear upon machines simply to waste current. He has a clearly defined number of hours to operate, a certain maximum production to obtain in these hours, and a definite number of machines to operate. A flat-rate peak-load contract can thus be easily drawn which will cover the situation fairly well. Say nothing about the horsepower required. The company merely agrees to furnish energy in sufficient quantities to drive a certain number of carefully described machines a certain number of hours per day. The contract is very useful in landing certain classes of men and business which could not be otherwise obtained.

One of our western plants in a city of 25,000 has now a day load of 1,500 kilowatts and has upon its circuits over 90 per cent. of the total power business in the city, the only exceptions being the paper mills. Another plant, in a city of 30,000, has a day load of 1,000 kilowatts and is closing down plants as fast as station capacity can be installed to take care of it. Fully 50 per cent. of the power contracts in both these cities contain this peak-load clause.

The value to the central station of a good, heavy, long-hour motor load cannot be overestimated. It furnishes a steady income for every month of the year. The amounts received per customer are relatively large and difficulties of collection very small. This power business will represent a satisfied class of customers, the most influential and best element of the city, and they will influence public opinion in your favor and largely minimize the danger of municipal-ownership agitation.

1. A paper read before the National Electric Light Association at Washington, D. C., June 7, 1907. Mr. Tidd is a central-station man of Scranton, Pa.

How to Get the Old Buildings Wired.[1]

By F. H. Golding.

Great possibilities for remunerative business in lighting are offered by the residences, and central-station men generally are awakening to the fact that a strenuous effort should be made to secure this class of business, particularly the old houses in which gas or some other established illuminant offers strong competition.

The campaign outlined in this paper has produced most gratifying results, and is adapted to the needs of the average central station, subject, possibly, to minor changes or modifications made necessary by local conditions. To attain the highest efficiency, this campaign should be supplemented by a liberal policy as to the kilowatts connected for which service will be furnished. One central station that has been very successful in securing old-house business by these methods—in fact, increased 700 per cent. in 18 months—will give service to any installation, no matter how small the current consumption promises to be, on the assumption that the use of electricity, even in the most trivial manner, soon becomes a habit and inevitably leads to a more extended use.

As a preliminary, a house-to-house canvass of the residential districts should be made, the information thus obtained to be compiled in card-index form, containing the street and number of each house, name of owner, name of tenant or tenants, means of illumination in use, and if electricity is not used, whether or not the house is wired. With this information available, the solicitor is in a position to work his district intelligently and systematcally, canvassing a block at a time and persisting until he has had one or more interviews with the head of every family in his district. After the preliminary canvass he may select those offering the most favorable prospects and concentrate his efforts on these selections, endeavoring to have not less than one or two on each block in his territory.

The head of the new-business department, being informed by daily reports as to the progress the solicitor is making, should aid him with mailings of personal letters and literature pertaining to various lighting and power appliances for the home use.

If the solicitor is at first unsuccessful in interesting the prospective subscriber to the extent of lighting his entire premises with electricity, he should endeavor to secure an entering wedge in the shape of a cellar or porch light, an electric iron, sewing-machine motor, or any other appliance that he thinks will most appeal to his prospect, offering the free use of same for a 30 or 60-day trial, provided the prospective customer will pay for the small amount of wiring necessary and for the current consumed.

It is right here that a liberal policy on the part of the company is of vital assistance to the solicitor, as the appliance most favored may be a heating pad, night light, or something else in which the current consumption is negligible. Having obtained a foothold, it is comparatively easy for a capable solicitor to gradually extend the uses of electricity in a home by a diplomatic and unobtrusive introduction of other appliances, so that almost before the householder realizes it he is relying on electricity for his light and various other needs and wondering how he could have gone without it so long. The enthusiastic testimonial of the pleased subscriber thus obtained is of material assistance to the solicitor in his work in neighboring houses, hence the importance of obtaining at least one on each block.

In conjunction with the solicitor's work, a good series of newspaper advertisements should be used, care being taken to have the copy attractive and readable, and arranged to fit the season or local conditions. For instance, in the fall, when lengthening and chilly nights offer the opportunity, devote the article to porch lights or electric radiators; in the winter, when the furnace must be cared for, to cellar lights; in the holiday season, to attractive gifts, such as chafing dishes and coffee percolators; in the spring, to flatirons, fans and other electrical hot-weather comforts; in epidemics of sickness, to heating pads, sterilizers, turn-down lamps, and so forth. In addition to the work above outlined, very good results can be obtained from a special advertisement inserted in the "For Sale or For Rent" columns at intervals, advising the prospective purchaser or lessee to

1. A paper read before the National Electric Light Association at Washington, D. C., June 7, 1907. Mr. Golding is a central-station man of Dayton, Ohio.

consider the desirability of electricity and avoid houses without it. These should be brief and pointed, and alternated with appeals to the real-estate dealers to wire all their houses and thus secure higher prices and easier sales. Pamphlets, flyers and other mail matter seasonably selected and pertaining to local uses or events when possible, should be freely used. A "burglar" pamphlet, issued at a time when several burglaries had occurred in succession and the city was much aroused in consequence, is a good example of what this class of matter could be; it was directly instrumental in securing many customers.

A liberal use of small electric signs, scattered freely through the residential sections, and of illuminated billboards, is a valuable adjunct to residential work. The signs should be of the picture-frame variety, to facilitate handling, and should be changed to new locations twice or three times a year.

Arrangements can be made with store or shop-keepers, by making a concession in their lighting rates, for the location of signs on their buildings and the switching on and off—the company's trouble men, or sign men, if it has them, caring for the renewals.

The billboards should be erected in favorable positions, preferably along the routes of the street-car lines, radiating out into the residential districts, and should be repainted at least two or three times a year to retain the interest of the passing public. Trough reflectors may be used for the illumination, and the reading matter and illustrations should bear on the uses of electricity in the home. A time switch may be used to control the lighting, unless the central station maintains a sign-switching service.

The company should be prepared, where conditions seem to warrant, and the prospective customer's responsibility is assured, to offer a proposition whereby the installation of wires and fixtures may be paid for in installments—weekly, monthly or quarterly, as may be desirable. By this means many customers can be secured who would not otherwise feel able to meet the installation expense. If the central station does not do interior work, a satisfactory arrangement could be made with the electrical contractors whereby the latter would add, say, 10 per cent. for interest and the expense of carrying the account, the lighting company guaranteeing the contractor against loss. As the cost of the average installation will not exceed $100, the percentage added will lay no great burden on the customer.

A number of central stations about the country have in effect a plan whereby a certain number of outlets is installed at or below cost, and some of them are obtaining very satisfactory results, but propositions of this character must be governed entirely by conditions existing in the territory served, and should be carefully considered. In one city recently brought to the writer's attention, where the lighting company installed the first work with its own men, the practice was discontinued because the contractors regarded it as a usurpation of their prerogatives, and when called upon to furnish estimates for wiring the remainder of a house would add to the estimate a sum equivalent to the assumed profit they would have received on the original work. In another city, where the lighting company arranges with the electrical contractors to do the work and pays them the difference between the amount the customer pays and the normal price for the installation, the plan has worked out well.

The question of getting new houses wired is so closely allied with the one under discussion that a few words on the subject may not be amiss here.

In growing cities it is advisable to maintain solicitors exclusively for this business, averaging one man to about 50,000 to 100,000 population, depending on how rapidly the city is growing and new houses are being erected. It should be the duty of the "new-house man" to keep track of the building permits and of the building-trade notes, to keep in close touch with architects, builders and real-estate men, and a generally watchful eye on new building. In the latter he will be aided by the daily reports of the district solicitors, who should be required to note on their reports the building preparations in their districts.

He should receive the same assistance in the form of follow-up letters and other mail matter that the other solicitors receive, and, in addition to that, a special mailing series to architects, builders and real-estate dealers should be used. The special series, supplemented by frequent personal letters proffering the services of the company's illuminating and construction engineers in laying out the supervising and installation of distributing systems free of cost to the persons addressed, could consist of mailing folders containing illustrations of successful residential lighting effects, preferably local, and reading matter descriptive of and calling attention to the illumination in the picture. One lighting company in a city of about 100,000 population adopted a similar plan for its new-house work, with the result that, while less than 10 per cent. of the new houses built in the city during the first five months of 1905 were wired, during the same period of the current year 92 per cent. were wired.

A Clever Cover Design.

The accompanying illustration is a reduced facsimile of the front cover of Edison Light the house organ of the Edison Electric Illuminating Company of Boston—for June. It shows a wind mill in Holland with an electric fan instead of the revolving arms of the mill. The picture is made to give a clever imitation of Dutch tiles, and in the original the color is a very exact reproduction of the Delft blue. Altogether, the design is pleasing and attractive. Referring to it, Edison Light says: "Such a change as is indi-

A CLEVER COVER DESIGN.

cated by the cover of this number of Edison Light —in which the artist has attempted to convey an impression of beauty as well as a suggestion of value—would be found impracticable, it may be confessed. However, it should be remembered that the electric fan, as now available, is a distinctly practical device, able and willing to introduce greater comfort and better conditions in home, or office, or workshop."

The central-station advertising literature of the United States shows very clearly the work of many bright minds engaged in the publicity end of selling electricity.

Electrical Exhibit at White City.

The Commonwealth Electric Company maintains a handsomely appointed exhibition room at White City, the pleasure resort, whose thousands of electric lights are supplied by the company. All kinds of electrical domestic conveniences, cooking utensils, fans, turn-down lamps, signs and flashers are shown to interest the stream of people the exhibit attracts. Plate-glass windows in one side of the room give a clear view of the interior of the substation which supplies the district. The switchboard and converting machinery, of the latest type, show the excellent construction and admirable maintenance for which the Chicago company has become known.

Canadian Electrical Exhibition.

The first annual electrical show of the Canadian Electrical Exhibition Company will be given in the Power Building, Montreal, from September 2d to 14th inclusive. A charge will be made for space, and alternating current of 60 cycles, 110-220 volts, will be furnished at a special rate. The Canadian Electrical Association and the Canadian Street Railway Association will hold their conventions in Montreal during the show, which will be the first of its kind to be held in Canada for 17 years. Three-quarters of the space has been sold. W. McLea Walbank is president of the company giving the show, and R. S. Kelsch is managing director.

The annual conversazione of the British Institution of Electrical Engineers was held on June 18th at the Natural History Museum, South Kensington. There was an attendance of about 1,500, among the number being many members of kindred societies. Dr. R. T. Glazebrook, the president, and Mrs. Glazebrook and Lord Kelvin, the president-elect, and Lady Kelvin received the guests, who included Lord Justice Buckley, Mr. Justice Grantham, Rear-admiral Sir Henry Jackson, Sir William Crookes, Sir H. C. Mance, Sir W. H. Treacher, Sir J. Clifton Robinson, Sir William Ramsay, Sir J. I. Thornycroft, Sir C. Trevor, Sir Patrick Manson, Major-general E. R. Festing and Prof. G. Carey Foster.

QUESTIONS AND ANSWERS.

A Question of Employment.

I. A., Chicago, asks for information about requirements for admission to the local union of electrical workers; also about the prospects for employment as an electrician in Washington and Oregon.

ANSWER.

The Chicago "Local 134" of the International Brotherhood of Electrical Workers is addressed at 166 East Madison Street. For information about the employment outlook in Washington and Oregon, why not write direct to those states? Perhaps the general superintendent of the Seattle (Wash.) Electric Company and the superintendent of lines of the Portland (Oregon) General Electric Company will give the desired information.

Effect of Higher Voltage on Meter Registration.

H. A. Z., Anamosa, Iowa.: What effect will it have on a meter calibrated at 110 volts, 60 cycles, when put onto a 115-volt 60-cycle circuit? Will it make the meter run or register faster?

ANSWER.

As a rule, when a meter is calibrated for 110 volts and the compensating coil balances the friction of the bearings, the meter will tend to run slightly faster if applied to 115 volts pressure. This, however, depends in a measure, upon the torque of a meter. In meters possessing a high driving torque, the increasing of the pressure from 110 to 115 volts has little effect, if any, upon its accuracy, but in meters where the driving torque is small, the increase in speed will be noticeable; and will be more marked on the lower loads, on account of the element of friction forming a greater percentage thereof than the higher loads.

However, in everyday practice, the entire matter will resolve itself into the following:

In low-torque meters, the increasing of the pressure from 110 to 115 volts will, in all probability, make them "creep" slightly on no load, especially if subjected to vibration, and incidentally cause the other readings also to be a trifle fast. In high-torque meters, this increase in pressure will make no material difference, since that portion of the load of the meter that is represented by the friction of the bearings is so small as compared with the retardation or drag that is set up between the disk and permanent magnets that it becomes negligible.

If the pressure at the switchboard has been raised five volts, thereby affecting all the meters in service, it would be wise to inspect each meter, and those of them that "creep" on pressure only should be re-compensated to avoid any trouble that might arise later on.

Further, if the meters in question have already been in service for some time, the friction of the jewel and registering train may have increased to a point where the added five volts will just compensate for it, thereby bringing the meters back to their original accuracy.

BOOK TABLE.

THE FINANCES OF GAS AND ELECTRIC-LIGHT AND POWER ENTERPRISES. By William D. Marks. (Fourth Edition.) New York: Published by the author. 1907. Pp. (7 by 5 inches), xv., 532, with numerous tables and curves. Price, $4.

Following the exhaustion of the three earlier editions of this work, the present volume appears with substantial additions to the subjects of gas and electric street lighting and appended notes by the author, who is a well-known consulting engineer of New York city. In much of the text the author has preferred to leave his work as a collection of papers, and he gives facts and figures derived from hundreds of operating electric railways, electric-light stations and gas plants.

The object of the book is to afford those interested in the proper prices for electric-railway fares and freight, gas and electricity, a practical method of determining them for any locality.

The subject of the finances of electric railways includes a detailed account of the costs of survey, construction, equipment, and maintenance, and a discussion of the choice of location, character of service, etc., all illustrated with many actual examples. Then follows a commercial analysis of small and unprofitable electric-lighting plants and a chapter on how to get paying loads for stations. The last five chapters are new with this edition and cover electric street lighting and gas and prices in the larger cities. For the calculation of railway rates there are presented in algebraic form all factors required. Numerous curve sheets and diagrams give costs at a glance.

The book is a remarkable compilation of information on investments in public utilities, and shows, besides financial knowledge, the author's close acquaintance with the practical operation of plants. The style is entertaining and, despite the difficulties of the subject, the pages hold the reader's interest. To the owners and operators of plants of the character described the book cannot fail to prove of value, if given the careful study which it deserves.

Code of Ethics for Electrical Engineers.[1]

A. General Principles.

1. In both his professional and his business relations the electrical engineer should follow strictly the same ethical principles that are recognized in the social relations of everyday life. He should consider himself personally responsible for the character of the enterprises and the persons with which he is associated professionally.

2. Before entering into professional relations, it is therefore the duty of the electrical engineer to satisfy himself that the enterprises with which he connects himself are of a legitmate character. If, after becoming associated he finds them to be of a questionable nature he should sever his connection as soon as possible. It should not be considered an excuse that his connection extends only to legitimate engineering work.

3. An electrical engineer permitting the use of his name in any enterprise or exploitation becomes morally responsible for its character. He should therefore not allow the use of his name in connection with anything upon which he is not qualified by training and experience to exercise competent judgment.

4. The electrical engineer should take care that credit for engineering work is attributed to those who, as far as his knowledge of the matter goes, are the real authors of such work.

5. The electrical engineer should incline toward and not away from standards of all kinds, since standardization is peculiarly essential to the general progress of the profession. This applies to construction, measurement and expression, or nomenclature as well as to conduct, or ethics. Even the tendency to give individuality by providing special construction may sometimes be avoided with advantage.

B. Relations of the Electrical Engineer to His Employer, Customer or Client.

7. The electrical engineer should consider the protection of his client's interests as his first obligation, and therefore should avoid every act that would be contrary to this duty; if any other consideration such as professional obligations or restrictions interfere with his so acting, in accordance with the expectation of his client, he should inform him of the situation.

8. He can honorably accept compensation, financially or otherwise, from one side or party only, interested in the same matter. The electrical engineer, whether consulting, designing or operating, may therefore not accept commissions, either directly or indirectly, from other parties dealing with his principals.

9. Electrical engineers in a position to decide on the use of inventions, apparatus, etc., should not be financially interested in their use, as by receiving a royalty, etc., unless the matter is clearly understood by the client or employer.

10. Electrical engineers should not accept employment while financially interested in a rival concern except upon the express permission of both parties. An electrical engineer may be employed by more than one party, as in the case of a consulting engineer, when the interests of the parties do not conflict, and it is understood, as is usual in such cases, that he is not expected to devote his entire time to the work of one party but is free to enter into other engagements. A consulting engineer permanently retained by a party should notify other prospective employers of this affiliation before entering into relations with them. A consulting engineer when not exclusively retained by one side may advise rival concerns, with the full knowledge of all of them and upon taking care that the interests of the parties do not conflict in the particular matter handled.

11. Operating engineers should consider themselves responsible for defects in apparatus or dangerous conditions of operation, should bring the same to the attention of their employers and urge remedial action. If the causes of the danger are not removed they should withdraw.

12. An electrical engineer should in general be considered directly responsible to his employer or client for the successful fulfillment of the work upon which he has been engaged and for its satisfactory performance as a whole. It should therefore be clearly understood at the outset just what the extent or the limitations of responsibility of the engineer are to be. Whether he has been employed merely as designer or whether he is retained to design and to superintend construction; whether to design only the chief features, or to pass as well upon all details of the apparatus that is to be installed. Attention should be directed to the fact that defects in the manufacture of material or apparatus is a matter distinct from the matters of design or installation. An engineer should not be held responsible for the unsatisfactory performance of a plant resulting from defective apparatus furnished, unless he has undertaken to include this subject.

C. Relations of the Electrical Engineer to the Ownership of the Records of His Work.

15. The following general principles should be recognized:

If in executing his work, the electrical engineer uses data or information which are not common and public property, but which he receives, directly or indirectly, from his employer, or if the problem solved by the engineer is met in the pursuit of his work for his employer, and is not of such character that his attention would have been directed to it regardless of his relations to his employer, the products of his work, in the form of inventions, plans, designs, etc., are not his private property, but the property of his employer, though the engineer may be entitled to special remuneration for such inventions, etc.

16. If in the execution of the work the engineer uses only his own knowledge or data or information which are public property by prior publication, etc., and receives no engineering data from his employer or customer, except performance specifications, the results of the work, such as inventions, plans, designs, etc., are the private property of the engineer, and his employer or customer is entitled to their use only in the specified case.

17. All the work done by the engineer in the form of inventions, plans, designs, etc., which are outside of the field of engineering for which his employer has retained him, are the engineer's private property.

18. When an engineer or manufacturer builds apparatus from engineering designs supplied to him by his customer, the designs remain the property of the customer and should not be duplicated for other customers without express permission. When the engineer or manufacturer and his customer are jointly to work out designs and plans or develop inventions, a clear understanding should be arrived at before the beginning of the work regarding the proportionate rights of ownership in any inventions, designs, etc., that may result, since in such case both parties should be considered to have rights therein.

19. Any engineering data or information which an electrical engineer obtains, directly or indirectly, from his employer or customer, or which he creates as a result of such information, must be considered by the engineer as confidential; and while the engineer is justified in using such data or experience in his own practice as going toward his education, the publication thereof without express permission is improper, as is also its use in producing for other parties, work that is characteristic of the original customer or employer.

20. Designs, data, records and notes made during his engagement by an engineer employed on salary under permanent engagement, and referring to his work, are his employer's property. The same matter in the case of a consulting electrical engineer paid by fee or by commission, are the property of the consulting engineer.

21. A customer in buying apparatus, does not acquire any right in its design beyond the use in the apparatus purchased. A customer of a consulting engineer does not acquire any right to the plans made by the consulting engineer except for the specific case for which the apparatus was built or the plans made.

D. Relations of the Electrical Engineer to the General Public.

22. The electrical engineer should endeavor to assist the public to a fair and correct general understanding of engineering matters, spread the general knowledge of electrical engineering, and discourage wrong or exaggerated statements on engineering subjects published in the press or otherwise, especially if these statements are made for the purpose of, or may lead to, inducing the public to participate in unworthy schemes.

23. Controversies on engineering questions, however, should never be carried on in the public press, but should be confined to the technical press and the engineering societies or through trade bulletins.

24. First publication of inventions or other engineering advances should not be made through the public press, but rather through the technical press and the engineering societies or through trade bulletins.

25. The publications which an electrical engineer is justified in making through the public press should therefore be of a historical, educational, instructive or similar character, and should not relate to controversies between engineers or on engineering questions, to new inventions, etc., nor contain technical criticisms of fellow engineers, and it should be considered unprofessional to give opinions without being fully informed on all the facts relating to the question, and on the purpose for which the opinion is asked, with a full statement of the conditions under which the opinion applies.

26. In giving expert testimony before judicial bodies, the electrical engineer should confine himself to brief and clear statements on engineering or historical facts. He should not give personal opinions without so expressly stating, and should avoid pleading on one side or the other.

E. Relations of the Electrical Engineer to the Engineering Fraternity.

30. The electrical engineer should take interest in and show due regard for the electrical engineering societies and the technical press.

31. He should assist his fellow engineers by exchange of general information, experience, instruction, etc.

32. He should not take a position left by another electrical engineer without satisfying himself that the former has left it voluntarily, or for proper reasons.

33. Where engineering work is in charge of an electrical engineer, no other electrical engineer should undertake the work except on request of or in co-operation with the electrical engineer who had charge of the work before, unless the latter's connection with it has already terminated.

34. An electrical engineer in responsible charge of work should not permit other engineers or non-technical persons to overrule his electrical engineering decisions. If this is done and persisted in, he should as soon as is practicable withdraw.

35. In engineering work in charge of a board of engineers, the respective limitations of the authority of each should be decided at the outset, and each electrical engineer should give full and complete information on his part to the other engineers and insist on this being reciprocated.

F. Relations of the Electrical Engineer to the Standards of His Profession.

40. The title "electrician" should be applied to those having practical training sufficient to enable them to carry on intelligently certain classes of electrical work, such as the installation of electric lights and bells, and the operation of small electric plants.

41. The title "electrical engineer" should be applied only to graduates from the electrical engineering schools of universities of recognized standing, and such men as possess an equivalent knowledge of electrical engineering. Letters usually employed to denote college degrees, such as E. E., should be used only by those holding such degrees.

42. The title "consulting electrical engineer" should be applied only to those electrical engineers who possess such knowledge and experience in electrical engineering as would qualify them to full membership in the American Institute of Electrical Engineers.

1 This code of ethics was approved by the American Institute of Electrical Engineers at Niagara Falls, N. Y., June 27, 1907. It was prepared by a committee consisting of Dr. S. S. Wheeler, Dr. C. P. Steinmetz and H. W. Buck, which has considered it "both practicable and desirable to record some of the general principles of professional conduct that should be a guide for the electrical engineer, leaving it to him to make specific application to the cases which he may meet.

Coming Street-railway Convention at Atlantic City.

The annual convention of the American Street and Interurban Railway Association and its affiliated associations will be held at Atlantic City, N. J., from October 14th to 18th, inclusive.

It has been decided by the official representatives of the various associations that each organization shall have its own hotel for its headquarters, so that each individual hotel may be used as a general meeting place for those interested in specific lines of work. The Marlborough-Blenheim will in general be considered the headquarters of the American association and also of the Manufacturers' association, the Chalfonte for the Accountants' association, and the Dennis and St. Charles hotels for the Engineering and Claim Agents' associations, respectively. Arrangements for hotel reservations should be made directly with the hotels.

The steel pier at Atlantic City has been recently widened, strengthened and reinforced with concrete the entire length. It extends 1,600 feet into the ocean and will be the general headquarters during the day for the meetings, and upon it will be held the exhibition of electric-railway apparatus and appliances given by the Manufacturers' association. Over 70,000 square feet of net exhibit space on this structure is available and all indications point to a manufacturers' exhibit which will be even larger and more interesting than that given in Columbus at the 1906 convention. In addition to the exhibits shown on the pier there will be a fine display of cars within walking distance of the pier.

The committees on subjects for the various associations have been actively engaged on the programme for several months past, and there is every prospect of the presentation of a number of interesting papers. Each of the four associations will have a programme. The complete programmes will be announced in a bulletin which will be issued early in July. The opening session of the convention will be held in Casino Hall. The usual arrangements for transportation are being made with the various passenger traffic associations. Round-trip tickets for one and one-third fare upon the certificate plan will be issued.

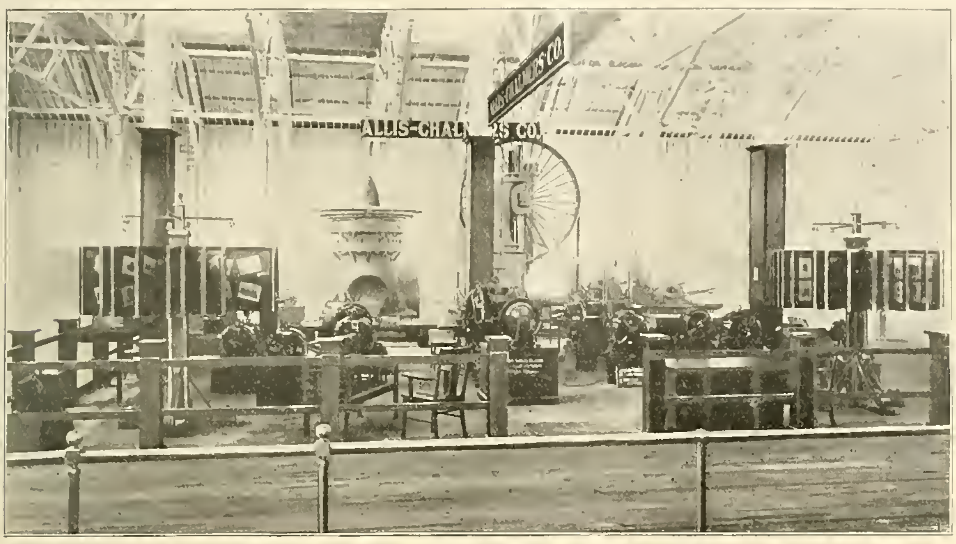
The association has recently issued bulletin No. 2 on the convention arrangements, and further information may be had by addressing Bernard V. Swenson, secretary and treasurer, 29 West Thirty-ninth Street, New York city.

Allis-Chalmers Exhibit at the Jamestown Exposition.

So much stress has been laid on the naval and military features of the Jamestown Exposition that the importance of the display made by commercial and industrial interests may be overlooked by the public of the country at large. Every state in the Union is, however, represented industrially, and many foreign governments were among the first exhibitors to secure space for a similar purpose. This feature of the fair is developing beyond expectations, having exceeded the plans originally made for the exploitation of manufactured articles of trade, and it is proving one of the leading attractions.

Among the principal exhibits of machinery, to which visitors will be early attracted, is that made by Allis-Chalmers Company of Milwaukee, occupying Section 8, Machinery and Transportation Building, as shown in part by the accompanying illustration.

The character of this exhibit is not marked by the display of any unusual or special apparatus, nor does it include specimens of all Allis-Chalmers Company's extremely large and varied line of products, but only a few of the standard machines whose designs have been well established, such as are used in thousands of installations the country over, and are doing efficient, economical, everyday service.



PARTIAL VIEW OF ALLIS-CHALMERS EXHIBIT AT JAMESTOWN.

The larger machines seen at the back of the picture, a No. 5 style "K" Gates breaker and an Allis-Chalmers band mill, with sawmill carriage, are representatives of three important branches of industry in which Allis-Chalmers Company is the acknowledged leader; namely, the manufacture of complete rock and ore-crushing equipments, cement-making plants and sawmill machinery.

The breaker is identical with those used by the Pennsylvania Railroad in the concrete construction of its famous tunnel under the East River, New York, a model of which is exhibited just across the aisle; and the band mill might be taken for a twin of one which recently broke the timber-sawing record of the South.

The exhibit includes a belted alternator and an Allis-Chalmers Reliance engine, the latter hidden in the background of the picture. The company builds both Corliss engines and electric generators especially designed for operating with them, and the purchaser is able to deal with a single concern and thereby avoid any division of responsibility for the satisfactory operation of both the steam and electrical ends of his power plant. There is also shown a complete line of apparatus for electric drive, including standard Allis-Chalmers induction motors and direct-current motors.

In the photographs, model and parts of Allis-Chalmers steam turbines shown in this exhibit may be observed three of the special features of these machines, viz., channel-shaped shrouds protecting the ends of the blading from injury, machine-cut slots in the foundation rings, insuring accurate spacing of the blades, and improved arrangement of balance pistons, reducing the diameter of the cylinder and preventing distortion under varying temperatures.

The greatly extended use of compressed air for driving drills, pneumatic riveters, hammers, cleaners, clipping and calking tools, etc., has created a strong demand for small air-compressor plants which may be placed conveniently to the work in hand. A portable compressor outfit mounted on a truck, comprising a Christensen air compressor, driven by an Allis-Chalmers motor, may be seen here, with all its accessories.

At either corner of the space are placed large swinging racks of frames containing photographs and illustrated summaries of bulletins of the principal products of Allis-Chalmers Company.

J. J. Thomson on Electrons[1]

Of late a surprising amount of quite definite information has been obtained as to the nature of negative electrification. Negative electricity is an atomic stuff the particles of which (corpuscles or electrons) are all of the same size, have an inertia which is 1/1700th that of the hydrogen atom (but is accountable for on purely electromagnetic principles) and may either rush about violently by themselves, passing straight through an ordinary molecule of matter, or, when their speed is not sufficient to remove them from the sphere of its attraction, may stick on to it or a part thereof and convert it into the familiar negative ion. Of what positive electrification may be there has been very little except negative knowledge. In his Royal Institution discourse on March 22d and the last of his course of six lectures delivered on March 23d, Prof. J. J. Thomson set out the results of the last 12 months' work at the Cavendish laboratory, designed to ascertain as much as possible about the nature of positive electricity, or what is the same thing in other words, to catch the positive electron. Professor Thomson has not caught that non-existence, but he has caught three other little things instead, one negative and two positive, and if subsequent investigation substantiates the present work, he has established a fundamental and far-reaching discovery as to the constitution of ordinary matter.

The most likely way of finding out all about a thing is so far as possible to isolate it from everything else, and to this end Professor Thomson went fishing for his positive electron in a highly exhausted vacuum tube; that is to say, he investigated the kanalstrahlen, or as he calls them, the rays of positive electricity there. These rays are obtained by making a hole in the cathode. They were discovered a long time ago by Goldstein, and in these latter days have been investigated by Wien, who got as far as to show that they carried positive electricity.

First, however, as to their origin. They come from the gas on the front or anode side of the cathode and apparently not far from it, that is to say, from the bright patch which is called the first cathode layer. Obviously, then, they are the carriers of the positive electricity seeking the negative electrode, and happening to come up to it at a hole, pass through and appear on the other side. Professor Thomson exhibited the effect very beautifully, using a helium vacuum tube in which all the negative fluorescence is blue or green light, while the positive rays, where they are not masked by the former, have a pink coloration. The method of investigation of the positive rays thus separated is in principle exactly similar to that used to determine the nature of the negative corpuscle. That is to say, their velocity and inertia are determined by comparing the deflection produced by known electrostatic and magnetic fields in a manner that has been already briefly described (and can be found in the text books). But since it turns out that the inertia of the particle to be deflected will be 1,500 to 5,000 times greater than in the cathode ray, and the speeds are only about 10 to 30 times less, it will be seen that the electrostatic and electromagnetic fields necessary to produce an observable and still more measurable deflection must be very much stronger than in the former case.

The experimental difficulties, indeed, are very considerable, but nothing can be said about them here, only results can be presented. One of the troubles is to calculate the distribution of the intense magnetic field. It is evaded by not doing it, but by comparing instead the deflection of the stream of positive rays with that of a wire in the same field under tension and carrying a current. It may also be mentioned that at a high exhaustion the use of aluminum cathodes has to be abandoned in favor of a cathode covered with sodium potassium alloy, which gives off corpuscles much more freely (a property which is probably connected with the high atomic volume of these metals). The rays are sent through a capillary tube and received on willemite powder (zinc silicate) cemented on to the interior of the tube with soluble glass (sodium silicate).

The first important observation made on the deflection of the rays under the magnetic and electric field is that instead of the fluorescent spot where they strike the willemite being simply shifted, it lengthens out into a long band of light. Wien made the natural assumption that this was due to the fact of the carriers of the positive electric charge having all kinds of different masses (the heavier being obviously the least deflected, when the charge remains the same), and that explanation has hitherto been accepted as satisfactory by everyone. It would involve that in certain cases the carriers of the electric charge must consist of a relatively very large number of atoms. Professor Thomson has observed, however, that there is at low exhaustions[1] a small amount of fluorescence in the opposite or negative direction, which can only be accounted for by some of the particles carrying not a positive but a negative charge. It cannot be due to the ordinary cathode corpuscle, for that would be brushed away to one side immediately by the intense fields used. The only supposition that will fit with the facts is that one has carriers proceeding at approximately the same speeds but liable to lose their charge. They would then be no longer deflected, or even (by contact with one or more particles of the gas) might acquire a charge of the contrary sign and would then be deflected in an opposite direction. (Here, then, is a new thing altogether, a negative something quite unlike the corpuscle electron, and equally not a negative ion, since it has the mass of hydrogen or helium and is rushing precipitously in the wrong direction.)

The supposition is confirmed by the fact that at high exhaustion, where collisions may be regarded as of rare occurrence, the negative deflection disappears, and the comet-like band of light becomes replaced by a couple of patches. The curious thing is that there are in all cases two patches and indications of two bands. Measurement in the usual way shows that the ratio of the electric charge to the mass e/m corresponds in the case of the first to the 10^4 and of the second to $\frac{1}{2}\ 10^4$, except in the case of helium tubes at the lower exhaustion, when it is $\frac{1}{4}\ 10^4$. The first figure corresponds to a carrier having the same inertia as a hydrogen atom, the last corresponds to one having the same mass as the helium atom.

Curiously enough, whatever be the gas in the tube, this is the only case in which the atom of an element other than hydrogen has been certainly obtained as a positive carrier. Professor Thomson is endeavoring to find others by using lime cathodes, which give discharges at much lower potentials, but at present that research is only just begun. (There is a considerable gap between helium, 4, and the next gas, nitrogen, 14, which may have something to do with it.) The $\frac{1}{2}\ 10^4$ carrier corresponds to that which has been obtained for the α particles of radium. (A half atom of helium with a single charge, a whole molecule of hydrogen with a single charge, or an atom of helium with a double charge would equally fit the specification, the last seems the likeliest.) The speed of the particles is from 10^8 centimeter (say 600 miles) per second to three times that amount.

The really remarkable thing is that carriers of the hydrogen value are obtained whatever the gas and cathode in use. The result is so unexpected that it has been suggested against it that the gas in the tube is not really that which was put in (and pumped out again), but hydrogen and helium emitted from the glass and cathode in the last stages of exhaustion. So far as is possible to do so, Professor Thomson has satisfied himself by various means that it is exceedingly improbable that this is the case. We have, therefore, the result that under sufficiently severe electrical stress any gas gives off positive particles, which are the same in all cases, are of two sorts only, and one of them is the hydrogen atom. The result must be taken in connection with the demonstration of Prout's hypothesis obtained from the deviation of cathode corpuscles in gases being proportionate to the atomic weight. Professor Thomson spoke of this as being "one of the most far-reaching results obtained lately in physics."

The summary of the matter is, therefore, that in sufficiently high electric fields all gases give off the same positive carriers, but there are two sorts, and the ratio of the charge to the mass is that of a charged atom of hydrogen in the one case and of something else in the other. There is nothing at all like the negative corpuscle or electron.

Professor Thomson's last lecture consisted of a compression of his hour's discourse of the evening before into half an hour, and as much further information on the same subject as could be crammed into the remaining 30 minutes. A part

1. From Electrical Times of London.

1. Relatively low, all in fact under one millimeter.

of this relates to the observations of other people and part to his own. Quite shortly, while the cathode rays give a continuous spectrum, the positive rays give a line spectrum of the material they hit, but this only takes place when that substance is a salt or other compound; pure metal (conductors) declines to light up at all. Investigating the positive streamers spectroscopically, Starke has obtained the Döppler effect and deduced from it velocities corresponding to the figures obtained otherwise. The experiment was repeated by Hull in the Cavendish laboratory, and the effect got with ease with a hydrogen tube, but on endeavoring to carry the matter further with helium and mercury, no effect whatever could be obtained even by the most delicate methods, and the cause remains a mystery.[1] Where positive rays strike a metal plate they cause an emission of cathode rays normally to the surface, which is largely independent of the amount of discharge. (It has been, in fact, quite possible for the experimenter to persuade himself that he has succeeded in electrifying negatively a piece of metal by pouring upon it a stream of positive electricity. The subject is simply full of traps. (In spite of their retiringdisposition the positive rays are therefore of primary importance in producing a discharge through a gas by initiating this outpouring of negative electrons. The α rays of radium are positive corpuscles, and from Rutherford's examination of them they appear to consist of the ½ 10' carriers. They perform, of course, in the open air, not inside a vacuum tube, but they are difficult to experiment with, because there are so few of them. The investigation of their absorption in air gives a result entirely different to those of the cathode rays where absorption is gradual and depends on the substance penetrated. Professor Bragg has shown that according to measurement the α rays are hardly absorbed at all up to a certain point in air, and then they appear to be absorbed altogether, and no further fluorescence can be obtained.

The curious thing is that the velocity with which the α particles are expelled from radium is much greater than that which can be obtained for the positive carriers in tubes of the highest exhaustion, and when the α rays can no longer be detected their particles must still retain nearly 60 per cent. of their original velocity. That is to say, they become invisible in air when in the tube the fluorescence would be of the strongest. Two suggestions are made in explanation. One is that the fluorescence is an additive effect; in the former case, the particles being sparse, each one must carry in it sufficient energy to produce the effect by its single blow, while in the tube there may be instead a series of impacts from successive particles, but individually of much less strength. The other suggestion is that in air (where the atoms are comparatively crowded) the critical speed for the ceasing of the phosphorescence corresponds to the speed at which a positive carrier would cease to get away from anything negative that it came into collision with, but the two would travel on together and neutralize each other.

In a highly exhausted tube there is only a very small chance instead of a certainty of the particle meeting something of the opposite or neutral sign. Very briefly, in the last few minutes, Professor Thomson also referred to the electrification given out by salts at a red heat. The nature of this, it seems, depends on the salt. In general oxides give out negative electrification and phosphates positive electrification. So far as the investigation has gone the sign corresponds with the electrification produced when a substance is rubbed.

Telephone Extensions in Columbus.

The board of directors of the Columbus (Ohio) Citizens' Telephone Company has declared the regular quarterly dividend of 1½ per cent. on the preferred stock of the company. The new issue of stock comes within the dividend, and for that reason the sum distributed July 1st was much larger than on any previous occasion since the company was started. The company expects to cut over the wires from the east side branch exchange located near Oak Street in about two weeks. The building is completed and the switchboard is now being installed. The exchange will take care of the subscribers of that section and will be operated automatically. Later it is expected to erect another branch exchange, probably on the north side. According to E. R. Sharp, one of the directors, there are about 4,000 applicants for telephones in the north side that cannot be taken care of until after the exchange is completed. In all about 98 per cent. of the trunk lines north of the viaduct are in use.

1. The Döppler effect is the shifting of the spectrum lines produced when the source of light is moving with great rapidity to or from the observer. The light of the positive streamers must result from collisions of their particles with something else. It looks like an explanation to suppose that in the case of hydrogen the light comes from the particles themselves, and in the other cases from what they graze or collide with, but do not materially shift in so doing, or it might be from particles which are stopped by colliding. But that would be a state of things which calls quite as strongly for explanation also. From considerations of time the matter was referred to very briefly, and the writer does not know the exact circumstances of the observations.

Proposed Franchise for Chicago Telephone Company.

The committee on gas, oil and electric light of the Chicago City Council has about completed its work in relation to applications for a telephone franchise in Chicago. The Chicago Telephone Company (Bell) and the Manufacturers' Telephone Company (Independent) are the two principal contenders for the franchise.

After months of deliberation, in which the committee had the advice of a committee of telephone experts, an ordinance has been prepared for submission to the City Council. This ordinance proposes the terms of a franchise to the Chicago company and is the report of a majority of the committee. It is possible that there may also be a minority report.

Following is a brief outline of the ordinance to be reported by the committee:

The proposed grant shall expire January 8, 1929. The telephone company's books are to be open to examination by city officials. At the end of every six months the company is to file with the city comptroller a statement of all its gross receipts, and at the time of filing is to pay into the city treasury three per cent. of these gross receipts. "Gross receipts" include all money received by the company as its share of the returns of long-distance calls completed outside of the city, as well as local business.

The usual requirements as to efficiency of service are made, and free service is to be given to the City Hall. Free instruments for fire and police telephoning are to be provided. The city may place its wires, to a certain extent, on the company's poles and in the company's underground conduits.

The company agrees to build new branch exchanges and extend its cables in the direction of additions to the city.

A set of maximum rates of charges is enumerated as follows:

Business single-party telephones, including 1,200 outgoing messages, $60 per year, with three cents per message for the next 2,400 and two cents apiece thereafter. There are other provisions for reduced rates in case of large users of telephone service.

Residence service—Single-party lines, $18 a quarter; two-party lines, $14 a quarter.

Nickel prepayment service is furnished where 20 cents a day is guaranteed for a single line, and 15 cents a day on a two-party line. Private residences must guarantee 10 cents a day on two-party lines and five cents a day on four-party lines.

When the coin-box collection shows a deficit below the guarantee, this is paid by the subscriber, who is given a receipt; then, if within 60 days, the collection shows an excess above the guarantee, this is applied on the preceding deficit. Only four parties are permitted on a line.

For single conversations within the city the charge cannot exceed five cents. Neighborhood single-party service rates, for connections completed within the local exchange, are $4 and $3 per month for business and residence telephones respectively. Toll service within 15 miles of the City Hall will cost not more than 10 cents for two minutes, and five cents a minute thereafter. When metered service is required, no charge will be made unless the conversation is actually transmitted. Extension telephones to lines already installed (not four-party lines) are not to cost more than 50 cents per month.

The telephone directory is to be printed at least three times a year and one delivered to each subscriber. Private exchange lines between points less than half a mile distant will be charged for at $5 a quarter, and for greater distances at a rate per telephone of $2.50 per quarter per quarter-mile. Private lines of less than a mile will be furnished at $10 per quarter each, with corresponding increase for greater distances.

The ordinance provides that in the future, when the city desires to take up the regulation of rates, after 30 days' notice the company will produce any data necessary to effect a reasonable regulation.

Excess of earnings over 10 per cent. on the investment for the year is to be paid over to the city. The company is to expend at least six per cent. of its gross receipts on repairs and maintenance, under penalty that the part not so spent goes to the city.

Nothing in the ordinance is to be taken as preventing the city, empowered by legislative enactment, from passing future general ordinances fixing the rates, as there is no intention that the city shall surrender any present rights by this ordinance.

It is expressly provided that the company shall not enter into contract with other concerns for rate agreement or division of territory, the possible penalty for infraction of this provision being the repeal of the ordinance.

The district for underground conduits is specified clearly. Records of lines are to be filed with city officials, and all work is done under the supervision of the commissioner of public works. Underground conduits, their construction, plans, permits, the subsequent restoration of streets, overhead wires and distribution, wires over buildings by consent of owner, and method of stringing are treated in detail.

A bond of $50,000 is required of the company at the time of acceptance of the ordinance. The present agreement will remove all future obligations of previous ordinances under which the company is now operating.

In 1919 or 1924 the city may take over the plant of the company on payment of the amount of appraisement by a special board, jointly appointed.

At the City Council meeting on July 1st the ordinance was not presented for passage, but the action of the council on the subject of a telephone franchise seemed to portend no particular good to the tentative ordinance. Against the protests of some of the committee which drew up the ordinance, the council almost unanimously authorized the mayor to appoint a committee to go to New York and investigate the measured-service plan in vogue there. Three aldermen known to oppose measured service and three favorable to it were appointed, leaving the report practically in the hands of Alderman Bennett, the seventh member of the committee. This move makes it uncertain whether the ordinance will get to the council before the summer vacation.

Indiana Telephone Items.

The Cumberland telephone officials have decided not to pay the city of Petersburg $500 bonus and two per cent. of the annual receipts, which is demanded by the City Council in consideration of a new franchise, and have notified the council that the company will remove its wires and poles on or before July 10th and quit the field. The officials say they could not afford to establish such a precedent.

The Rushville Co-operative Telephone Company of Rushville has begun work on a new automatic telephone system. The total cost will be in the neighborhood of $35,000. This is the second automatic system in the state. But one operator is required, to take care of long-distance work. The new system will be in operation by October 1st. The company has just completed a new building which will be used for the office and central station.

On June 26th the Bell company abandoned its local exchange in Wabash. M. C. Glass of Peru will hereafter manage the local central station as well as the stations at Peru, Deedville and Bunker Hill, all having smaller systems, due to the rivalry of the Independent companies. The Wabash exchange was established in 1894, and it had a monopoly of the business until a few years ago. The Home Telephone Company was organized in 1895 by citizens. The Central Union recently sought the passage of an ordinance not limiting the price to be paid for telephones. This was defeated, and now the Bell abandons the field. Victor Black, local manager, goes elsewhere. S.

Telephone News from the Northwest.

The North Dakota Independent Telephone Company is installing a local exchange at Pingree, N. D., having bought the interests of the Pingree Telephone Company.

The council of Huron, S. D., has refused a renewal of franchise to the Dakota Central Telephone Company and announces its intention of granting a franchise to a company which is owned and controlled locally.

The Northwestern Telephone Exchange Company will make extensive improvements to its local system in and around Fargo, N. D., including considerable cable work.

The Independent Telephone Company of Omaha has let the contract for the construction of a new branch exchange at a cost of about $12,000. It will be 42 by 80 feet and will have switching accommodations for about 5,000 subscribers. R.

GENERAL TELEPHONE NEWS.

The Persia (Neb.) Mutual Telephone Company has been incorporated for $10,000 by E. C. Campbell and R. W. Evans.

The New York Cahill Telharmonic Company has applied to the Manhattan authorities for a franchise. The company transmits music by wire from its plant at Thirty-ninth Street and Broadway, and wants the use of conduits to string its wires and extend service.

Charles M. Thompson of Chicago has been granted a patent on a new automatic telephone switch. The device is in the general form of the connector of the automatic boards, having vertical and rotary motions of the switch-arm. The patent rights have been assigned to the Thompson Company of Chicago.

Among the recently incorporated telephone companies are the following-named: Manning Telephone Company, Malone, Tex.; Central Telephone Company, Houston, Tex.; Persia (Iowa) Mutual Telephone Company; Dunksburg-Concordia Telephone Company, Concordia, Mo.; Indian Creek (Tex.) Telephone Company; Farmers' Independent Telephone Company, Randolph, Neb.; Sunny Side (Neb.) Telephone Company; Chester (Neb.) Telephone Company; Horton (Kan.) Telephone Company; Utah and Wyoming Telephone Company, Randolph, Utah.

CORRESPONDENCE.

Continental Europe.

Paris, June 21.—Quite an extensive programme has been laid out for the future increase in the electric-lighting supply of Paris. This is made necessary by the increased number of subscribers. Two large stations are to be erected, one in the north and the other in the southwest suburbs, both of them being located on the Seine and connected to the railroad lines. These stations are to produce two-phase current at 12,300 volts and a frequency of 42 cycles. The current will be sent into sub-stations which will give low-tension direct current, or else to transformer posts containing banks of transformers for lowering the voltage for alternating-current secondary mains. As to the plant located in the southwest, it will have a capacity of 25,000 kilowatts, and the second station will commence with about the same capacity. Both these plants are to be ready to furnish current by the first of January, 1914. The municipality can oblige the company which operates the stations to increase the power of the north station to 50,000 kilowatts in one or in several stages. Such extensions are to be carried out in the maximum space of two years and a half after the plans have been approved. At the same time the city may secure a source of current from a distant hydro-electric plant. As to the wiring which is soon to be carried out, there will be at least 360 miles of circuits run in addition to what now exists. Sixty miles is to be put in before December 31, 1909, and the same amount per year in the three following years, while the rest will be carried out before 1920. The primary wiring will be laid out for 12,000-volt two-phase current.

A concession has been asked for an electric railroad of considerable length which is to run between Italy and Switzerland. Starting from Turin, it will cross the Alps by the Ferret Pass and will end at Martigny, Switzerland. The concession is applied for both at Berne and at Rome. The road is to be built in five sections and will have a total length of 95 miles. According to data already obtained from running the Valtellina railroad, there will be no difficulty in working upon the grades of 50 per cent., which occur upon the present line. Another road, the Samaden-Tirano, by way of the Bernina, will have no less than 70 per cent. grades. It is proposed to use heavy electric locomotives and 120-ton trains, making an average speed of 30 miles an hour, and having four trains running on the road at a time. The new road will reduce the distance from Lausanne to Turin, both of which are important railroad centers of middle Europe, by 85 miles or more over the Mont Cenis or the Simplon routes. The Municipal Council of Turin has already approved the project and now asks the consent of the government.

In the north of Italy the commune of Biasca has voted a subsidy of $30,000 for the construction of a railroad line known as the Greina. On the other hand, the communes of Locarno and Muralto have also voted subsidies of $6,000 and $4,000 for the line of Lago Maggiore, which is to connect the St. Gotthard system with the Simplon line.

A new company is formed in France for operating a hydro-electric plant of some size in the east Pyrenees region. This plant is known as the Pas-du-Loup station, and the headquarters of the company are located at Perpignan.

The town of Blois, France, is to have an electric tramway line, a concession to this effect having been applied for not long ago. At Bergerac a new electric lighting project is on foot, and the municipality decided that the plans should be drawn up so that the project could be turned over to the contractors by July 15th next. A. DE C.

Great Britain.

London, June 22.—The opening of the Charing Cross, Euston and Hampstead Railway tomorrow is being boomed, inasmuch as the railway is to be thrown open to the public for free travel for the day. In its structural features the line is a tube railway, worked electrically, and has been constructed to the standard designs of the Underground Electric Railway Company of London, which has constructed all the other tubes of the Yerkes group in London. It runs from Charing Cross away to the northwest, to Hampstead and Golden Green, and is the last of the tube railways in London that have been under construction for so many years to be put into operation. Electrical energy will be supplied to the railway from the Lot's Road (Chelsea) generating station, which supplies the District Railway and three other tube lines. The railway has a total distance of six miles, but powers have been obtained for extending it as a surface line for some distance beyond. The feature of the line is the automatic signaling arrangements, which are on the electro-pneumatic system supplied by the Westinghouse company. These signals are absolutely automatic throughout, and all questions of error by signalmen is eliminated. There has also been fitted to the rails a lever, which, working with the signal, is enabled to operate the brakes should a driver accidentally run past a signal set against him. The rolling stock is of steel. In the present overcrowded traffic facilities in London, and the decision of both electric railways and motor omnibuses to increase fares, it will be interesting to watch the development of the new undertaking. From being regarded as badly served, London is now suffering from an embarrassment of riches in the matter of locomotion.

The fourth biennial engineering conference under the auspices of the Institution of Civil Engineers was held this week. The work of the conference, which was divided into seven sections, was to discuss short notes on selected subjects, which were specially prepared for that purpose, and not to hear long papers read. Section VII. was the electricity sections, but papers were discussed in other sections relating to the applications of electricity. Probably the feature of the meetings, taken collectively, has been the pitting of every other form of power against electricity.

Mr. C. E. S. Phillips, who has been experimenting for some time with an electrically conducting glass, now has an electroscope, in which a thread of this glass takes the place of the gold leaf. The conductivity of this glass is said to be about 500 times as great as ordinary glass.

A case of some interest to the electrical industry has just been decided in the courts here. In May, 1906, Babcock & Wilcox entered into an agreement to purchase the water-tube boiler business of R. Hornsby & Sons, but which the former later on sought to be relieved from on the ground of misrepresentation. Judgment has now been given in favor of Messrs. Hornsby, the purchase price being $50,000 for the British business, or £27,500 for the foreign business.

The students of the Institution of Electrical Engineers have arranged a tour to Switzerland next month.

An application will be made to the courts early next month for the reduction of the capital of the British Westinghouse Electric and Manufacturing Company from $17,250,000 to $9,375,000.

In connection with the new Imperial Technical College, which is being founded at South Kensington, the crown has nominated the following gentlemen to sit as its representatives upon the board of governors: Lord Crewe, Sir Julius Wernher, Sir Francis Mowatt, Dr. Ronald MacAlister and Sir William White. The Board of Education has nominated Dr. R. T. Glazebrook, F. R. S. (director of the National Physical Laboratory), Mr. Arthur Acland, Mr. J. C. Sykes and Mr. F. G. Ogilvie.

The British Electric Traction Company's report has just been issued and shows that no dividend is to be paid upon the ordinary shares for the last year. This fact emphasizes the question of increased fares, for the greater proportion of the capital of the company is invested in tramway undertakings which it has initiated.

A few years ago there was considerable discussion upon the possibilities of damage to gas and water pipes due to electrolytic action from escaping electric currents from electricity or tramway networks. It gradually died out, however, after a continual succession of attempts by gas and water companies to secure protective clauses on various bills before Parliament. Most of these were unsuccessful, although in some cases clauses were inserted by agreement between the parties. This week, however, the controversy was revived in the House of Commons, and the Metropolitan Water Board was granted a clause in a Metropolitan Power Company's act giving it compensation in case of proved damage. G.

Dominion of Canada.

Ottawa, June 29.—The city of Sherbrooke, Que., has voted a by-law to raise $200,000 to develop an electric-light plant at Westbury. This proposition was defeated on two previous occasions, and now the city will at once proceed to develop power for municipal purposes.

The Shawinigan Water and Power Company of Shawinigan Falls, Que., is floating an issue of $1,000,000 new 4½ per cent. perpetual consolidated mortgage debenture stock in England. The issue price is 90, and can therefore be regarded by the investor as a five per cent. stock. It is stated that the result of the company's extensions, made during the year 1906, is now being felt in the largely increased income. For that year the gross income was $357,147, but for the current year the directors anticipate a gross revenue of $600,000, and, after the payment of all charges, it is expected that the interest on the present issue will be covered six times over.

Speaking recently of the comparative cost of electricity and steam as motive powers on railways, Sir Thomas Shaughnessy, president of the Canadian Pacific Railway Company, said: "With the present volume of business, I think the cost of electricity on the mountain grades at present would be somewhat greater than steam. The condition, however, would be reversed with the great increase in traffic which will come. The generation of electricity by water will not be a very big item, and I think we shall have plenty of waterpower where we require it. The introduction of electrical power will not do away with the necessity of tunneling in some of the grades in the mountains."

Frederic Nicholls of Toronto has arrived home from a visit to Berlin, Germany, where he has been in connection with an arrangement entered into between the Canadian General Electric Company and the Allgemeine Elektricitats Gesellschaft, the latter identified with the scheme to foster South Africa's industrial expansion by means of the Victoria Falls power scheme. Under the arrangement with the Canadian company the latter acquires all such rights for Canada as it secured some years before by an agreement with the General Electric Company of New York. Thus the Canadian concern now enjoys the advantage of working alliances with the foremost American associated company and the largest European electrical company as well. W.

Winnipeg, Man., June 29.—The Spokane Falls Placer Mining Company of Spokane, Wash., which owns large placer grounds at the mouth of the Lardean River in British Columbia, has filed a water right, and is arranging to put in a power plant to supply the town of Trout Lake, B. C., and also the nearby mines, with light and power. The new plant will cost about $100,000. The company is capitalized at $250,000.

At a meeting of the Winnipeg City Council it was decided to at once notify the Winnipeg Electric Company to proceed with ten extensions which have been proposed by the company. Wilford Phillips, general superintendent of the Winnipeg Electric Company, can furnish information.

The City Council of Strathcona, Alb., has had a number of meetings with the Strathcona Radial Tramway Company, and it is expected an agreement will soon be reached. From present indications the company will be granted an exclusive franchise. Lines will be run to Cooking Lake and other well-known summer resorts in the vicinity of Strathcona and Edmonton. The company has been negotiating with the city of Edmonton for connections between the two systems.

Arrangements are now being completed between the residents of Fort Langley, B. C., and the British Columbia Electric Street Railroad Company for an extension of the company's system to that town.

This year there have been a number of street-car accidents in Winnipeg, six of which have proved fatal. The City Council and Board of Control are now inquiring into the subject of fenders. It is apparent the style of fender now being used by the Winnipeg Electric Company is of little use to prevent accidents.

The Cranbrook Electric Light and Power Company of Cranbrook, B. C., will erect a power plant at St. Mary's River, about seven miles north of Cranbrook. At first a 700-kilowatt generator will be installed giving 6,600 volts, with step-down transformers at Cranbrook, reducing it to 2,250 volts, which will suit the present transformer equipment. A dam will be constructed on St. Mary's River which will give a maximum of 2,200 horsepower. The cost of the plant is estimated at between $60,000 and $70,000. R.

New England.

Boston, June 29.—It is said that the net earnings of the Edison Electric Illuminating Company of Boston show an increase of 5 per cent. for the current fiscal year which ended June 30th, and that they now equal 13 per cent. on the stock, not including the new shares recently issued, which will not receive dividends until August. In view of this fact, it is intimated that the company may increase its dividend rate from 10 to 12 per cent.

In order to promote the constructon of the Connecticut end of an important interstate trolley road, the House of Representatives of Connecticut passed this week a resolution incorporating the Putnam and Rhode Island Street Railway. The franchise authorizes the company to build an electric road from Putnam to the Rhode Island state boundary at Gloucester. The road will have a capital of $200,000. The promoters are seeking to build a trolley line from Putnam to Providence, R. I.

The legislative committee of the Legislature of Connecticut on railroads has made a favorable report on the resolution incorporating the Norwich, Colchester and Hartford Traction Company. The corporation has an authorized capital stock of $1,000,000, and its plan is to establish trolley connections between Hartford and Norwich.

The Senate of the state of Connecticut has passed the resolution incorporating the Danbury and New Milford Street Railway Company. The company is capitalized at $900,000, and the rural line it proposes to build is about 16 miles long.

The petition for freight rights in Boston streets by the Boston Elevated railway came up for hearing before the committee on public improvements of the Board of Aldermen of Boston on June 19th. More time was asked for by the company and the request was granted. The board fixed August 25th as the date upon which the company shall tell what it plans to do. B.

New York.

New York City, June 29.—On June 28th Governor Hughes announced the members of the newly created public service commissions to be as follows:

For the first district (Greater New York), William R. Wilcox, Manhattan, chairman; William McCarroll, Brooklyn; Edward M. Bassett, Brooklyn; Milo R. Maltbie, Manhattan, and John E. Eustis of the Bronx.

For the second district, to have jurisdiction over all of the rest of the state, Frank W. Stevens, Jamestown, chairman; Thomas M. Osborne, Auburn; Charles H. Keep, Buffalo; James E. Sague, New Hamburg; Martin S. Decker, New Paltz.

The salary of each of these commissioners is fixed at $15,000, and the term of office is five years, but a system of rotation is provided by which one of the present commissioners only is appointed for five years and the others for four, three, two and one years respectively, so as to secure continuity. Mr. Wilcox is now postmaster of New York city and Frank W. Stevens is a lawyer of Jamestown, who took a leading part in the formulation and prosecution of the charges against Supreme Court Judge Warren B. Hooker of Fredonia before the State Bar Association two years ago. The men chosen were selected wholly on account of their fitness, many of the appointees being comparatively young, but they are said to be men well fitted, both by technical education and practical experience in connection with railroading or else by legal training, to grapple with the important questions that will come up before the commission. The Rapid Transit Commission and the other commissions which go out of existence with the incorporation of the Public Utilities Commissions, have spent some very busy hours closing up their work and of disposing of such contracts as were before them.

The question of giving a franchise to Mr. Behr to operate his monorail railroad was considered at a number of the recent meetings of the railroad commissioners, but in default of a payment of $25,000 nothing was done. At the close of the last meeting of the commission it was announced that three of the commissioners are behind the Newark and New York Monorail Company, which has been organized to build a monorail line from Jersey City to Newark, with connecting lines with the McAdoo tunnels. The fare is to be five cents between Newark and Jersey City and three cents between New Jersey and New York. The road will attempt to give an "ideal" interurban service and is expecting to operate trains at from 60 to 100 miles an hour. The new Utilities Commission will now have to take up the proposed Brooklyn monorail line.

The Queens Borough Street Railway Company is the name of the new street railway corporation in Astoria, L. I., formed by the officers of the Rickert-Finley Realty Company and the Astoria Light, Heat and Power Company, to construct a short trolley line along Van Alst Avenue from Flushing Avenue through the East River Heights tract to the new development of the power company.

The Suffolk Traction Company was granted another franchise by the Brookhaven Town Board and ighway Commissioners, this time for a cross-island route connecting Patchogue and Port Jefferson, L. I.

A certificate of consolidation and merger of the Pennsylvania, New York and Long Island Railroad Company and the Pennsylvania, New Jersey and New York Railroad Company forming the Pennsylvania Tunnel and Terminal Railroad Company was filed on June 26th with the secretary of state. The new company is capitalized at $40,000,000 or the combined capital of the present companies. These two consolidated roads were projected to carry on the tunnel construction under the East River and Hudson River, respectively.

The poles and wires of the South Shore Telephone Company, later known as the New York and Long Island Telephone Company, which have for the past three years stood along the county roads in the town of North Hempstead, although the telephone service in that town had practically been abandoned, will have to be taken down, because of a resolution adopted by the Board of Supervisors of Nassau County authorizing Supervisor Christ of that town to have these poles removed, as they had become a menace and source of danger to those traveling on these roads. The wires were badly broken and the poles in a rotten condition.

E. H. S.

Ohio.

Toledo, June 29.—The Railroad Commission of Ohio last week dismissed the complaint recently filed with the commission by T. W. Ashley of Huron County against the Sandusky, Norwalk and Mansfield Electric Railway Company, charging inadequate service, unlawful rates and failure to file and post schedules of fares, rates and charges as required by law.

Stockholders of the Cincinnati, Dayton and Fort Wayne Traction Company have decided to increase the capital stock from $1,000,000 to $3,000,000. A bond issue of $3,000,000 was also provided for. It is understood that the work of construction will begin at once.

The board of directors of the Scioto Valley Traction Company reports that the earnings of the company show large increases over last year. The freight business is especially gratifying. A large amount of berries and small fruit is being handled over both branches, and the outgoing freight is increasing rapidly.

In order to have its line in operation by the Fourth of July, the Lake Shore Electric has been paying as high as $5 a day for teamsters and helpers on the Sandusky-Fremont branch. The track is being laid at the rate of a mile a day, and indications are that it will be completed in time.

After having been dropped and then revived, the Fremont Belt Railway proposition now seems to have been abandoned again for the second time. An effort was making to secure a $50,000 bond subscription in Cleveland to promote the same, but only $48,000 was secured in the given time.

Because of the great scarcity of railway ties electric roads are having difficulty throughout Ohio in keeping their tracks in repair.

It is said that Cleveland is probably suffering less from electrolysis trouble than any other city in Ohio. Ever since the underground work was begun 20 years ago the companies have been careful to bond back their lines with the street-railway tracks, thus returning the current to the street-railway power house without injury to telephone or telegraph cables.

The county commissioners at their regular meeting last week rejected all the bids submitted for the erection of a new power plant at the infirmary. The county surveyor was instructed to advertise for bids on a revised estimate. H. L. S.

Michigan.

Grand Rapids, June 29.—Percy T. Cook is asking the city for a franchise for lines paralleling in a large measure the tracks of the Grand Rapids Railway Company, and serving some sections not reached by this company. The franchise offers liberal concessions to the city in the way of right to assume ownership after a period of years and an agreement to turn in to the city treasury all earnings above 6 per cent. net on the capital stock. It is rumored that the proposed Grand Rapids-Kalamazoo interurban is back of the enterprise.

The Grand Rapids Railway Company has promised to make four extensions asked for by the city, certain charter amendments sought by the council having been granted. The charter amendment permits of the extensions without bringing the company under the provisions of the new charter which provide for municipal ownership under certain conditions.

To facilitate the handling of mail in Grand Rapids the street cars have for several years been equipped with mail boxes and have been required to stop at any time they were hailed for the mailing of a letter. A recent order of the postmaster general was to the effect that the mail boxes must be removed from the cars, as Congress made no provision for the maintenance of the service. At a discussion of railway officials, Senator Smith, Congressman Diekema and Postmaster Bishop, it was learned that if the company would continue the service until an appropriation could be secured at the coming session of Congress, the order to take off the boxes would be withdrawn. This may be done. The street-railway officials protest that the service interferes with schedules, but it has become a fixture and the people would kick if it were withdrawn. Over 20,000 stops are made every week by the cars to permit the mailing of letters.

The Common Council of Hancock has entered into a contract with the Houghton County Electric Light Company for a street lighting service for a period of five years. The price is $80 a lamp. There was talk of installing a municipal plant, but it is shown that a 65 or 75-light plant would cost $33,000, and the project was abandoned.

Work has begun on the building of a dam across the Chippewa River near Mt. Pleasant, to furnish power for the electric-light plant at Shepherd.

Construction work on the $1,000,000 dam of the Berrien Springs Power and Electric Company has begun. The dam across the St. Joseph River, near Berrien Springs, will be 21 feet high and 1,000 feet long.

The city lighting department of South Haven is preparing to lay a new cable across the river in that city. L. W. B.

Indiana.

Indianapolis, June 29.—The Indiana, Huntington, Columbia City and Northwestern Railroad, which went into the hands of a receiver while under construction, will be offered for sale by the receiver some time in August. It is said the stockholders have organized with the purpose of buying in the road.

C. L. Henry, president of the Indianapolis and Cincinnati Traction Company, has withdrawn from the interstate coupon-ticket agreement. Mr. Henry says that he does not wish to come under the jurisdiction of the interstate-commerce law.

The United States Express Company, which on July 1st will lose local business on New York Central lines in Northern Indiana, officially announces a contract with the Chicago, South Bend and Northern Electric line for service, together with the South Bend and St. Joseph (Mich.) electric line and the Winona line, giving outlets via the Baltimore and Ohio and the Pere Marquette.

The Fort Wayne, Toledo and Detroit Traction Company has bought 10 miles of the old Wabash and Erie canal bed from Fort Wayne to the Ohio state line for its road, which will go through New Haven, Antwerp, Defiance and on to Toledo.

The first car was run over the new extension of the Fort Wayne and Wabash Valley Traction Company's lines between Lafayette and Logansport on the 28th inst. The party making the trip was composed of the following, in addition to Mr. Emmons and his wife: Charles Goyles, superintendent of power in Fort Wayne, and wife; Chief Engineer H. P. Weber and wife; J. B. Crawford, superintendent of transportation; J. J. Brennan, superintendent of construction, and William Dolan, roadmaster. A regular schedule will be arranged for regular traffic in about two weeks.

The Board of Public Works of Fort Wayne has awarded the contract for turbines, dynamos and condensers for the new municipal electric-light plant to the Fort Wayne Electric Works. The estimated cost is $50,000. Arc lamps and transformers will increase the cost to $75,000.

The Town Council of Danville has just granted a 25-year franchise to the Danville Light, Heat and Power Company, whose president is George E. Varney of the Varney Electrical Supply Company of Indianapolis.

Official announcement is made by the Goshen Electric Company that preparation is being made for the erection of a $50,000 plant.

The Indiana Railroad Commission, to make travel in Indiana safer, has instructed the inspectors who will be sent out July 1st, to make daily reports of their work. They must carefully examine all main tracks, side tracks, connections, culverts, bridges, trestles and tunnels. They must examine the officers and men and inquire into every detail of operation. S. S.

Illinois.

Peoria, June 29.—Vice-president Reid of the executive board of the International Brotherhood of Electrical Workers was in Springfield this week conferring with the supreme officers regarding the erection of a head office there. The purpose is to erect a large office building to contain the offices and also a large printing shop, to be conducted exclusively by the union. The printing amounts now to about $60,000 a year. The matter will be brought up at the international congress.

An excursion under the auspices of the Springfield business men was run this week by the Illinois Traction System; the plan was to sell tickets at a rate of a cent a mile to the city, where the tickets were stamped, which allowed the holder to return home free. About a thousand tickets were sold and the merchants were very well satisfied with the results. Another excursion will run next week.

The Citizens' Telephone Company of Pekin has been granted incorporation papers by the secretary of state. The Citizens' company has purchased the Pekin Telephone Company's interests and has increased the capital stock from $75,000 to $200,000.

Congressman McKinley, head of the Illinois Traction System, while in St. Louis this week said that his company intends to make an agreement with the interurban system of Indiana to form a through route from St. Louis to the cities on the Great Lakes, to include Port Huron, Detroit, Toledo, Cleveland and Erie, Pa. Congressman McKinley expects to make the agreement by the first of January, 1908.

The Illinois Traction Company will erect a new freight and passenger depot at Virden. The company is pushing the work of building the Mackinaw-Lincoln line, and already has a few miles of the grading done, awaiting the track-layers.

The Midland Telegraph Company of Chicago has been incorporated with a capital of $10,000 to acquire and operate telegraph and telephone lines. Incorporators are Nathan S. Smyster, John A. McKeown and F. W. Raymond.

Congressman McKinley and a party of newspaper men from Chicago made a trip on the lines of the Illinois Traction Company this afternoon. The newspaper men had a special car from Chicago on the Alton to Bloomington, where they were met by Mr. McKinley and others connected with the system, and taken to breakfast, after which they went to Decatur and Springfield, on the way to St. Louis. The Illinois Traction Company is trying to get a line into Chicago, and this trip is made to show the newspaper men what the company has in operation and how well they serve the public.

A first mortgage on the Springfield and Northern was filed for record in Lincoln yesterday. It was given to the Central Trust Company of Chicago to secure the payment of $1,500,000 five per cent. bonds. The bonds, which are issued by the traction company, are in denominations of $1,000 each and are made payable December 1, 1936.

V. N.

Northwestern States.

Minneapolis, June 29.—The so-called Walker ordinance, containing the maximum lighting and power rates, has been passed by the Minneapolis City Council after a stubborn fight. The ordinance will become effective August 1st, but it is thought that the Minneapolis General Electric Company will make a fight before submitting to its enforcement. The maximum lighting rate is fixed at eight cents and power at six cents per kilowatt-hour.

The Twin City and Lake Superior Railway Company is receiving bids for grading 40 miles of the proposed air line between the Twin Cities and the head of the lakes. It is also reported that some contracts have already been let. Grading will be commenced at Stacey, Minn., but it will also be started from Duluth before the end of the summer.

The Wagner, Lake Shore and Armour Traction Company is making preparations for the construction of a $25,000 power plant at Armour, S. D. The machinery will be secured from the Minneapolis Steel and Machinery Company.

The council at Washburn, Wis., has voted to purchase the outside electrical equipment and business of the Washburn Electric Light and Power Company, the price to be paid being $22,580.

Alexander Hughes of Minneapolis is investigating the feasibility of establishing an electric-light plant at Aberdeen, S. D., and is conferring with the commercial club on the subject.

A deal is on at Mahnomen, Minn., whereby the town's electric-light plant is to be sold to the McBride Company of St. Paul. R.

Pacific Slope.

San Francisco, June 26.—The California Street Cable Railroad Company started its first car on June 25th, after having been out of commission since May 5th, when the carmen's strike began throughout the city. The cars are now running over that portion of the cable road which extends from the corner of O'Farrell and Market streets to the Bay via O'Farrell, Hyde, Pine and Jones streets. The company is paying 30, 31 and 32 cents an hour, the same wages that prevailed before the strike, and refuses to recognize the carmen's union.

The preliminary motion interposed by Garrett McEnerney, on behalf of Eugene de Sabla, John Martin and Frank G. Drum, the members of the executive committee of the San Francisco Gas and Electric Company, has been partly heard. Although 14 indictments were returned for alleged bribery of supervisors, the case has not come to trial yet.

The Allis-Chalmers Company has been awarded a contract for the electric equipment for the new sub-station which is to be established by the Northwestern Pacific Railway Company at San Anselmo, Cal. It will be used to supply the additional current needed by the North Shore Railroad division of the system. Electric current from a transmission line will be used to drive the motor-generators.

The San Francisco Gas and Electric Company has improved its local electric-lighting service considerably since the fire some weeks ago, which damaged the main generating station in the Patrero district to the amount of $32,000.

A 1,200-kilowatt direct-current 110-220-volt generating set that was saved from the ruins of the old Jessie Street power station, which was burned February 22, 1906, is being erected in the Mutual Electric Light Company's station. It consists of a triple-compound vertical engine built by the Union Iron Works and two direct-connected direct-current generators, which have been used to supply current for the Edison three-wire system. The Mutual's plant is virtually under the control of the San Francisco Gas and Electric Company.

The San Francisco Gas and Electric Company has submitted to the Board of Supervisors bids for lighting the streets and outlying districts for 8.7 cents per lamp for gas and 20.713 cents for each electric arc lamp per night. For lighting public buildings, the company's bid was four cents per kilowatt-hour for electric current. No other bid was submitted, as the San Francisco company has at present a practical monopoly of electric-lighting service. The Mutual Electric Light Company, now practically a department of the San Francisco Gas and Electric Company, has had its contract for lighting the Union Ferry Depot and the wharves and warehouses on the city front renewed at the rate formerly charged. A.

PERSONAL.

Henry G. Bradlee has become a partner in the firm of Stone & Webster of Boston.

George B. Foster, well known among electrical men in the West, is now manager of the Power Improvement Company, Fisher Building, Chicago.

G. B. Perham became manager of the Fargo (N. D.) exchange of the Northwestern Telephone Exchange Company July 1st, succeeding S. T. Hudson, who has resigned and will probably locate in the West.

William L. Derr, recently a division superintendent of the Chicago and Alton Railroad, has been appointed general superintendent of the New York Street Railways Company of New York city. Mr. Derr has had a long career as a railroad man since his graduation in 1876 from the Polytechnic College of Pennsylvania.

F. B. Behr, inventor of the monorail system which bears his name, has sailed for a brief vacation in England. Later in the season he will return to make application again for a franchise to build and operate his Brooklyn road to Coney Island, which he failed to get from the Rapid Transit Commission. It is also reported that new applications will be made to construct a comprehensive system of monorails interconnecting all five boroughs of New York city, but more especially the Bronx and Staten Island.

The executive committee of the Massachusetts Institute of Technology has named Arthur Amos Noyes, Ph. D., to act as president of the Institute from July 1st until a permanent president is appointed. Dr. Pritchett presented his resignation as president of the Institute in January, 1906, but he agreed to remain pending the selection of his successor. Mr. Noyes is professor of theoretical chemistry and director of the research laboratory of physical chemistry at the Institute. He was born in Newburyport, Mass., September 13, 1866, and was graduated from the Institute with the degree of S. B. in 1886.

William Edward Louis Gaine, general manager of the National Telephone Company of England, died in London on June 18th. Mr. Gaine was born in 1851 and was trained as an attorney. While town clerk of Blackburn in 1875 he acquired a reputation for executive ability and in 1892 was appointed general manager of the National Telephone Company. Before his death he saw the company under his direction increase the number of its subscribers from 46,000 to almost 400,000. His knowledge of law was of much assistance to him in administering the affairs of the company, and he was a close student of American telephone practice, having made several journeys to this country for the purpose of acquiring new ideas for installation at home.

Mr. L. E. Holderman has resigned as superintendent of the light and power department of the Eastern Wisconsin Railway and Light Company of Fond du Lac, Wis. On July 1st he took a position as superintendent of light and power for the Terre Haute, Indianapolis and Eastern Traction Company of Terre Haute, Ind. Mr. Holderman is an energetic and progressive young man. He was with the Eastern Wisconsin company four years and while there planned and successfully carried out the first gas and electric show ever attempted in one of the smaller cities. By following up with an energetic new-business campaign the company's books show that, comparing April, 1907, with April, 1906, a gain of 31 per cent. was realized in the lighting output and a gain of about 60 per cent. in the power load. At Terre Haute Mr. Holderman will have a larger field and will be a valuable addition to the new forces which have consolidated and are developing the railway and lighting properties at Terre Haute and Brazil, including interurban roads.

ELECTRIC LIGHTING.

St. Charles, Iowa, has voted to install a municipal electric-light plant.

The Brainerd Roller Mills will put in an electric-light plant at Brainerd, Neb.

The Wanatchee (Wash.) Electric Company has let the contract for $60,000 worth of improvements to its plant.

The Altus Gin and Manufacturing Company has received the contract for furnishing lights in Altus and Ozark, Ark.

The Spokane Falls Placer Mining Company will build a power and light plant at Trout Lake, B. C., and supply the near-by mines.

The Shattuck (Okla.) Electric Light and Power Company has been granted a franchise for an electric-light and power system.

The city of Columbus, Ga., will hold a special election on October 10th to vote on a proposition to issue $100,000 of bonds for establishing an electric-light plant.

The Dallas City (Ill.) Light Company has been incorporated for $10,000 to operate heat, light and power plants. The incorporators are N. H. Dowd, M. Loomis and E. R. Black.

The Corinth Electric Light and Power Company of Corinth, N. Y., has been incorporated for $25,000 by Warren Curtis of New York city and F. B. Coolidge of Glens Falls, N. Y.

The Warrensburg (Mo.) Light and Power Company has been incorporated with $50,000 capital stock by Allen B. Collins, Joseph C. Christopher, R. H. Cloyd, William E. Houston and others.

It is reported that the city of Canton, Miss., is considering enlarging and improving the electric-light plant, the betterments to include changing of system from 60 to 133 cycles and replacing of present machines by a direct-connected outfit.

About $2,000,000 will be invested in an electric-light and power plant in Kansas City, Mo., by W. F. Lyons if he is granted a franchise on his application to furnish light and power for the entire city.

H. Laussat Geyelin, F. King Wainright and W. Innes Forbes of Philadelphia have taken out state charters for two companies to be known as the Lewistown Light, Heat and Power Company and the Mount Union Light, Heat and Power Company. Each company has $5,000 capital and will operate in those Pennsylvania towns. The same persons took out a charter for Tyrone.

The city of Lexington, Ky., has appropriated $30,000 for installing an electric light and heating plant in the City Hall at Lexington. Louisville, Ky., will spend a similar amount for a plant in the City Hall annex.

Harvey J. Hayes of Bristol, Tenn., would like to be informed of an opportunity in a southern city of from 2,000 to 5,000 inhabitants where an electric-light plant is needed. He contemplates installing a plant in some southern city.

The following-named electric-light companies have been recently incorporated: Home Light and Water Company, Blooming Grove, Tex.; College Addition Water, Light and Power Company, Denton, Tex.; Livingston (Tex.) Electric Light Company; Palestine (Tex.) Electric Light and Ice Company.

The New York State Commission of Gas and Electricity has ordered reductions in charges for electricity in Mount Vernon supplied by the Westchester Lighting Company from 20 cents per kilowatt-hour to 13 cents. Electricity in Orangetown supplied by the Rockland Light and Power Company is to be reduced from 20 cents to a maximum rate of 15 cents per kilowatt-hour outside of incorporated villages.

The Consolidated Gas, Electric Light and Power Company of Baltimore has distributed among contractors for estimates plans and specifications for the construction of an addition to its large power house at Westport which will be larger than the present building and will provide an additional capacity of 48,000 kilowatts. As now equipped this plant has a capacity of 13,000 kilowatts, and the addition will provide for a total capacity of 61,000 kilowatts.

The announcement of a special dividend of five per cent. by the directors of the United Electric Company of New Jersey a few days ago was followed by the announcement by President McCarter of the Public Service Corporation that the board of directors of the electric company had decided to submit to the stockholders a plan for its lease to the Public Service Corporation for a term of 999 years. A stockholders' meeting to pass on the lease has been called for July 12th.

ELECTRIC RAILWAYS.

The ordinance permitting the Chicago, Milwaukee and St. Paul Railroad to electrify its Evanston branch and connect with the Northwestern Elevated Railroad of Chicago has been passed by the Chicago City Council.

John D. Fletcher of Nashville, Tenn., offers a free site for the power house of the Nashville and Columbia interurban railway, provided that company will erect a plant of sufficient horsepower to supply other industries that may be located on the same tract with current for operating their machinery. To the latter class of industries Mr. Fletcher offers sites in return for stock.

It is announced from Greensboro, N. C., that W. T. Van Brant of New York, Dee Allen and associates have purchased the Greensboro Electric Company with its holdings and will soon take over the same. This company has the sole ownership of the street-car, electric-light, gas and power plants of Greensboro. The new owners plan to connect Haw River, Graham, High Point, Thomasville and Winston-Salem with Goldsboro by trolley.

C. F. Adams of Boston, former president of the Union Pacific Railroad, was the guest of President Jay P. Graves of the Inland Empire electric railway system at Spokane, Wash., a few days ago. A ride was taken over 76 miles of the system from Spokane to Palous and later over the western division to Rosalia. Upon the return Mr. Adams is quoted as saying that the Inland Empire system is far superior to any of the electric roads in eastern states, having all the characteristics of a steam road without the drawbacks of smoke and cinders.

While the above-ground evidences of progress along the line of the subway in Philadelphia are meager to the eye, says the Philadelphia Record, the work is assuming tangible shape and has more reasonable prospect of early completion than the average citizen is presumably aware of. The work of connecting the Market Street subway with the elevated structure on Front Street has been begun. The loop from Arch to South will be taken in hand next, the bases for the steel superstructure having been put in place. The loop about the City Hall is likely to be opened for traffic before the end of summer.

POWER TRANSMISSION.

The Utah-Nevada Power Company has been incorporated in Colorado with a capital of $7,500,000 by Orlando B. Willcox, Horace G. Lunt, Charles I. Hawthorne and others. The company is an auxiliary of the Central Colorado Power Company, capitalized at $22,000,000. The Utah-Nevada Company will furnish electric power to the mining districts, cities and towns in Utah, Nevada, Idaho and Colorado.

A Pennsylvania charter has been granted to the Juniata Valley Electric Company, which will furnish power at Lewistown for that place and other points in Mifflin County, Pa. The incorporators are W. P. Woods, Lewistown; Wallace Wilson, Alexandria, and James S. Woods, Huntingdon.

The city of Kingston, Ontario, according to information furnished by Consul H. D. Van Sant, has rejected an offer made to supply the city with power from the river Trent. The power committee on investigation found that it would be more advantageous to generate power in small quantities by the producer-gas engine.

H. M. Byllesby & Co. have been retained as consulting and operating engineers for the Flathead Valley Water Power Company of Kalispell, Mont. The company's waterpower is situated at Big Fork, Mont., on the Big Fork River, having a head of about 105 feet. This development is to be added to and the capacity of the plant greatly increased.

The Harwood Electric Company, which will build the big electric plant at Harwood, near Hazleton, Pa., utilizing fuel right at the mines in the anthracite region, has filed a mortgage of $3,000,000 with notice of increase of stock and debt at the State Capitol at Harrisburg as required under Pennsylvania laws. The company will furnish power over a number of counties in the hard-coal region.

President Wiley of the Southern Power Company says that the company has sold its power to the full limit of the 50,000 horsepower in commission and will have none to sell until some time next year. The operations of the Southern Power Company are in the territory of which Charlotte, N. C., is the center, and while 50,000 horsepower has been developed, the company is extending its operations with a view to eventually having about 200,000 horsepower. The fact that it has already sold its entire developed power strongly illustrates the great demand in the Central South for electric power.

PUBLICATIONS.

The Northern Electrical Company of Minneapolis and Duluth is sending out an artistic calendar for the month of July.

The American Conduit Company is sending out post cards on which are printed details of construction of the Jumper system used by the Pennsylvania Railroad as shown in Bulletin No. 207. The conduit company makes a specialty of furnishing highly insulating conduit for railway and powerhouse work.

In a small illustrated leaflet the Pittsburg Transformer Company briefly calls attention to the use of the word "efficiency," especially as applied to its transformers. For eight years, it is pointed out, this company's transformers have demonstrated the qualifications necessary to the just use of the term efficiency. A pretty calendar for July also attracts attention to the company's product.

The General Electric Company's supply department has published bulletin 4514 relating to the Thomson inclined coil portable voltmeters, wattmeters and ammeters. The two former are constructed on the dynamometer or two-coil principle, while the latter operates as a magnetic vane. The moving elements are very light and are mounted on vertical bronze shafts pivoted in sapphire jewels. A lamp inspector's wattmeter is shown, fitted with receptacles in the case, so that the lamp may be inserted and tested on either alternating-current or direct-current circuits.

A neat folder issued by Harvey Hubbell, Inc., of Bridgeport, Conn., illustrates and describes that company's system of interchangeable electric installation by attachment plugs. A number of forms of receptacles for different purposes are shown, all fitted by one style of push plug. This type avoids the necessity of twisting the cord, the great fault of the screw plug, and secures an easy interchange of extension lamps, fans, heating apparatus and other portable electrical conveniences. The live clips are entirely concealed in separate porcelain cells within the receptacle.

Bulletins 4509 and 4515 of the railway department of the General Electric Company are attractive folders showing the company's latest products for railway train lighting and car control, respectively. The first describes the train equipment of a Curtis turbine generator, when carried on the engine or baggage car, as a generating unit, presenting the advantages of simplicity, adaptability for mounting on boiler shell, small floor space, absence of vibration, low maintenance cost and amount of attention required. The revolving system is a single unit without couplings, which runs on two bearings. The other bulletin describes the auxiliary contactor equipment for cylinder controllers brought out to meet the requirements of increased power and higher voltages in electric-railway equipment. Two standard Sprague-General Electric type M control contactors are connected in the main trolley circuit, and additional contacts in the controllers open and close the contactors as the controller is on or off.

SOCIETIES AND SCHOOLS.

At its last meeting the executive committee of the National Fire Protection Association elected 31 associate and 15 subscribing members.

At its twentieth annual convention, in Boston recently, the Train Dispatchers' Association of America approved the train rules committee's report recommending the adoption of the A. B. C. rules by railroad companies. These rules put all trains more fully under the control of dispatchers.

The latest bulletin of the Lowell Textile School, Lowell, Mass., is a fine book of over 150 pages carefully defining the courses and methods of instruction and giving full information about the institution. Modeled on the lines of the departments of the higher polytechnic institutes, the Lowell school offers thorough instruction in the elements and principles of the sciences and arts applicable to textile and kindred branches of industry and also in their application to the manufacture of all varieties of textile fabrics, and the machinery required therefor.

A new engineering society has been organized in Philadelphia called the Engineers and Constructors' Club. Membership in this society is limited to the engineers composing the organization of Dodge & Day. Its object is to discuss subjects relating to engineering and construction and to give all members the benefit of the experience gained by each in his particular line of work. Up to date the following papers have been presented and discussed at the meetings: "Civil Engineering Preliminaries for an Interurban Trolley," by Charles Reed Marsh; "Electric Welding," by J. H. Gravel; "Gas Producers and Internal Combustion Engines," by John E. Zimmermann; "Concrete Piling," by Julian C. Smith. The proceedings of the club, giving the papers presented and discussions, will be published regularly. The officers of the club are: President, Harold T. Moore; secretary, George Walters; managers, F. C. Andrews, H. F. Sanville, John E. Zimmermann and C. N. Lauer.

MISCELLANEOUS.

Dr. Samuel Rideal has been permitted by the city authorities of London to carry out experiments on the sterilization of water at one of the swimming baths by electrolytic chlorine, with the object of ascertaining whether the water need be changed as frequently when kept purified as at present.

Boston old-home week celebration and reunion will not be without special features of interest to electrical men. There will be an electrical procession and the general illumination will be on an elaborate scale. Several conventions of an electrical nature will also be held in Boston during the week. The date is July 28th to August 3d. A committee of 1,000, headed by Mayor Fitzgerald, is in charge of arrangements. The committee says: "The entire period will be given over to a series of midsummer festivities and observances such as no other city in the world is in a position to offer to its guests."

On the night of June 26th, when the sandboat Atlas went to the bottom of the Chicago River after a collision with the abutments of the Clark Street bridge, which stove a hole in her bow, it was discovered that the sinking vessel had in some manner severed the cables supplying power to the Clark Street drawbridge. The bridge had been opened to allow the passage of another vessel, and the bridgetender found himself unable to turn the span back into position. After an impatient half hour's wait a number of pedestrians marooned on the bridge were taken off in the fire boat Illinois and the cable connections were soon repaired.

The use of sodium as a conductor of electricity may probably be limited to overhead transmission lines or feeders for railway work, for although it is said to be cheap and to possess good conductive properties, its marked affinity with oxygen causes it to ignite when placed in contact with water. The general process of constructing sodium conductors is to take standard wrought-iron pipes and heat them to a point well above the melting temperature of sodium. The sodium is then melted in special kettles and is run into the pipes, solidifying when cool. There is said to be no marked depreciation of either the sodium or the pipe if the latter be properly protected by a coat of weatherproof paint. For the same conductivity the price of a complete sodium conductor is much below that of copper cables, being in small sizes not more than 50 per cent. and in large sizes not more than 20 per cent. of the cost of copper.

The Department of Electricity of the city of Chicago is making preparations to extend the underground conduit system for its various wires. Several extensions will be made at different points about the city, but the principal part of the present work will be the construction of a new conduit on Western Avenue to accommodate the cables which will carry the electric power contracted for from the Lockport plant on the Drainage Canal. Over 38,000 feet of six-duct and eight-duct conduit will be laid in concrete. Six bids were received on the conduit, for the two principal sections of which the Citizens' Construction Company and James Lyman & Co. of Chicago were the lowest bidders. About 31,000 feet of three-conductor No. 00 paper-insulated lead-encased cable will be required. For the cable the Standard Underground Cable Company and the John A. Roebling's Sons Company bid, the latter being slightly the lower.

TRADE NEWS.

The Power Improvement Company announces the opening of its office at 2018 Fisher Building, Chicago, to handle DeLaval steam turbines, generating units and centrifugal pumps and the Wilkinson mechanical stoker. George B. Foster is the manager.

The Speer Carbon Company of St. Marys, Pa., has been experimenting for the last year on a new reinforced carbon brush which it is now putting on the market. This brush is said to be meeting with phenomenal success. If any consumer is having brush trouble the Speer company suggests that samples of the new brush can be had by writing to St. Marys.

In order to handle the mass of business in electric generators and motors in Southern Ohio the Cleveland office of the Crocker-Wheeler Company of Ampere, N. J., has found it advisable to open a sub-office in the Columbus Savings and Trust Company Building, Columbus, Ohio. The sub-office will be in charge of Charles W. Cross, formerly of the Cleveland office of the Crocker-Wheeler Company.

George F. Adams and James R. Downs, who have been connected with the Westinghouse Electric and Manufacturing Company for the last 10 years, have resigned from the Cleveland selling organization and have opened an office in the New England Building, Cleveland, Ohio, under the style of Adams & Downs. They have an agreement with the Burke Electric Company as selling representatives to handle the complete line of alternating and direct-current dynamos and motors manufactured by the Burke Electric Company.

BUSINESS.

Sealed proposals will be received at the office of the supervising architect, Washington, D. C., until 3 o'clock p. m. on July 31st, for the construction (including plumbing, gas piping, heating apparatus, electric conduits and wiring) of the postoffice at Owosso, Mich., in accordance with the drawings and specifications, copies of which may be had at the above office or at the office of the custodian of the site at Owosso.

The work of clearing the ground and laying track for the new creosoting plant to be installed at Little Rock, Ark., by the Ayer and Lord Tie Company of Chicago, has been started. The plant will cost $150,000. It will be known as a four-cylinder one. Each cylinder is made of steel and is six feet and two inches in diameter and 130 feet long. Six hundred ties are creosoted at a time. The Ayer and Lord Tie Company already has two creosoting plants in operation, one at Carbondale, Ill., and one at Grenada, Miss. The former is a seven-cylinder plant, while the latter is a four-cylinder one.

The National Fire Protection Association has prepared a list of watchmen's time-recording apparatus which have been examined under the requirements of the National Board of Fire Underwriters and which are approved for use, having been tested by the Underwriters' Laboratories. The list contains the apparatus of 20 different manufacturers, including boxes for central-station systems, apparatus for local or private systems, stationary clocks and magnetos, and portable clocks. Information regarding tests of watchmen's time-recording apparatus may be obtained by addressing Underwriters' Laboratories, 382 Ohio Street, Chicago, Ill.

Further evidence of the spirit of enterprise that pervades the F. Bissell Company of Toledo is the recent appointment of Mr. A. G. H. Jenssen as "traffic manager" for the company. Mr. Jenssen is an experienced railroad man and comes from the Wabash System to organize and head the Bissell company's new traffic department. The F. Bissell Company has during the last two years grown at such a remarkable rate and traffic matters in its establishment have assumed such proportions as to require the organization of this departure. This simply means to customers of the Bissell company that, through Traffic Manager Jenssen's efforts, they will be assured of the lowest possible freight rates on all shipments, delays of all sorts will be minimized, and, generally speaking, the Bissell company's relations with railroads and customers will be tremendously expedited. A visitor to the big combination store, factory and warehouse of the Bissell company will be surprised at the many other evidences of the company's rapid growth of business. Almost the entire Bissell establishment has been remodeled. The store on the ground floor has been greatly changed, and not only has more space in the building been made available for stock, but a greatly increased force has been put on with which to take care of the company's splendid business.

ILLUSTRATED ELECTRICAL PATENT RECORD.

Issued (United States Patent Office) June 25, 1907.

857,569. Electric Curling Iron. Isabell Allen, Kansas City, Mo., and George Hanlon, Shawneetown, Ill. Application filed October 16, 1906.

An electric heater is arranged in a tube carried by the handle of a curling iron.

857,591. Trolley Harp. Arlington D. Brittain, Youngstown, Ohio. Application filed April 18, 1906.

Two grooved wheel-sections are provided.

857,606. Battery. Frank A. Decker, Philadelphia, Pa., assignor to the Decker Electrical Manufacturing Company, Wilmington, Del. Application filed March 30, 1904.

The battery compartment comprises a pair of diaphragms, one of the diaphragms having ribs in compartment. A perforated plate in compartment is supported by the ribs, and an active fragmental element is placed between the plate and the other of the diaphragms.

857,607. Electrochemical Apparatus. Frank A. Decker, Philadelphia, Pa., assignor to the Decker Electrical Manufacturing Company, Wilmington, Del. Application filed January 16, 1906.

The inventor describes a set of cells, each having one or more horizontally disposed insulating conduits within and cemented to the bottom thereof, and one or more horizontally disposed insulating conduits without and cemented to the bottoms of the several cells, each of the exterior conduits communicating with a conduit within each cell.

857,612. Trolley Stand. Edgar L. Fixler, Delta, Ohio. Application filed July 12, 1906.

A movable member normally coacts with the pole to prevent withdrawal. Means are provided for automatically effecting release of this member from the pole at a predetermined point in the lowering movement of the socket part.

857,621. Switching Device. Alexander M. Haubrich, Chicago, Ill., assignor to the Stromberg-Carlson Telephone Company, Rochester, N. Y. Application filed September 28, 1904.

The invention described is a four-party operator's key arranged to lock the individual ringing button last pressed in an indicating position and to release it upon the rotation of the operator's key.

857,643. Trolley Guard. George L. Matheney, Bridgeport, Ohio, assignor of one-half to J. O. Howells, Bridgeport, Ohio. Application filed July 12, 1906.

A combination of a trolley harp and wheel is described, having guide blocks designed to extend above the wire and prevent the trolley leaving it.

857,662. Telephone Directory. Guy C. Odor, Lima, Ohio. Application filed May 10, 1906.

Two cardboard disks are mounted on the transmitter. The names are exposed by turning the rear disk so as to bring them in front of a slit.

857,664. Electromedical Appliance. David R. Overman, St. Louis, Mo. Application filed January 10, 1907.

A pad of soft leather and wool, containing a battery, is arranged with straps to be applied to the body.

857,686. Electrically Propelled Vehicle. Russell Thayer, Philadelphia, Pa. Application filed April 4, 1907.

An electrically propelled vehicle derives its current alternately from an external supply system and from a storage battery carried by the vehicle. It is constructed to co-operate with a railway system, which includes two overhead electrical conductors and parallel subjacent tracks insulated from the conductors, with means to connect the motor electrically with the overhead conductors or to the storage battery carried.

857,708. Circuit-operating Device. Leonidas G. Woolley, Lima, Ohio, assignor to John C. Riley, Lima, Ohio. Application filed August 31, 1906.

In a circuit-operating device a motor drives a signal wheel and a magnetic generator. An escapement controls the operation of the motor.

857,715. Means for Automatically Timing the Spark for Producing Ignition in Explosion Motors. Auguste E. Brillié, Paris, France, assignor to Société Anonyme des Automobiles Eugène Brillié, Paris, France. Application filed December 24, 1906.

The invention of a commutator for combustion engines is described, in which a magneto igniter provided with an armature shaft is combined with sleeve carrying projections. The motor shaft is provided with a socket having grooves into which the projections are adapted to enter, and there are means acting upon the projections for advancing the armature shaft relatively to the motor shaft.

857,729. Electric Brake. Emil Franke, Astoria, N. Y. Application filed August 4, 1906.

Force developed by electromagnets is transmitted through a system of multiplying levers and brake-beams to apply the shoes to the wheels.

857,735. Fused Plug and Receptacle. John C. Hatzel and Edgar L. Morley, New York, N. Y. Application filed January 5, 1906.

This plug for switchboards comprises a handle composed of insulating material having a longitudinal aperture a portion of which is enlarged to form a fuse cavity. There are means for permanently securing a flexible cable in one end of the handle, and a standard inclosed fuse in the cavity in metalic connection with the cable.

857,752. Mechanical Power Brake. Louis Pfingst, Boston, Mass., assignor to the Pfingst Electric Manufacturing Company, Kittery, Me. Application filed March 6, 1903.

A power-driven brake spindle is in combination with the motor and hand-power mechanism to simultaneously or independently wind or unwind the brake chain for actuating the brake mechanism.

857,786. Machine for Separating or Assorting Coins. William W. Broga, Springfield, Mass. Application filed October 31, 1904.

One feature is an arrangement by which a distorted coin will not only operate an alarm, but arrest the further passage of coins by energizing an electromagnetic device controlling the electric-driving motor.

857,787. Oscillating Device for Motor-driven Fans. Herbert S. Brown, New York, N. Y. Application filed June 26, 1902.

The motor fan support is in two sections, connected by a pivot and supported on a pivot, both pivots being inclined to the vertical. The fan, located on one section, has its center of gravity to one side of the axes of both pivots.

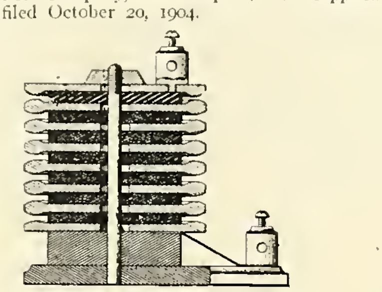
857,792. Railroad Brake. Howard A. Coleman, Sanborn, Iowa. Application filed March 4, 1907.

When a pair of electromagnets are energized they attract armatures, rock a crank-shaft and apply the brakes. When the circuit of the electro-magnets is interrupted the brake-shoes fall away from the wheels.

857,797. Motor-control Apparatus. George W. Euker, Pittsfield, Mass., assignor to the Stanley-G. I. Electric Manufacturing Company, Pittsfield, Mass. Application filed August 31, 1905.

A motor-starting rheostat has a movable contact member tending normally to assume its "off" position, but arranged with electromagnetically actuated means for locking in a running position. A flexible operating member is connected to the arm, which carries a switch with connections to the locking mechanism.

857,849. Lightning Arrester. Joseph V. E. Titus, Keokuk, Iowa, assignor to the Electric Service Supplies Company, Philadelphia, Pa. Application filed October 20, 1904.



NO. 857,849.—LIGHTNING ARRESTER.

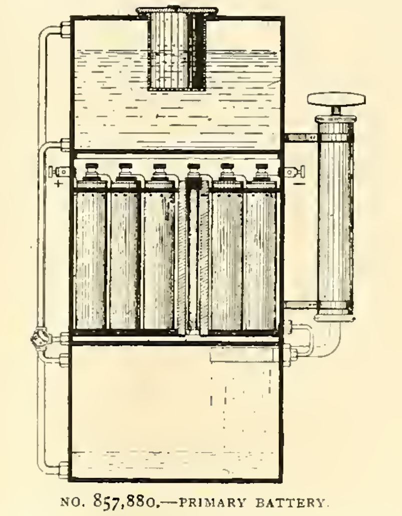
This invention comprises the combination with a number of plates having spark gaps arranged between a portion of them of layers of resistance material interposed between the plates and electrically connecting them, one of the plates being arranged closer to its neighbor than the remainder. (See cut.)

857,856. Magnetic Drawing Apparatus for Pipes, etc. George Baehr, McKeesport, and Harry B. Lynch, Versailles, Pa., assignors to the National Tube Company, Pittsburg, Pa. Application filed February 25, 1907.

This apparatus for drawing or pulling pipes or other objects in an endwise direction has an inclined trackway mounted by a carriage or trolley carrying an electromagnet having a pivotal magnetic clamping member.

857,866. Induction Coil. Morris W. Brinkmann, New York, N. Y. Application filed March 14, 1905.

The novelty of this invention consists in its provision for two or more interrupters operating simultaneously to break the primary circuit, with means for adjusting the tension of each and having each interrupter and corresponding contact point controlling a definite current strength.



NO. 857,880.—PRIMARY BATTERY.

857,880. Primary Battery. Charles E. Hite, Philadelphia, Pa., assignor to the Hite Electric Company. Application filed November 15, 1904.

Combined are a number of cells having insulated outer walls, the cells opening at their bottoms into a body of electrolyte. The electrolyte flows upwardly through the cells and then downwardly upon the outside of the cells and over the insulation. A common chamber receives the overflow of electrolyte and it is filtered as it passes. (See cut.)

857,890. Automatic Safety Stop Device for Electric Vehicles. John T. McIntosh, Chicago, Ill., assignor of one-third to Charles H. Roberts, Evanston, Ill. Application filed June 14, 1902.

Forty-nine claims of novelty were allowed on this device for regulating the application of power in electric automobiles, which utilize an electric circuit and a controller and a brake actuated by fluid pressure. The handle automatically sets the brakes, independently of controller action on release of the handle.

857,909. Electrolytic Cell. Alfred O. Tate, New York, N. Y. Application filed September 28, 1904. Renewed November 23, 1906.

An electrode for an electrolytic cell embraces two series of carbon conductors located in close mechanical and electrical relation to each other, but separated by insulating media, the lateral edges or faces only of the conductors being exposed.

857,910. Apparatus for Treating Liquids Electrolytically. Alfred O. Tate, New York, N. Y. Application filed September 28, 1904. Renewed February 12, 1907.

In the cell described the electrodes consist of a multiple series of strips of platinum constituting the anode and a like multiple series of strips of other conducting material constituting the cathode, all of the strips being secured to a common base or support.

857,927. Process of Recovering the Nickel Contained in Basic Nickel Precipitates. Herbert H. Dow and Walter S. Gates, Midland, Mich., and Arthur E. Schaefer, Cleveland, Ohio, assignors to the Ontario Nickel Company, Worthington, Canada. Application filed April 18, 1906.

The inventor describes a method of recovering nickel by electrochemical processes.

857,928. Fitting for Electric Lamps. John Dugdill, Failsworth, near Manchester, England. Application filed November 3, 1906.

An improvement in the construction of electric fittings, such as lamp brackets, is described.

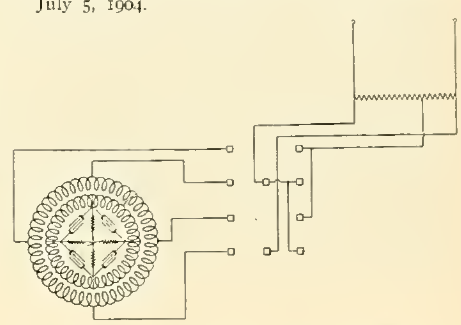
857,929. Storage Battery Electrode. Thomas A. Edison, Llewellyn Park, Orange, N. J., assignor to the Edison Storage Battery Company, West Orange, N. J. Application filed March 30, 1905.

Mr. Edison describes the use of an electrode mass for storage batteries employing alkaline electrolytes, comprising an intimate mixture of nickel hydroxide and flakes, scales or films of cobalt-nickel alloy, also the mixture of a flake-like insoluble conducting material with the active material of storage batteries employing alkaline electrolytes.

857,931. Tool for Truing and Dressing Commutators. Claus H. Frick, San Antonio, Tex. Application filed October 2, 1906.

Details of a tool of the class described are given.

857,953. Alternating-current Machine. Ralph D. Mershon, New York, N. Y. Application filed July 5, 1904.



NO. 857,953.—ALTERNATING-CURRENT MACHINE.

In an alternating-current machine adapted for variation in the number of its poles the inventor combines with the primary element, a secondary element, resistances in the secondary element, permanent connections from the resistances to the secondary winding or windings at such points that the resistances are less effective or non-effective in their action for one number of poles and more effective for a greater number of poles, additional resistances in the secondary element, and permanent connections therefrom to the secondary winding or windings at such points that the additional resistances are less effective or non-effective for the greater number of poles and more effective for a still greater number of poles. (See cut.)

857,959. Automatic Telephone Exchange. Nils E. Norstrom, Junction City, Kan., assignor of one-half to John Anderson, Salina, Kan., and one-sixth to M. E. Richardson, Sterling, Kan. Application filed May 31, 1900.

The rather complicated mechanism of an automatic telephone system is described.

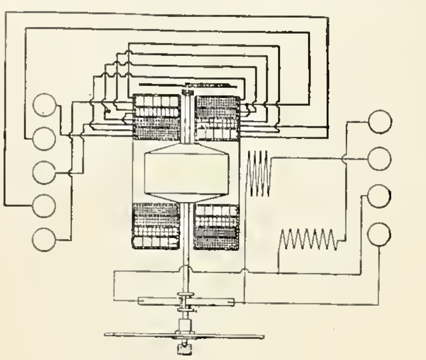
857,966. Automatic Telephone Switch. Charles M. Thompson, Chicago, Ill., assignor to the Charles M. Thompson Company, Chicago, Ill. Application filed January 25, 1907.

The switch-arm has both a rotary and vertical movement in finding its jack, but the invention consists in the new order of movement and control of the connecting devices.

858,002. Speed Governor for Dynamos. Edward B. Jacobson, Pittsfield, Mass., assignor to the Pittsfield Spark Coil Company, Pittsfield, Mass. Application filed January 18, 1904.

When a small dynamo is to be driven by simple friction between its shaft-wheel and the fly-wheel of an engine, as is often the case in magneto ignition of gas engines, the present invention proposes to regulate the speed of the dynamo by an electromagnet in its circuit decreasing the friction at the contact drive by withdrawing one of the driving train.

858,011. Meter. William J. Mowbray, New York, N. Y. Application filed April 30, 1906.



NO. 858,011.—METER.

In a meter the inventor has provided a support having a slot therein, a frame suspended from one side thereof, a shaft mounted for rotation in the frame perpendicular to the support, an armature carried by the shaft, a field coil mounted in inductive relation to the armature, a shunt-field coil also mounted in inductive relation to the armature, and a supporting device for the shunt-field coil extending through the slot in the support to permit adjustment of the shunt-field coil from the side of the support opposite to that to which the frame is secured. (See cut.)

858,016. Armature-testing Apparatus. Victor Patton, Hastings, Colo. Application filed May 24, 1906.

For testing armatures the inventor has arranged in a circuit a relay having a plurality of windings of varying resistance, a switch for cutting either of the windings into the test circuit, and a local signaling circuit.

858,059. Electroplating Apparatus. David F. Broderick, New Britain, Conn., assignor of one-half to Lewis Sperry, South Windsor, Conn. Application filed August 10, 1906.

The inventor describes two series of tanks, one disposed above the other, an endless carrier, means for causing the carrier to travel over both series of tanks, means for suspending holders for the work from the carrier, and means for causing the carrier to rise and descend to dip the work successively in the tanks of the upper series and then to dip the work successively in the tanks of the other series.

858,064. Signal. Harold W. Eden, Detroit, Mich., assignor to P. R. Manufacturing Company, Detroit, Mich. Application filed February 5, 1906.

In this electric-bell signal the interruption of the current is provided by the blow of a projection from the armature against a resilient tongue, which, when depressed, opens the contact, but closes the circuit immediately the armature springs away, thus accomplishing a continuous vibrating motion of the striker.

858,097. Dynamo-electric Machine. Bradley T. McCormick, Cincinnati, Ohio, assignor to the Bullock Electric Manufacturing Company. Application filed September 14, 1905.

In a compound-wound dynamo-electric machine there are the usual field poles, but a series winding thereon has coils connected in multiple series, and segmental strap connectors for the coils arranged on one side of the machine, the segment of the connectors having overlapping ends.

858,117. Medical Battery. Charles W. Taylor, New York, N. Y. Application filed December 22, 1905.

The invention consists in the compact arrangement of the various parts and attachments of a medical battery set.

858,120. Signaling System for Alternating Currents. Louis H. Thullen, Edgewood Park, Pa., assignor to the Union Switch and Signal Company, Swissvale, Pa. Application filed March 2, 1906.

The inventor contemplates dividing a railroad track into insulated blocks and connecting the rails with special inductive bonds presenting low resistance and high impedance.

858,135. Electric Tank Switch. Jacob T. Anderson, New York, N. Y. Application filed May 17, 1906.

A cord carrying a float passes over a drum and is balanced by a weight. The blades of a knife-switch extend from the drum and close into clips.

858,137. Loom Shuttle and Bobbin Tensioning Means Therefor. Charles H. Atkins, Springfield, Mass. Application filed June 18, 1906.

When electromagnetic means are used to secure tension between the bobbin and a portion of the shuttle, it is effectively made intermittent, it is said, by breaking the electrical circuit.

858,139. Warp Stop-motion for Wire-weaving Looms. Charles H. Atkins, Springfield, Mass. Application filed July 31, 1906.

The breaking of a warp wire makes a contact which may release the magnetic clutch or apply a magnetic brake, stopping the machine.

858,160. Anode. Alexander J. Deloye, Torrington, Conn. Application filed January 31, 1907.

This anode comprises a body gradually tapering from its upper end, elliptically shaped in cross-section and having a series of integral outwardly projecting obliquely disposed spurs or projections formed one above the other.

858,196. Apparatus for Producing Electric Sparks. William Marshall, New York, N. Y., assignor of one-fourth to John A. Bullinger, New York, N. Y. Original application filed May 2, 1906. Divided and this application filed October 29, 1906.

The primaries of two induction coils with individual interruptors are paralleled. The secondaries have an end of each connected, and the other extremities and middle point brought to three spark electrodes.

858,197. Circuit Controller. Edward S. Massie and John H. Hawkins, Quincy, Ill. Application filed April 11, 1906.

Contact is made between a rotating lug and a ball yieldingly held in a tube by a spring.

858,211. Electromagnetic Locomotive. Joseph L. Potter, Indianapolis, Ind., assignor to Harry G. Hawekotte, Indianapolis, Ind. Application filed December 11, 1905.

The armature of an electromagnet furnishes reciprocating motion to a crank, which turns the wheels.

858,216. Telegraph Repeater. Worth Rogers, St. Louis, Mo. Application filed December 13, 1904.

The continuity of the main line from which the signals are being transmitted is preserved by keeping closed the transmitter controlled by the main line being repeated into, by opening the front contact point of the repeating transmitter controlling the line being repeated into the shunt around the magnet of the transmitter controlled by the main line being repeated into before the shunt can be closed by the opening of the armature of the relay of the main line being repeated into, and thereby preventing the local battery of the second transmitter from being shunted around the coils of the second transmitter at any time.

858,222. Electric-circuit Controller. Max Schuppe, New York, N. Y., assignor to Bernard F. Seadler, New York, N. Y. Application filed January 7, 1905.

The invention applies to starting boxes for electric motors and comprises two branch circuits, one for connection with the motor armature and the other with its field, and means for completing it through the field before through the armature, and for breaking the circuit first through the armature.

858,238. Trolley Finder. Frederick G. Weber, Ashland, Ky. Application filed February 19, 1907.

A Y-shaped trolley-finding member is pivoted to the forward end of the head and has one end heavier than the other to cause finder to lie normally in a horizontal position until the trolley rope is tightened, raising it to active position for engagement with the wire.

858,246. Direct-current Dynamo-electric Machine. Edwin C. Wright, Newport, Ky., assignor to the Allis-Chalmers Company, Milwaukee, Wis. Application filed November 30, 1906.

In combination are an armature, a core, coils carried by the core and projecting beyond the end thereof, a ring surrounding the projecting portions of the coils, a commutator and commutator leads or necks connecting the coils and commutator bars, the commutator leads extending outward beyond the ends of the coils and serving to support and retain the ring in position.

858,255. Trolley for Electric Railways. Harry Bennett, Newark, N. J., assignor to the Bennett Inventing and Manufacturing Company. Application filed April 17, 1906.

A form of overhead trolley is described.

858,288. Branch Box. Albert F. Hills, Syracuse, N. Y., assignor to the Crouse-Hinds Company, Syracuse, N. Y. Application filed October 19, 1905.

A branch outlet box from interior conduit is described.

858,301. Automatic Time Circuit-breaker. Walter N. Martin, Andrew J. Thomas and Earl F. L. Russell, Denver, Colo. Application filed July 25, 1904.

Clock mechanism provided with alarm devices connects with a circuit-breaker arranged to be actuated thereby. The circuit-breaker has a part arranged to engage the alarm mechanism and lock the latter against movement when the circuit-breaker has reached its limit of movement after breaking the circuit.

858,317. Corn-popper. George B. Young and Joseph H. Young, El Paso, Texas. Application filed November 30, 1906.

The popper is heated and shaken by electrical means.

858,325. Process of Producing Vanadium and Its Alloys. Frederick M. Becket, Niagara Falls, N. Y., assignor to the Electro Metallurgical Company, West Virginia. Original application filed June 19, 1906. Divided and this application filed November 26, 1906.

One continuous process of producing vanadium consists in passing an electric current through a molten bath containing vanadium oxide, silicide of carbon and a basic flux, adding fresh portions of the charge and withdrawing the product as desired.

858,327. Alloy and Method of Producing It. Frederick M. Becket, Niagara Falls, N. Y., assignor to the Electro Metallurgical Company, West Virginia. Application filed March 20, 1907.

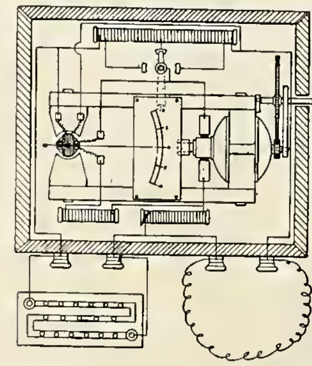
A method of producing by the aid of the electric furnace an alloy containing titanium, calcium and silicon is described.

858,329. Process of Effecting Chemical Reductions and Producing Metals and Alloys. Frederick M. Becket, Niagara Falls, N. Y., assignor to the Electro Metallurgical Company. Application filed April 12, 1907.

The patentee describes a process of reducing refractory metallic oxides, which consists in effecting partial reduction by electrically smelting a mixture of the oxide and carbon, and effecting complete reduction of the product by silicon carbide.

858,335. Apparatus for Measuring Electrical Resistance. Sydney Evershel, Chiswick, England, assignor to himself, and Evershed & Vignoles, Ltd., Chiswick, England. Application filed February 28, 1906.

This apparatus consists of a hand dynamo, a Wheatstone bridge, a resistance box and a galvanometer, in which the control coil is directly connected between the two poles of a dynamo, the working coil being connected to opposite points of the Wheatstone bridge, a single pole of the dynamo being divided between the resistance box and the line to be measured, coming back to the Wheatstone bridge and the working coil of the galvanometer and thence to the other pole of the dynamo. (See cut.)



NO. 858,335.—APPARATUS FOR MEASURING ELECTRIC RESISTANCE.

858,341. Apparatus for Electrolytic Deposition of Metals. Herbert C. Harrison, London, and Joseph Day, Weston-super-Mare, England; Day assignor to Harrison. Application filed August 7, 1902.

In the electrodeposition of metals upon a revolving cathode of circular cross-section the anode is arranged round the cathode in elements consisting of one or more anode bars, and pipes for directing the jets of electrolyte are arranged so that the greatest action of the jets upon the cathode will take place at the points nearest the elements of the anode where the resistance between the electrodes is least and consequently the current density greatest.

858,351. Instantaneous Electric Water Heater. Herbert N. Roche and Fred F. Breese, San Francisco, Cal., assignors to the James W. Edwards Company, Herbert N. Roche and Thomas B. Gray, San Francisco, Cal. Application filed October 20, 1904.

A casing contains a number of parallel heating tubes, containing electric heaters, each having an end closed except for a small opening, all of the openings being arranged near to each other, with a cover inclosing them.

858,355. Trolley Catcher. Robert Shields, South Boston, Mass., assignor to the Frank Ridlon Company, Boston, Mass. Application filed March 14, 1906.

The inventor describes a trolley-cord, reel or catcher in which, when the cord is unwound rapidly, the centrifugal force developed operates a pawl, which checks the reel.

REISSUE.

12,664. Duplexing Telegraph Line. Isidor Kitsee, Philadelphia, Pa. Application filed May 25, 1907. Original number 850,305, dated April 16, 1907.

This invention secures duplex telegraphy by means of a polarized-receiving device, the use of successive impulses of aproximately equal duration and alternating in polarity, induction coils, condensers, etc.

PATENTS THAT HAVE EXPIRED.

Following is a list of electrical patents (issued by the United States Patent Office) that expired July 1, 1907:

431,035. Electric Cut-out. L. Daft, Plainfield, N. J.
431,088. Individual Call Device for Telephones. C. H. Vincent, Lynn, Mass.
431,092 and 431,093. System of Electric Locomotion. F. Wheeler, Meriden, Conn.
431,094. Switches for Electric-railway Systems. F. Wheeler, Meriden, Conn.
431,095. System of Electrical Locomotion. F. Wheeler, Meriden, Conn.
431,118. Electric Switch. O. P. Loomis, Somerville, Mass.
431,134. Dynamo-electric Machine. C. F. Winkler, Troy, N. Y.
431,141. Electrical Call-box. G. F. Gale, Winthrop, Mass.
431,170. Electromagnetic Drill System. H. N. Marvin, Syracuse, N. Y.
431,181. Electric Bell. P. B. Delany, South Orange, N. J.
431,185. Multiple Fusible Cut-out. L. B. Favor, Bridgeport, Conn.
431,186. Multiple Thermal Cut-out. L. B. Favor, Bridgeport, Conn.
431,213. Electric Motor for Railway Cars. William M. McDougall, East Orange, N. J.
431,216. Regulation of Dynamo-electric Machines. William Stanley, Jr., Great Barrington, Mass.
431,217. Self-regulating Dynamo-electric Generator. W. Stanley, Jr., Great Barrington, Mass.
431,218. Self-exciting Alternating-current Electric Generators. W. Stanley, Jr., Great Barrington, Mass.
431,248. Electric Meter. J. Cauderay, Paris, France.
431,256. Suspended Electric Railway and Car. F. E. Drown, Pawtucket, R. I.
431,341. Secondary Battery. T. M. Foote, Allston, Mass.
431,414. Electric-railway Conductor. E. Thomson, Lynn, Mass.
431,447. Secondary Battery. T. S. E. Dixon, Chicago, Ill.
431,460. System of Electrical Distribution. L. Gutmann, Fort Wayne, Ind.
431,482. System of Distribution for Electric Railways. E. E. Ries, Baltimore, Md.
431,492, 431,493 431,494, 431,495 and 431,496. Reciprocating Electric Engines. C. J. Van Depoele, Lynn, Mass.

WESTERN ELECTRICIAN

EVERY SATURDAY

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Hydro-electric Power Development on the Muskegon River.

Although in a rather desolate spot, surrounded by sand hills and scrub oak, the site of the Croton Dam hydro-electric power plant now building by the Grand Rapids and Muskegon Power Company offers a scene of industry and activity. Already the Grand Rapids and Muskegon Power Company has in operation a waterpower plant at Rogers Dam on the Muskegon River, 51 miles north of Grand Rapids, Mich. Electrical energy generated at this plant is used for lighting and power in Grand Rapids, Muskegon, Holland and other towns intervening, besides supplying several street and interurban railways. Current is transmitted to Muskegon and Grand Rapids at 66,000 volts.

So great has been the demand for power that the company some time ago decided to build another plant of greater capacity about six miles down the river. Work is now nearing completion on the new dam and power house, known as Croton Dam. A feature of this enterprise is two steel-tower transmission lines, one to Muskegon and one to Grand Rapids, which will be operated at 100,000 volts. The line is being substantially constructed, each of the three legs of each tower being anchored with a special steel-concrete base made on the ground. Three 3,750-kilowatt transformers are now being installed in the Grand Rapids substation to receive the 100,000-volt current and reduce it to the distribution pressure.

In the accompanying group picture Fig. 1 shows the Rogers Dam project, now in full operation. Fig. 2 is a view of the up-stream side of the Croton Dam development during construction, while Fig. 3 shows the down-stream side.

The Croton Dam is built of concrete and steel, the power house housing the generators and waterwheels being a part of the dam, much the same as the Sanitary District project at Lockport on the Chicago Drainage Canal. The working head of water at the dam is 41 feet, and to create this head a reservoir covering nearly 2,000 acres has been formed.

Provision has been made for the control of flood water by the installation of movable-crest sections in the dam. These sections, shown at the right in Fig. 2, are raised or lowered by electric motors. Until the dam was completed, the river in its natural course flowed between the west end of the dam and the hill shown in Fig. 2. The river is shown in the foreground of Fig. 3, which, of course, is the opposite side of the power house at the left in Fig. 2.

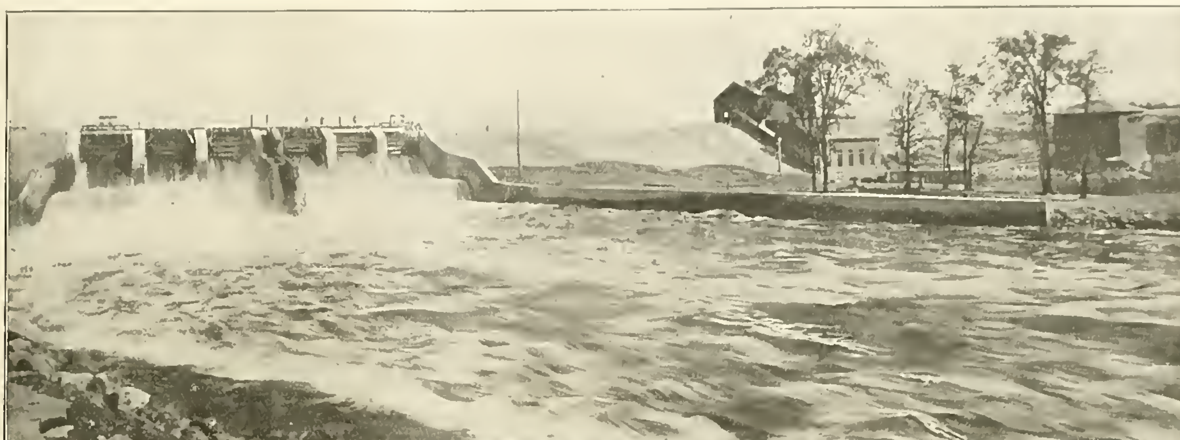
The river channel at the side of the power house has now been closed, diverting the water into the reservoir. The work of changing the course of the river was accomplished largely by hydraulic excavating. Water at high pressure was forced through a large nozzle against the side of the hill, removing the dirt, which was washed down the hillside. At the bottom banks of trees and shrubs were thrown up, which served to check the progress of the hydraulically excavated dirt and form a new embankment.

There are two generating units installed at Croton, each unit composed of a generator and eight waterwheels direct-connected. The waterwheels are of the Leffel type, each unit being guaranteed by the makers to deliver 7,200 horsepower at the generator shaft. One of the two groups of eight wheels is shown in Fig. 4, the other group being located directly alongside. The wheels can be operated in sets of two, and the turbine chambers are divided into compartments so that any set of two wheels can be shut off if necessary.

The generators, one of which is shown in Fig. 5, are Westinghouse three-phase 30-cycle machines. They will generate at 6,600 volts, which pressure will be raised to 100,000 volts for transmission. Three oil and water-cooled step-up transformers are installed for raising the voltage to 100,000.

The Croton Dam plant is attracting considerable attention among engineers, principally because it is one of the first to transmit at 100,000 volts. The older plant at Rogers Dam has already demonstrated the commercial practicability of generating electricity by waterpower and transmitting the power to points in Western Michigan. Besides supplying cities and street railways with light and power, many manufacturing industries are using the cheap power. A ready market awaits the output of the new plant.

J. B. Foote of Jackson, Mich., was in charge of electical engineering at Croton Dam, and W. G. Fargo of Jackson was the hydraulic engineer. Thomas Hume of Muskegon is president of the power company, and A. J. Bemus is general manager.



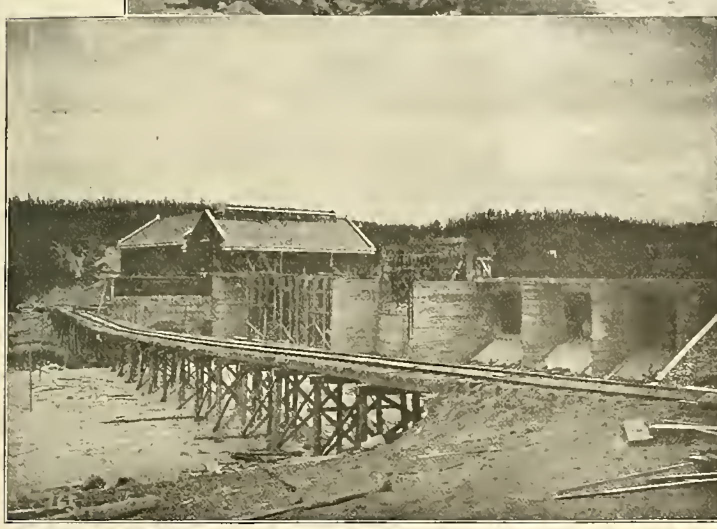


Fig. 2. Up-stream Side of Plant at Croton Dam. Fig. 1. Rogers Dam and Power House. Fig. 3. Down-stream Side of Plant at Croton Dam.

HYDRO-ELECTRIC POWER DEVELOPMENT ON THE MUSKEGON RIVER.

Electrical Exports for May.

Electrical exports from the United States for the month of May, 1907, amounted to a total value of $1,419,959, compared with $1,391,830 for May, 1906. The increase over May, 1906, is due to the larger amount of electrical machinery exported, electrical appliances having fallen off considerably. The detail figures are as follows: Electrical machinery—May, 1907, $800,566; May, 1906, $681,955. Electrical appliances—May, 1907, $619,393; May, 1906, $709,875.

The following-named countries were the principal importers of electrical machinery and appliances from the United States in May, 1907:

Machinery—British North America, $242,716; Mexico, $100,904; Brazil, $97,521; Japan, $89,359; United Kingdom, $63,484; France, $61,190; Chinese Empire, $41,025; British Australasia, $15,686; British East Indies, $12,266; Germany, $12,002; Central

American States and British Honduras, $9,429; Philippine Islands, $7,764; Cuba, $4,914.

Appliances—United Kingdom, $128,828; British North America, $117,925; Mexico, $84,548; Brazil, $50,725; Germany, $42,865; Japan, $31,291; Cuba, $28,957; British Australasia, $25,641; Central American States and British Honduras, $15,982; Belgium, $11,314; Argentina, $6,861; British Africa, $3,811; France, $3,025; Philippine Islands, $2,621.

Single-phase versus Three-phase Generation for Single-phase Railways.[1]

By A. H. Armstrong.

The introduction of the alternating-current single-phase railway motor calling for a single-phase secondary distribution system makes it pertinent to inquire into the question of power generation

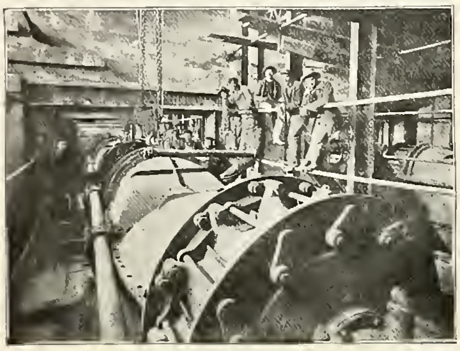


Fig. 4. A Waterwheel Unit at Croton Dam.

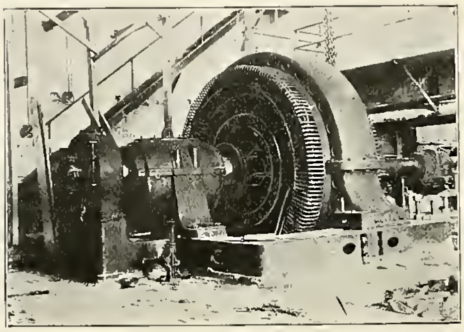


Fig. 5. 3,000-kilowatt Generator in Croton Dam.

HYDRO-ELECTRIC POWER DEVELOPMENT ON THE MUSKEGON RIVER (SEE PAGE 21).

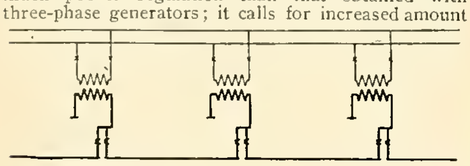
and primary distribution for such systems. While the simplicity of single-phase generation and distribution is unquestioned, it is not always possible or desirable in these days of general power distribution to install a generating station and primary distribution system capable of taking care of alternating-current railway load alone to the exclusion of synchronous converters and other receiving machinery requiring three-phase input.

As the use of either single-phase or multiphase generators seems to be open to certain objections, various methods of distribution are presented herewith, with some of the advantages and disadvantages pertaining to each.

Single-phase Generation.

1. Single-phase generation and transmission makes it impossible to use synchronous converters, self-starting synchronous motors, or induction motors starting under load. It is poorly adapted to general power distribution and is largely limited in its application to alternating-current railway operation alone. Its use is therefore open to grave objections of a commercial nature where there exists any possibility of selling power or in any way utilizing it for general converter and motor work.

2. The single-phase generator has an unbalanced armature reaction which is the cause of considerable flux variation in the field pole-tips, and in fact throughout the field structure. Such generators must therefore be constructed with thinner laminations and oftentimes poorer mechanical construction in order to minimize eddy currents, resulting in increased cost of the generator. The large single-phase armature reaction results in a much poorer regulation than that obtained with three-phase generators; it calls for increased amount



SINGLE-PHASE PRIMARY AND SECONDARY DISTRIBUTION.

of field copper and more liberal design, which, with the larger exciting units required, brings the cost of the single-phase generating unit throughout considerably in excess of that of a three-phase unit of the same output and heating.

The difficulties of single-phase generator construction appear to increase with any reduction in frequency, and the adoption of any lower frequency than 25 cycles may result in serious difficulties in construction for a complete line of machines of the single-phase type, especially of the two or four-pole turbine-driven type, where the field flux is very large per pole.

3. Against the difficulty of single-phase generator construction, its greater cost and poorer efficiency there is the great advantage of simplicity in the entire generating, primary and secondary distribution system for single-phase roads. This advantage is so great that it justifies considerable expense. Looked at from the railway point of view only, the single-phase system throughout may be considered as offering the most advantages.

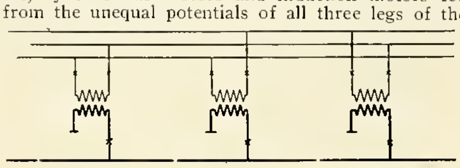
1. A paper read at the Niagara Fall convention of the American Institute of Electrical Engineers, June 27, 1907.

Three-phase Generation.

Three-phase generation and distribution is in almost universal use. Many single-phase railways receive power from such systems, and the commercial advantages resulting from the use of such generators may in certain cases justify the complication of single-phase secondary distribution obtained from a three-phase source. As these commercial advantages are in many cases controlling, various combinations of three-phase--single-phase connections are presented herewith.

1. *Three-phase Generation and Primary Distribution to Motor-generator Sets Feeding into the Single-phase Secondary Distribution.*—This system has all the advantages of obtaining power from a three-phase distribution which may also feed synchronous converters and general power load, and is independent of the frequency of the generating system, being equally adapted to 60 or 25 cycles. Its disadvantage lies in the cost of the motor-generator sub-station, but it is the only system which will give perfect balance on a three-phase distribution system.

2. *Three-phase Generators Operating Alternating-current Railway Load on One Leg, thus Calling for both Primary and Secondary Single-phase Distribution.*—Commercial considerations of possible future synchronous converter or power load may justify the installation of three-phase generators designed for single-phase output for railway load and three-phase output for general power distribution. This system is open to the objection of serious unbalancing due to railway load on one phase only, and this unbalancing may be so great as to cause undue heating in synchronous converters, synchronous motors and induction motors fed from the unequal potentials of all three legs of the

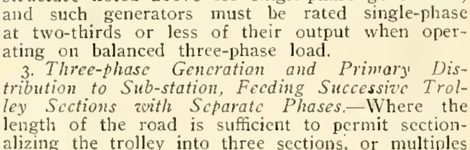


THREE-PHASE PRIMARY AND SINGLE-PHASE SECONDARY DISTRIBUTION.

three-phase generator. Tests have been made which indicate that receiving apparatus may have its capacity reduced from 30 to 50 per cent. with normal heating with the unbalancing caused by single-phase railway load fed from a three-phase generator in commercial operation.

A three-phase generator run as single-phase is open to all the objections of excessive armature reaction, poor regulation, pulsating flux in field structure noted above for single-phase generators; and such generators must be rated single-phase at two-thirds or less of their output when operating on balanced three-phase load.

3. *Three-phase Generation and Primary Distribution to Sub-station, Feeding Successive Trolley Sections with Separate Phases.*—Where the length of the road is sufficient to permit sectionalizing the trolley into three sections, or multiples of three, having an equal load on each section, this method provides for balancing the three-phase load, thus securing full output of the generator, non-interference with power load, etc. Each sub-



THREE-PHASE PRIMARY AND SINGLE-PHASE SECONDARY DISTRIBUTION.

station must contain two sets of transformers connected to separate phases, so that adjacent sub-stations may feed like phases into a common trolley section extending between them. The installation of a single transformer in each sub-station would necessitate the sectionalizing of the trolley midway between sub-stations, hence losing half the effective value of the copper as obtained with the trolley sectioned at the sub-stations and two adjacent sub-stations feeding a common trolley section.

This method of securing a balanced three-phase load is open to the objection of complication and possible ineffectiveness with serious disarrangements of schedule such as take place in railway operation during different periods of the day and season.

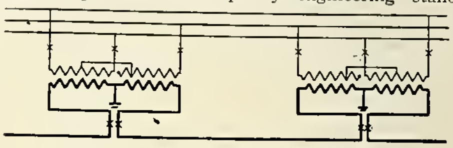
4. *Two-phase Generation, Generating Station Located in Center of System and Feeding One Phase Each Way.*—So long as the load is balanced upon the two primary distribution systems this method of connection is capable of good results, but operation under the necessities of commercial service shows it to be very difficult to balance the load upon the two phases, thus resulting in considerable unbalancing and extreme voltage variation on the less loaded leg. This same criticism holds true of method 3.

5. *Three-phase Generation and Primary Distribution to Transformer Sub-stations Connected Three-phase--Two-phase, and Feeding Secondary Distribution in such Manner that Adjacent Sub-stations Feed like Phases into a Common Trolley Section.*—This method of connections is capable of giving good results in operation, although occasional serious unbalancing may occur in the primary distribution with a disarrangement of schedule or improperly proportioned trolley sections. Each sub-station must contain two transformers for regular service, and possibly one spare, which together with the necessary switchboard arrangement increases the complexity and cost of such sub-stations compared with simpler arrangement possible with straight single-phase distribution.

There are other methods of connection, such as independent transmission lines to several outlying sub-stations, thus giving the generating station operator the opportunity to balance the load on the several phases of the generators; but the methods outlined are those commonly proposed for single-phase secondary distribution used in connection with three-phase generation and primary distribution.

General Conclusions.

The matter of proper selection of generating apparatus for single-phase roads seems to be closely connected with questions of a commercial character relating to a possible future load requiring a three-phase input. From a purely engineering stand-



THREE-PHASE PRIMARY AND TWO-PHASE SECONDARY DISTRIBUTION.

point, and considered from the point of view of the railway load only, the single-phase system of generation and distribution is to be recommended. The possible installation of generators having a lower frequency than 25 cycles would help this decision, owing to the unfitness of such a low frequency for general power distribution work.

Of the several methods of single-phase combinations proposed the motor-generator set best protects the three-phase distribution system where power is purchased from foreign distributing systems, and such a method presents many advantages which may outweigh its increased first cost. Where the railway company finds it expedient to generate and distribute its own power from three-phase generators the use of a single leg for the railway load (3) or the installation of three-phase-two-phase transformer sub-stations (5) seem to offer advantages justifying their recommendation, and the choice between the two may perhaps be left to the needs of local requirements.

National Civic Federation and Public Ownership.

After two years' investigation of the conditions obtaining in the principal cities of the United States and Great Britain, the National Civic Federation's committee on public ownership has brought in the first two of its reports. Professor John R. Commons of the University of Wisconsin, in his report entitled "Labor and Politics," favors municipalization more than his colleague, J. W. Sullivan, editor of the Clothing Trades Bulletin, who makes caustic references to political jobbery, of which he claims to have found conclusive evidence in Syracuse, Alleghany and Wheeling. While the first gentleman asserts that common labor in America is better paid and treated in utilities owned and operated by the public, Mr. Sullivan asserts that this is only partially true, if at all, for the skilled and more competent workers receive no more compensation than if employed by private concerns in the same section of the country.

Of the effect of politics on municipal service, Professor Commons says that no evidence of political appointments could be found in the municipal water or electricity departments of Chicago during recent years, but admits that the proper method of dealing with employes is the most difficult and critical problem of public ownership. For this reason he favors the recognition of organized labor as a safeguard against political recommendations.

Mr. Sullivan is not so sanguine of the success of the Chicago system, calling attention to the vulnerable point left by the mayor's power of appointing the department heads, and even the civil service commission itself. Further, he declares that municipalization, as exhibited in the labor reports, is seen to be a project to restrict men in their activities by methods foreign to American genius. The report is concluded with statements of the working conditions and wages under the four principal utilities investigated.

High-tension Transmission Lines.

[From the Question Box of the National Electric Light Association.]

QUESTION.

Why has direct-current high-tension transmission been practically neglected in the United States?

ANSWERS.

M. C. Turpin, superintendent Auburn (N. Y.) Light, Heat and Power Company: Because of the difficulty in obtaining direct current at high voltage, on account of the commutation troubles.

John Cyrus Distler, Public Service Corporation of Trenton, N. J.: An alternating-current system has a lower first cost, is less expensive to operate, has a higher efficiency and greater simplicity than a direct-current system. For very long transmission lines the harmful influence of large inductance and charging current weighs heavily against the many advantages and it becomes a question which system is the better.

QUESTION.

Considering cost and difficulty in making good joints, does aluminum show any advantage over copper for high-tension long-distance transmission?

ANSWERS.

William Hoopes, Aluminum Company of America, Pittsburg: The cost of making joints in aluminum conductors on long-distance high-tension transmission lines averages about 0.2 per cent. of the cost of the conductor. The saving in the original investment varies between 50 and 100 times the cost of making the joints.

H. C. Stoddard, superintendent Condor Water and Power Company, Tolo, Ore.: Our company has 100 miles of 20,000-volt transmission line using No. 1 seven-strand aluminum wire that has been in operation for over two years, and had no trouble or break with this wire. The aluminum wire costs less than copper of the same carrying capacity and is lighter, making less strain on the poles.

QUESTION.

What are the advantages of the Y over the delta connection, grounded and ungrounded neutral?

ANSWERS.

F. C. Clark, Chicago Edison Company: If transformer or armature windings are delta-connected the pressure across the terminals of one phase is the same as that of the circuit to which they are connected, but in the case of a star connection each winding furnishes only 58 per cent. of the line or bus pressure. The current in one leg of a delta winding is 58 per cent. of the line current, while in a star system each leg carries the full line current. On account of the above pressure relation much smaller transformers may be used for a given line voltage when connected in star than if connected delta. Less insulation is required with grounded neutral than when left ungrounded or when delta connection is employed, pressure to ground being 58 per cent. of phase pressures. If the neutral is grounded there is less shock on connected apparatus if the transmission line becomes grounded.

Where three transformers are connected in delta and one burns out, it may be disconnected, and three-phase current at line pressure be obtained from the other two on open delta or Y connection. Where the neutral is grounded on both ends three-phase current could be obtained from two of them, but it would be at only 58 per cent. of the normal voltage between phases in a star-connected system.

M. C. Turpin: When using the Y system, voltage can be increased 1.73 times with the consequent saving in copper.

QUESTION.

(a) Can a telephone line be successfully operated on same poles with 13,000-volt transmission lines at 60 cycles? (b) If so, what should be the space between transmission lines and telephone lines? (c) If open line, how often transposed?

ANSWERS.

F. C. Sargent, Malden (Mass.) Electric Company: We use cross-arms which we standardize ourselves on all voltages up to 3,000 volts. The distance between pole-pins is 30 inches, adjacent pins 12 inches. Have operated a telephone line successfully on a 13,000-volt transmission line at 60 cycles, telephone line being about seven feet from the nearest high-tension wire.

John J. Gaffney, Newark, N. J.: Eight feet and transpose every 500 feet.

H. H. Barnes, Jr., General Electric Company: (a) Yes, undoubtedly. (b) As far away as possible but not within less than four feet. (c) It would be advisable to transpose the telephone line every 500 feet at least. On a long transmission line it would also be necessary to transpose the power conductors to avoid interference with the telephone system through electrostatic induction.

W. M. Scott, Utah Light and Railway Company: (a) Yes. (b) Eight feet. (c) Every four or five spans.

Rebuilding a Boiler Room without Shutting Down.

The Peoria Gas and Electric Company is operating its central station at Peoria, Ill., under difficulty, as the larger boiler room is being rebuilt while the plant is in full operation. The accompanying picture, showing the boilers exposed, is therefore of particular interest.

REBUILDING CENTRAL-STATION BOILER ROOM IN PEORIA DURING OPERATION.

The illustration also shows the new concrete stack, which is 13 feet in internal diameter, with a height of 200 feet. In the center of the picture is shown the old original brick stack and at the right is the steel stack. A temporary breeching was erected to carry the gases to the new stack, and it is high enough to let the cars under, so that the boilers at the right can be supplied with fuel.

At the left in the picture will be erected the hoisting machinery, which will consist of a grab bucket to take the coal to a crusher, from which the coal will drop to a belt and be carried to the bunkers and hoppers over each boiler. The boilers will be equipped with chain grates, the ashes dropping onto a belt conveyor which will carry them to the grab bucket, which will lift them to the car.

The new building will be entirely of steel with a reinforced concrete roof. There will be 12 units in the boiler room with a total rated capacity of 4,500 horsepower.

Society for the Promotion of Engineering Education.

The annual meeting of the Society for the Promotion of Engineering Education was held at the Case School of Applied Science, Cleveland, Ohio, July 1st, 2d and 3d. The meeting was a successful one, representatives from nearly all the large universities of the country being present. A large number of good papers intended to promote engineering education were read. These included a series of papers from practical engineers and manufacturers on the subject of trade education.

Dugald C. Jackson of the Massachusetts Institute of Technology, Boston, president of the society, in his annual address made a strong plea for the establishment of trade and labor schools. He said that no use of money can bring greater returns to the state than the founding of schools to give instruction in trades.

It was the opinion of the society that there are not as many trade and technical schools in the United States as there should be. Along the lines advanced by President Jackson, the society authorized the appointment of a committee to work in conjunction with the American Institute of Mining Engineers, the American Society of Chemical Industry, the American Society of Mechanical Engineers and the American Society of Civil Engineers for the promotion of elementary technical education. This action followed the report of the investigating committee headed by C. M. Woodward of Washington University, St. Louis, and A. L. Williston of Pratt Institute, Brooklyn. The governing council of the society will have charge of the proposed work.

The election of officers for the ensuing year resulted as follows:

President, Charles S. Howe of Case School of Applied Science, Cleveland; first vice-president, Clarence A. Waldo of Purdue University, Lafayette, Ind.; second vice-president, William G. Raymond of the University of Iowa, Iowa City; secretary, Arthur L. Williston of Pratt Institute, Brooklyn, treasurer, William O. Wiley of New York city.

Councilors for three years—Fred W. Atkinson, Brooklyn Polytechnic Institute; Mortimer E. Cooley, University of Michigan, Ann Arbor, Mich.; William S. Franklin, Lehigh University, Bethlehem, Pa.; William Kent, Syracuse University; Walter B. Russell, the New York Central Railroad; Charles F. Scott, Westinghouse Electric and Manufacturing Company, and Harold B. Smith, Worcester (Mass.) Polytechnic Institute.

Antimonite Has Characteristics Like Selenium.

Another substance whose electrical conductivity varies with the intensity of illumination to which it is subjected, like selenium, has been discovered. Mr. F. M. Jaeger recently reported to the Dutch Academy of Sciences, says the Scientific American, that after noting the change in resistance of Japanese antimonite by a galvanometer when a ray of light fell upon it he investigated further to make sure whether this was actually due to the light or its accompanying heat. Heat alone applied to the substance was found to diminish its conductivity so that the changes noted in the opposite direction were clearly shown to be due to light alone. Strangely enough there were well-defined maxima of sensitiveness corresponding to the red and blue waves, while between these colors as well as in the whole range of the spectrum the effect decreased. It is intended to conduct further experiments with antimonite, making it up into photo-sensitive cells similar to those in which an allotropic modification of selenium finds application.

Reduced Lighting Rates Increase Business.

Under date of July 6th the Boston correspondent of the Western Electrician writes as follows: "An extra dividend of one per cent., payable August 1st to stockholders of record at the close of business July 15th, has been declared in addition to the regular quarterly dividend of 2½ per cent. by the Edison Electric Illuminating Company of Boston. Charles L. Edgar, the president of the company, says: 'By the reduction of its prices during the last year the company has reduced the bills of its customers by substantially $200,000. Notwithstanding this saving to the public, it finds itself able to pay an extra dividend of one per cent. to its stockholders, thus adopting, in a tentative way, the general principles involved in the operation of the so-called sliding scale.'"

Motors for Cranes and Hoists and the Advantage of Variable-speed Types.

By Albert F. Hemingway.

Motors for cranes and hoists, on account of the restricted space, should be of compact design. Again, due to the intermittent character of service, severe loading, etc., their construction should be durable and substantial. The series type of motor, because of its great starting torque, is, under ordinary circumstances, well adapted for this particular duty.

The torque of a series motor up to a certain critical field saturation multiplies as the square of the current; that is to say, if 2 pound-feet is the torque resulting from a current flow of 5 amperes, a torque of 8 pound-feet will be the result from a flow of 10 amperes. The above statement, however, is only approximate, for by referring to the saturation curve of the magnet field material it may be seen that the field magnetism for all but cast-iron increases rapidly up to a density of 80,000 lines per square inch, after which the magnetic increase becomes less and ceases to correspond with the increase of current. In consequence, after the point of saturation has been reached, the torque varies more nearly in direct proportion with the current flowing through the armature, and the statement that torque increases as the square of the current does not hold true.

By reference to the accompanying speed curves, it will also be seen that the speed of a series motor varies inversely with the load. Thus, under heavy strains, the speed is automatically controlled, slowing up with increase of load. Under conditions of rapid acceleration motors of the shunt-wound type would seem to be more desirable if not essential in cases where a relatively greater power is required during the period of starting than when operating after maximum speed has been attained. The series type of motor under these conditions, which is not unusual in hoisting work, will tend to race at part load. It is thus possible during constant speed, and especially at light loads, that resistance control, with its consequent losses, will be needed to avoid undue high speeds. In the case of shunt motors the speed is a constant quantity within a small percentage irrespective of the load, thus making it possible to use as large a motor as may be desired without detriment other than the extra weight and possibly lower efficiency due to the use of a large motor.

To explain the foregoing more completely an instance may be assumed of a five-ton crane hoist operating vertically at a hoisting speed of 100 feet per minute. By calculation the power required to accelerate a given load in a given time is expressed by the following general formula:

$$\text{H. P.} = \frac{W N_2}{550 \times T},$$

W being the load in pounds, T the time in seconds and N_2 the mean speed, or one-half the maximum. Therefore, supplying figures for the symbols, the power required to start, say in 15 seconds, is $\frac{10{,}000 \times 50}{550 \times 15} = 60.6$ horsepower. In the above calculation the resistance due to inertia has been neglected. This force, which we term R, equals $\frac{W V}{G T}$

where V = maximum velocity in feet per second,
G = gravity 32.16,
T = time in seconds to attain velocity V.

Therefore in the instance under consideration

$$R = \frac{10{,}000 \times 1.66}{32.16 \times 15} = 34.4 \text{ pounds.}$$

Except in cases of very great rates of acceleration and high speeds R may be neglected or taken into consideration as part of the friction load. It is seen in this case that R is less than one per cent. of the live load W. Considering the power after acceleration has ceased this may be calculated by means of the usual formula where $\text{H. P.} = \frac{W N}{550 \times 60}$, W being as before, the load in pounds and N the speed of travel in feet per minute of load W. Therefore, neglecting friction, the power required at maximum speed is $\frac{10{,}000 \times 100}{550 \times 60} = 30.3$ horsepower, being just one-half of the power required during the period of starting.

It is clear from the foregoing that the performance of a series motor during acceleration is complicated and difficult of speed calculation. Under ordinary crane service, however, it would make very little difference if the acceleration period were long or short. But in cases where crane mechanism is to operate and travel a certain distance in a given time acceleration amounts to considerable. It is highly advantageous to arrive at maximum speed as soon as possible. Regularity of speed is also an essential matter in cases where material such as ore, coal, etc., is handled in bulk; and from what has been pointed out and will be more fully dealt with later, the shunt type of motor having a uniform speed at all loads is the most satisfactory form of motor to use whether it be for a crane or regular hoist.

Theory and Principles Involved.

To treat the subject thoroughly it may be said that a series motor is one in which armature and field windings are so connected that they form a common path for the current instead of a divergent path, as is the case in the shunt form. In other words, with a series motor the current that may flow either to or from the armature passes directly through the field. It is clear from this that the field of a series motor is proportional in strength to the armature current up to a point where the material of the magnet cores has become saturated, after which there is little or no further increase in magnetism, no matter how much current may be forced through the field windings.

In consequence of a field having magnetism which varies with the armature current there is a corresponding inverse variation in speed. As a result a motor of this character, leaving out the time of acceleration, is especially suited for hoisting or traction service, the effort or exertion at all times being automatically controlled with the load.

The torque T of a motor is the pull in pounds multiplied by the distance from center of the armature shaft to point where the pull is exerted, and termed pound-feet. The formula by which torque may be determined is as follows:

$$T = \frac{N W C}{8.52 \times 10^8}$$

wherein N = the number of lines of force passing through the armature,
W = the number of conductors,
C = the current flowing through the armature.

The mechanical torque of a motor is expressed by the usual formula, $T = \frac{\text{H.P.} \times 33{,}000}{2 \times 3.1416 \times \text{R.P.M.}}$, and by reversing, $\text{H.P.} = \frac{T \times 2 \times 3.1416 \times \text{R.P.M.}}{33{,}000}$.

The prominent part that torque takes in hoisting service and its relation to horsepower may be explained in a simple manner as follows:

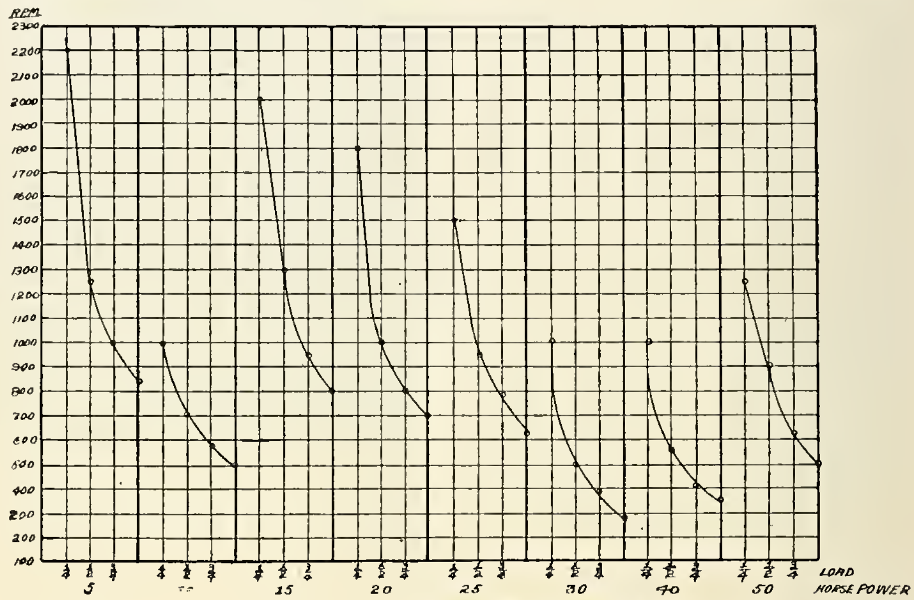
Assuming that the drum of a crane or hoist is to lift 10,000 pounds at a radius of one foot, it is evident that to start the load a torque of 10,000 pound-feet must be exerted. If, however, we introduce gearing between the drum and motor which is to furnish the motive power the torque becomes less at the motor, being proportionate to the ratio of gear reduction. If it is assumed that this ratio is 100—that is, that the motor shaft operates 100 turns to 1 on the drum, neglecting friction, the torque is $\frac{10{,}000}{100} = 100$ pound-feet.

The motor which is to operate this hoist must be capable of at least exerting this torque in order to start at all. The moment motion of the drum begins the rate of travel in feet per minute of the load multiplied by the weight of the load in pounds divided by 33,000 will give the horsepower. Figuring at the motor and assuming a motor speed of 1,000 revolutions per minute the horsepower required for the above would be

$$\frac{2 \times 3.1416 \times T \times \text{R.P.M.}}{550 \times 60} = 19.$$

Considering now the power required for starting, placing the time of acceleration at 15 seconds, this may be reasoned and determined as follows:

As the speed at the start is zero, the mean speed of the motor during the full period of starting is 500 revolutions per minute. The power required is therefore $\frac{2 \times 3.1416 \times 100 \times 500}{550 \times 15} = 38$ horsepower.



SPEED CURVES OF DIRECT-CURRENT SERIES CRANE MOTORS.

Assuming it within possibilities to maintain a maximum starting current, the value of this current may be determined as follows: $\frac{\text{H.P.} \times 746}{\text{mean voltage.}}$ If we take the effective voltage in this case as 200, we must remember that at the start it is zero. The mean would therefore be 100 and the current required would be $\frac{38 \times 746}{100} = 283.4$ amperes. As the current required at full speed is $\frac{19 \times 746}{200} = 70.7$, the starting current, according to the above determinations, is 400 per cent. in excess of the normal, which could not be permitted. Under usual conditions 100 per cent. current overload at starting is fairly safe, being in most cases within the possibilities of the average motor.

However, as previously stated, where crane or hoisting mechanism is employed for loading or unloading material—for instance, automatic buckets—the time required for starting is often an important matter, and, as pointed out in the foregoing, involves much more power during acceleration than after full speed has been attained, and in consequence a larger motor should be installed to do the work.

Notwithstanding that series motors have remarkable qualities for hoisting service, one pronounced characteristic is the ability of such motors to control their speed automatically, which at the time of starting means that they advance or delay the time period of acceleration. If the time period of acceleration be fixed it is apparent that a shunt motor would fulfill these conditions more perfectly. The speeds either during or after acceleration may be determined with greater certainty.

The constant-speed regulation of a shunt motor irrespective of the load is a desirable quality under conditions of maximum load; but the lack of self-speed regulation with the load makes it necessary to speed them up when the load is light or the crane is operating empty. This can be satisfactorily accomplished by the use of variable-speed motors and manual control.

RELATION BETWEEN SERIES AND SHUNT MOTORS.

The relation between shunt and series motors with reference to starting torque may now be analytically considered.

Assume, for simplicity, that we are dealing with motors of the bipolar form, one wound series and the other shunt, and both of the same mechanical and magnetic construction, with the principal points of electrical design as follows:

Current $C = 100$
Lines $N = 2{,}000{,}000$
Conductors $W = 200$
R. P. M. $= 1{,}500$.

To operate this motor at the stipulated speed will require a voltage of

$$\frac{2{,}000{,}000 \times 200 \times 1{,}500}{100{,}000{,}000 \times 60} = 100.$$

Applying the formula for torque, T is

$$\frac{2{,}000{,}000 \times 200 \times 100}{8.52 \times 10^8} = 47 \text{ pound-feet,}$$

or, by a simpler method, $T = \left(\frac{E}{R.P.S.}\right)\frac{C \times 1.41}{12}$,

which, by supplying the figures, is

$$\left(\frac{100}{25}\right)\frac{100 \times 1.41}{12} = \frac{4 \times 100 \times 1.41}{12} = 47.$$

The latter formula is more applicable in general practice, for the reason that, under average circumstances N and W are difficult to find without access to the engineering data of the machine. To make further determinations simple and practical, this formula will be used for torque. The torque of this motor at 100 amperes is, according to the determination just made, 47 pound-feet and the horsepower $\frac{100 \times 100}{746}$, or

$$\frac{2 \times 3.1416 \times 47 \times 1500}{550 \times 60} = 13.45.$$

As $\frac{\text{volts}}{R.P.S.} = 4$, the torque for full-load current flow $= \frac{4 \times 1.41 \times C}{12}$, and in the case of a shunt motor is directly proportional to the current.

Assuming at starting that it is possible without injury to the motor to admit 100 per cent. current overload, the torque would then be

$$\frac{4 \times 1.41 \times 200}{12} = 94 \text{ pound-feet.}$$

Before any exact comparison can be made with a series motor the full-load field saturation should be known. Assuming this to be 80,000 lines per square inch of field-core section, it will be observed that by doubling the full-load current about 20 per cent., increase in magnetism is all that results. For a series motor, therefore, the torque at 100 per cent. current over load may be determined as follows:

First, by ascertaining the speed in R.P.S., which is $\frac{100 \times 10^8}{2{,}400{,}000 \times 200} = 20.83$.

The torque equals

$$\left(\frac{100}{20.83}\right)\frac{200 \times 1.41}{12} = 113 \text{ pound-feet.}$$

As the torque of the same motor wound shunt is 94 pound-feet, the difference in favor of the series motor corresponds with the additional 20 per cent. increase of field strength. This slight additional field is readily obtained in a shunt motor by field control, or, so far as extra field at starting is concerned, a shunt motor can compete with the series type, but it must be by means of manual control.

In hoisting and crane duty more or less gearing between motor and the winding drum is necessary. In selecting this gearing to give the proper normal load speed of the drum, the speed curve of the motor should be consulted, if it be of the series type, and the gearing proportioned at the normal working load of the motor. This may be greatly under its rated capacity, depending upon the extra power required for acceleration.

Selecting the gearing in this way prevents in a measure undue high speeds at light loads; but more or less armature resistance, with its consequent loss, must, as a rule, be in circuit at the controller to curb the tendency to race. Now, considering the period during which acceleration takes place, for either a series or shunt motor, the latter being of the variable field, and consequently variable-speed, type, the shunt motor will perform at starting equally as well as the series motor. The increased torque and field strength at starting is effected by the controller. The speed after acceleration has ceased is governed without serious loss.

Variable-speed motors of the field varying class provide for independent commutation, and for brief periods, especially at the slowest speed, these commutating features provide for unlimited current overloads without sparking. This fact makes them especially suitable for periodic overloading, such being the conditions which exist in hoisting service.

Montevideo Electric Street Railway.

On November 19th, with much enthusiasm, the first electrically operated street-railway lines in Montevideo were put into service.

Montevideo, the capital of Uruguay, or, to give the latter its better known local title, the "Banda Oriental," is situated on the northern shores of the River Platte, near its mouth.

MONTEVIDEO ELECTRIC STREET RAILWAY.

At the present time the population of Montevideo exceeds 300,000. The streets, for the most part, are wide and fairly well paved, and the city being situated on a tongue of land between the bay and the River Platte, is pleasantly cool. The water, supplied by an English company, is copious in quantity and excellent in quality. The port works, long delayed, are now approaching a state in which they will be of great benefit to Montevideo in particular and the trade of the country in general. Altogether, if granted a succession of years of peace, Montevideo bids fair to become one of the most important places of the Western Hemisphere.

The first mule tramways in Montevideo were opened in the year 1868, 39 years ago. This was a short line, which has grown with the city, until there are now 150 miles of line, either electrified or in course of electrification. Ten years ago the Commercial Company applied to the authorities for authorization to reconstruct its lines on more modern principles, but the veto of the president, or rather the opposition of the municipality, frustrated every attempt. With the election of the present president, Mr. Battle y Ordonnez, a change came, and the long-wished-for concession was granted, the government stipulating that all the lines should be extended into more distant suburbs in order to facilitate the solution of the housing question, which in Montevideo, as in Buenos Aires, had become serious.

In the afternoon of November 19th some 400 guests were assembled at the power house when Dr. Williman, then minister of government, now president of the republic, switched the current on to the lines. Twelve cars then conveyed the party down through the crowded streets and out to the Pocitos Hotel, where a banquet prepared by the Commercial Company was awaiting the party. Among the guests were the minister of government, Dr. Claudio Williman; Mr. Juan Cat, the general manager of the Commercial Company; the minister of war, General Vazquez; the president of the Junta, Mr. Vidiella; the American minister, General O'Brien; the British minister, Mr. R. G. Kennedy, C. M. G.; Mr. A. N. Connett, chief engineer of J. G. White & Co.; Mr. C. C. Lewis, superintendent of construction of the same firm, and Mr. Harrison Jones, the engineer of the Commercial Company.

On the same evening Mr. Cat, the able manager of the Sociedad Commercial, gave a reception at the Pocitos Hotel, at which was present the elite of Montevidean society. On Wednesday evening a banquet was given by the contractors at the Uruguay Club to the leading men of Montevideo.

The Study of Men.

Choosing the title, "Study Men," John F. Hayford, C. E., inspector of geodetic work and chief of computing division, Coast and Geodetic Survey, Washington, D. C., delivered an instructive address at Commencement Day, June 14, 1907, at the Thomas S. Clarkson Memorial School of Technology, Potsdam, N. Y. Following are the concluding paragraphs:

"You have in your four-year course been studying material things, the facts of nature and the laws of nature. You have been acquiring that engineering knowledge, knowledge of the forces of nature and the strength and properties of materials, which is absolutely essential to your success as an engineer. You have studied men comparatively little. You have acquired your engineering knowledge largely through men and will continue to do so. The soundness of your engineering knowledge depends in part upon your knowledge of men; but what is still more important, the effectiveness with which you will use your engineering knowledge depends very intimately upon your knowledge of men. Hence, you are urged, as you do your part in the world, to study men as well as engineering. You are urged to pay attention to all phases of the men around you, to see and appreciate them as literary and artistic men, as well as technical men, as men of feeling, as well as men of thought, as incarnated motives as well as thinking and working machines.

"To attain to the highest success as an engineer you should not only be able to reach correct conclusions quickly when you have the facts before you for direct observation, you should also have the power to draw correct conclusions quickly from information which comes to you through other men. This power comes largely from knowing men.

"To attain to the highest success as an engineer you must not be the type of a man who knows how to do things excellently but cannot tell others how to do them—the man who gets knowledge abundantly but can apply it only through his own fingers. Instead of devoting your energy simply to increasing your own output by 50 or even 100 per cent., it is far better—you make yourself more useful to the world—by using your energy to increase the output of each of one hundred men by 10 per cent. The world recognizes this by awarding the prizes to the administrators."

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DEPARTMENTS.

DATES AHEAD.

National Electrical Contractors' Association (seventh annual convention), New York city, July 17th, 18th and 19th.

Illuminating Engineering Society (first annual convention), Boston, July 30th and 31st.

International Association of Municipal Electricians (twelfth annual convention), Norfolk, Va., August 7th to 9th.

Ohio Electric Light Association (annual convention), Toledo, August 20th to 22d.

Canadian Electrical Show, Power Building, Montreal, September 2d to 14th.

Central Electric Railway Association (regular meeting), Columbus, Ohio, September 26th.

American Street and Interurban Railway Association and affiliated societies (annual convention), Atlantic City, N. J., October 14th to 18th.

IN TIME, no doubt, all the suburban passenger traffic of the steam railroads doing business in Chicago will be carried by electric power. Perhaps, also, all long-haul trains will be electrically operated within the city limits. But progress in this direction seems to be slow, giving little more evidence of its existence than sporadic agitation in the newspapers or an occasional resolution in the City Council. Perhaps this delay is due to the fact that the railroads operate under state charters, the municipality being powerless to compel them to change their motive power without the sanction of the Legislature. In this situation a new plan, approved by the City Council at its most recent meeting, is of interest. The committee on state legislation is directed to prepare a bill empowering the state Railway and Warehouse Commission to compel the railroads to substitute electricity for steam in their suburban service in Chicago. It remains to be seen whether this action will have any practical effect.

ONE of the most interesting features of the recent Washington convention of the National Electric Light Association was the discussion of the so-called London sliding scale, by which, by an agreement between the state or municipality and a public-service corporation, the company is allowed to increase its dividends in proportion as it decreases its rates for service, starting with a certain predetermined base rate in each case. It was realized that this scale is difficult of application to the electric-light and power business, owing to the complications in rates of charging which the very nature of the central-station industry makes necessary. But it is recognized that the sliding scale, with its automatic—not arbitrary—adjustment of service rates and dividends and its obvious equity, has manifest points of advantage, appealing alike to the consumer and the company. Not a few of the central-station men were of opinion that it is worthy of serious study to discover whether it may not be practicable to apply it to the central-station business. One of these was Mr. Charles L. Edgar, president of the Boston Edison Company, and it is of considerable interest to observe that he has already made what amounts to a practical application of the principle involved. The company has declared an extra dividend of one per cent., and Mr. Edgar points out that while the bills of customers have been reduced substantially $200,000 by decreased prices during the year, the company is nevertheless able to pay the extra dividend, thus adopting, in a tentative way, the general principle of the sliding scale.

The London sliding scale is used considerably in the gas business in England and also by the Boston Gas Company. It may or may not become a feature of central-station practice in this country, for it is still a question whether rates varying with demand and hours of service can be adapted to it.

THE DECOMPOSITION of water into hydrogen and oxygen by the electric current has been known for more than a century, but it has been only recently that the cheap production of electrical energy upon a large scale has made this a commercial method for obtaining these industrially important gases. In Switzerland apparatus for the purpose has been designed and built in units capable of disassociating almost eighty pounds of water each hour.

One form of the arrangement for commercially producing hydrogen and oxygen consists of a number of iron plates separated by pads of asbestos cloth kept moist with a 10 per cent. solution of potash; plates and separators are held compactly under pressure. The current is passed through the whole pile of plates in series, and the two gases liberated at the surfaces are separately collected into reservoirs.

Hydrogen to the amount of 162 cubic feet and half as much oxygen (both gases at atmospheric pressure) are produced in an hour by the expenditure of 27½ kilowatts. This is the figure given for temperatures not exceeding 140° Fahrenheit, and it has been found that the rate of production shows a slight decrease for higher temperatures.

The voltage drop across a single cell varies from 2.3 to 2.7 volts. When the current is first turned on, until the gases have been generated in quantity sufficient to develop a counter or polarization electromotive force, there is encountered only the small internal resistance of the apparatus, so that a starting resistance must be inserted in the circuit to be gradually cut out as the current strength reduces to its normal value. It is also found advisable to regulate the number of plates or cells in the circuit by means of a switch similar to that used for end-cell regulation of batteries.

The gas products are said to be very pure as long as the device continues to operate steadily. The gases may be liberated at a pressure of four or five pounds. They are available for many purposes, and if it is true (which is the doubtful point) that the expense of production by this method is not prohibitive, this interesting form of electrical apparatus should have a considerable field of usefulness.

CHINA, or, more properly, the Chinese Empire, should offer for many years a widening field for the sale of American machinery and electrical and mechanical appliances. The trade of the United States with the Middle Kingdom has increased very satisfactorily for the last ten years, with the unfortunate exception of a drop from 76,000,000 taels value in 1905 to 44,400,000 taels in 1906. (The figures are from Chinese government sources.) However, this decrease is largely accounted for by a falling off in the Chinese import trade in cotton goods and in copper ingots. In copper alone the reduction was more than 21,000,000 taels, comparing 1905 and 1906, and most of the copper consumed in China is drawn from the United States. But although there was such a conspicuous decrease in 1906, there is consolation in the fact that the trade of the United States with China was larger in that year than in any other year except 1905.

A comparison of the figures of imports of China from the United States and from other principal countries during a considerable term of years shows that the gain of the United States has been more rapid than that of other principal countries, even when the figures of the unfavorable year of 1906 are used as the basis of comparison. Thus the percentage of gain in Chinese imports from the United States was 273 in the period from 1896 to 1906, while that of Japan was 251 per cent. and of the United Kingdom 77 per cent. The increase in all importations was 102 per cent. Apparently these percentages show that this country is getting its share of Chinese trade, but the trouble is that it started low, so that while its rate of increase is flattering the actual value of the imports is less than those from several other countries.

Unquestionably China is destined to play a much more conspicuous part in world-history in the future than in the past. It is "getting wise," in the speech of the street-boy. It will need railroads, factories, electric-light plants, telephones and all the comforts and conveniences of modern civilization. With its extensive area and dense population it will need these things in large quantities, as the awakening proceeds, and with its resources and frugal habits of living it will be able to pay for them. The Chinese are not stupid—far from it; many a keen intellect looks out through the almond-shaped eyes of the followers of Confucius. Ultimately they will build their own electrical plants and manufacture their own electrical machinery. But that period is still distant, and in the meantime the electrical manufacturers of the United States should use every effort to secure a large and increasing share of the Chinese trade.

It is not enough to fill the orders that come, to establish trading relations with some commission house in Canton or Shanghai; the Chinaman should be educated to use electrical appliances just as the American has been and is being so educated. China offers the richest field in the world's markets, when its possibilities are considered, and although some American electrical manufacturers are alive to the fact, a greater number, apparently, are not.

It may be that the time is coming in the home market when the capacity of producing electrical apparatus will exceed the demand, perhaps to a considerable extent. When that time comes the manufacturer who has judiciously worked up a trade in China will be in a fortunate position.

Revised Standardization Rules.[1]

DEFINITIONS AND TECHNICAL DATA.

1. The following definitions and classifications are intended to be practically descriptive and not scientifically rigid:

A. Definitions.—Currents.

2. A direct current is a unidirectional current.

3. A continuous current is a steady or non-pulsating direct current.

4. A pulsating current is a current equivalent to the superposition of an alternating current upon a continuous current.

5. An alternating current is a current which, when plotted, consists of half waves of equal area in successively opposite directions from the zero line.

6. An oscillating current is a current alternating in direction and of decreasing amplitude.

B. Definitions.—Rotating Machines.

7. A generator transforms mechanical power into electrical power.

8. A direct-current generator produces a direct current that may or may not be continuous.

9. An alternator or alternating-current generator produces alternating current either single-phase or polyphase.

10. A polyphase generator produces currents differing symmetrically in phase; such as two-phase currents, in which the terminal voltages on the two circuits differ in phase by 90 degrees; or three-phase currents, in which the terminal voltages on the three circuits differ in phase by 120 degrees.

11. A double-current generator produces both direct and alternating currents.

12. A motor transforms electrical into mechanical power.

13. A booster is a machine inserted in series in a circuit to change its voltage. It may be driven by an electric motor (in which case it is termed a motor booster) or otherwise.

14. A motor generator is a transforming device consisting of a motor mechanically connected to one or more generators.

15. A dynamotor is a transforming device combining both motor and generator action in one magnetic field, with two armatures, or with an armature having two separate windings and independent commutators.

16. A converter is a machine employing mechanical rotation in changing electrical energy from one form into another. A converter may belong to either of several types as follows:

17. a. A direct-current converter converts from a direct current to a direct current.

18. b. A synchronous converter (commonly called a rotary converter) converts from an alternating to a direct current, or vice versa.

19. c. A motor converter is a combination of an induction motor with a synchronous converter, the secondary of the former feeding the armature of the latter with current at some frequency other than the impressed frequency, i. e., it is a synchronous converter concatenated with an induction motor.

20. d. A frequency converter converts from an alternating-current system of one frequency to an alternating-current system of another frequency, with or without a change in the number of phases or in voltages.

21. e. A rotary phase converter converts from an alternating-current system of one or more phases to an alternating-current system of a different number of phases, but of the same frequency.

C. Definitions.—Stationary Induction Apparatus.

22. Stationary induction apparatus change electric energy to electric energy through the medium of magnetic energy. They comprise several forms, distinguished as follows:

23. a. In transformers the primary and secondary windings are insulated from one another.

24. b. In auto-transformers, also called compensators, a part of the primary winding is used as a secondary winding or conversely.

25. c. In potential regulators a coil is in shunt and a coil is in series with the circuit, so arranged that the ratio of transformation between them is variable at will. They are of the following three classes:

26. (a) Compensator potential regulators in which a number of turns of one of the coils are adjustable.

27. (b) Induction potential regulators in which the relative positions of the primary and secondary coils are adjustable.

28. (c) Magneto potential regulators in which the direction of the magnetic flux with respect to the coils is adjustable.

29. (d) Reactors, or reactance coils, formerly called choking coils, are a form of stationary induction apparatus used to produce reactance or phase displacement.

D. General Classification of Apparatus.

30. Commutating machines. Under this head may be classed the following: Direct-current generators; direct-current motors; direct-current boosters; motor generators; dynamotors; converters, compensators or balancers; closed-coil arc machines and alternating-current commutating motors.

31. Commutating machines may be further classified as follows:

32. a. Direct-current commutating machines, which comprise a magnetic field of constant polarity, a closed-coil armature and a multisegmental commutator connected therewith.

33. b. Alternating-current commutating machines, which comprise a magnetic field of alternating polarity, a closed-coil armature and a multisegmental commutator connected therewith.

34. c. Synchronous commutating machines, which comprise synchronous converters, motor converters and double-current generators.

35. Synchronous machines, which comprise a constant magnetic field and an armature receiving or delivering alternating currents in synchronism with the motion of the machine, i. e., having a frequency equal to the product of the number of pairs of poles and the speed of the machine in revolutions per second.

36. Stationary induction apparatus, which include transformers, auto-transformers, potential regulators and reactors or reactance coils.

37. Rotary induction apparatus, or induction machines, which include apparatus wherein the primary and secondary windings rotate with respect to each other, i. e., induction motors, induction generators, frequency converters and rotary phase converters.

38. Unipolar or acyclic machines, in which the voltage generated in the active conductors maintains the same direction with respect to those conductors.

39. Rectifying apparatus, pulsating-current generators.

40. Electrostatic apparatus, such as condensers, etc.

41. Electrochemical apparatus, such as batteries, etc.

42. Electrothermal apparatus, such as rheostats, heaters, etc.

43. Protective apparatus, such as fuses, lightning arresters, etc.

44. Luminous sources.

E. Motors.—Speed Classification.

45. Motors may for convenience be classified with reference to their speed characteristics as follows:

46. a. Constant-speed motors, in which the speed is either constant or does not materially vary, such as synchronous motors, induction motors with small slip and ordinary direct-current shunt motors.

47. b. Multispeed motors (two-speed, three-speed, etc.), which can be operated at any one of several distinct speeds, these speeds being practically independent of the load, such as motors with two armature windings.

48. c. Adjustable-speed motors, in which the speed can be varied gradually over a considerable range, but when once adjusted remains practically unaffected by the load, such as shunt motors designed for a considerable range of field variation.

49. d. Varying speed motors, or motors in which the speed varies with the load, decreasing when the load increases, such as series motors.

F. Definition and Explanation of Terms.

(I) *Load Factor.—*

50. The load factor of a machine, plant or system is the ratio of the average power to the maximum power during a certain period of time. The average power is taken over a certain interval of time, such as a day or a year, and the maximum is taken over a short interval of the maximum load within that interval.

51. In each case the interval of maximum load should be definitely specified. The proper interval is usually dependent upon local conditions and upon the purpose for which load factor is to be determined.

(II) *Non-inductive Load and Inductive Load.—*

52. A non-inductive load is a load in which the current is in phase with the voltage across the load.

53. An inductive load is a load in which the current lags behind the voltage across the load. A load in which the current leads the voltage across the load is sometimes called an anti-inductive load.

(III) *Power Factor and Reactive Factor.—*

54. The power factor in alternating-current circuits or apparatus is the ratio of the electric power in watts to the apparent power in volt amperes. It may be expressed as follows:

$$\frac{\text{true power}}{\text{apparent power}} = \frac{\text{watts}}{\text{volt-amperes}}$$
$$\frac{\text{energy current}}{\text{total current}} = \frac{\text{energy voltage}}{\text{total voltage}}$$

55. The reactive factor is the ratio of the wattless volt amperes (i. e., the product of the wattless component of current by voltage, or wattless component of voltage by current) to the total amperes. It may be expressed as follows:

$$\frac{\text{wattless volt-amperes}}{\text{total volt-amperes}} = \frac{\text{wattless current}}{\text{total current}} = \frac{\text{wattless voltage}}{\text{total voltage}}$$

56. Power factor and reactive factor are related as follows:

If p = power factor, q = reactive factor; then with sine waves of voltage and current,

$$p^2 + q^2 = 1$$

With distorted waves of voltage and current,

$$p^2 + q^2 = \text{or} < 1$$

(V) *Variation and Pulsation.—*

59. The variation in prime movers which do not give an absolutely uniform rate of rotation or speed, as in reciprocating steam engines, is the maximum angular displacement in position of the revolving member expressed in degrees from the position it would occupy with uniform rotation, and with one revolution taken as 360 degrees.

60. The pulsation in prime movers is the ratio of the difference between the maximum and minimum velocities in an engine cycle to the average velocity.

61. The variation in alternators or alternating-current circuits in general is the maximum difference in phase of the generated voltage wave from a wave of absolutely constant frequency expressed in electrical degrees (one cycle equals 360 degrees) and may be due to the variation of the prime mover.

62. The pulsation in alternators or alternating-current circuits, in general, is the ratio of the difference between maximum and minimum frequency during an engine cycle to the average frequency.

63. Relation of variation in prime mover and alternator.

64. If n = number of pairs of poles, the variation of an alternator is n times the variation of its prime mover if direct-connected, and n/p times the variation of the prime mover if rigidly connected thereto in the velocity ratio p.

PERFORMANCE, SPECIFICATIONS AND TESTS.

A. Rating.

65. Rating by Output.—All electrical apparatus should be rated by output and not by input. Generators, transformers, etc., should be rated by electrical output; motors by mechanical output.

66. Rating in Kilowatts.—Electrical power should be expressed in kilowatts, except when otherwise specified.

67. Apparent Power, Kilovolt-amperes.—Apparent power in alternating-current circuits should be expressed in kilovolt-amperes as distinguished from real power in kilowatts. When the power factor is 100 per cent., the apparent power in kilovolt-amperes is equal to the kilowatts.

68. The rated (full-load) current is that current which, with the rated terminal voltage, gives the rated kilowatts, or the rated kilovolt-amperes. In machines in which the rated voltage differs from the no-load voltage, the rated current should refer to the former.

69. Determination of Rated Current.—The rated current may be determined as follows: If P = rating in watts, or apparent watts if the power factor be other than 100 per cent., and E = full-load terminal voltage, the rated current per terminal is:

70. $I = \frac{P}{E}$ in a direct-current machine or single-phase alternator.

71. $I = \frac{1}{\sqrt{3}} \frac{P}{E}$ in a three-phase alternator.

72. $I = \frac{1}{2} \frac{P}{E}$ in a two-phase alternator.

73. Normal Conditions.—The rating of machines or apparatus should be based upon certain normal conditions to be assumed as standard, or to be specified. These conditions include voltage, current, power factor, frequency, wave shape and speed, or such of them as may apply in each particular case. Performance tests should be made under these standard conditions unless otherwise specified.

74. a. Power Factor.—Alternating-current apparatus should be rated in kilowatts, at 100 per cent. power factor, i. e., with current in phase with terminal voltage, unless a phase displacement is inherent in the apparatus or is specified. If a power factor other than 100 per cent. is specified, the rating should be expressed in kilovolt-amperes and

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1. At the convention of the American Institute of Electrical Engineers at Niagara Falls, N. Y., on June 27, 1907, the revised Standardization Rules of the Institute were adopted. These rules were prepared by a standardization committee consisting of Francis B. Crocker, chairman, Columbia University, New York, N. Y.; Arthur W. Berresford, Milwaukee, Wis.; Dugald C. Jackson, Boston, Mass.; Arthur E. Kennelly, Cambridge, Mass.; C. O. Mailloux, New York, N. Y.; Robert B. Owens, Montreal, Can.; Charles F. Scott, Pittsburg, Pa.; Henry G. Stott, New York, N. Y.; Charles P. Steinmetz, Schenectady, N. Y.; Samuel W. Stratton, Washington, D. C., and Elihu Thomson, Lynn, Mass. This strong committee held monthly meetings, beginning in September last. Its report is indeed valuable, representing the first systematic effort toward standardization in the electrical industry. The rules are too long to print entire in the Western Electrician, but extracts from them will be given. The general plan classifies the rules into five divisions—"Definitions and Technical Data," "Performance, Specifications and Tests," "Voltages and Frequencies," "General Recommendations" and "Appendices and Tabular Data." The present installment gives the first division nearly complete and part of the second. The original section numbers are retained. Further extracts will be given in a succeeding issue.

power factor at rated load.

75. b. Wave Shape.—In determining the rating of alternating-current machines or apparatus, a sine-wave shape of alternating current and voltage is assumed, except where a distorted wave shape is inherent to the apparatus. See Sections 79-83.

76. Fuses.—The rating of a fuse should be the maximum current which it will continuously carry.

77. Circuit Breakers.—The rating of a circuit-breaker should be the maximum current which it is designed to carry continuously.

78. a. Note.—In addition thereto the maximum current and voltage at which a fuse or a circuit-breaker will open the circuit should be specified. It is to be noted that the behavior of fuses and of circuit-breakers is much influenced by the amount of electric power available on the circuit.

B. Wave Shape.

79. The sine wave should be considered as standard, except where a difference in the wave form from the sinusoidal is inherent in the operation of the apparatus.

80. A maximum deviation of the wave from sinusoidal shape, not exceeding 10 per cent. is permissible, except when otherwise specified.

81. The deviation of wave form from the sinusoidal is measured by determining the form by oscillograph or wave meter, computing therefrom the equivalent sine wave of equal length, superposing the latter upon the observed wave in such a manner as to give least difference, and then dividing the maximum difference at any ordinate by the maximum value of the equivalent sine wave.

82. The equivalent sine wave is a sine wave having the same frequency and the same effective or r. m. s. (root of mean square) value as the actual wave.

83. Non-sine Waves.—The phase displacement between two waves which are not sine waves is that phase displacement between their equivalent sine waves which would give the same average product of instantaneous value as the actual waves, i. e., the same electro-dynamometer reading.

C. Efficiency.

(I) *Definitions.—*

84. The efficiency of an apparatus is the ratio of its net power output to its gross power input.

85. a. Note.—An exception should be noted in the case of storage batteries or apparatus for storing energy in which the efficiency, unless otherwise qualified, should be understood as the ratio of the energy output to the energy intake in a normal cycle. An exception should also be noted in the case of luminous sources.

86. Apparent Efficiency.—In apparatus in which a phase displacement is inherent to their operation, apparent efficiency should be understood as the ratio of net power output to volt-ampere input.

87. a. Note.—Such apparatus comprise induction motors, reactive synchronous converters, synchronous converters controlling the voltage of an alternating-current system, self-exciting synchronous motors, potential regulators and open magnetic circuit transformers, etc.

88. b. Note.—Since the apparent efficiency of apparatus delivering electric power depends upon the power factor of the load, the apparent efficiency, unless otherwise specified, should be referred to a load power factor of unity.

(II) *Determination of Efficiency.—*

89. Methods.—Efficiency may be determined by either of two methods, viz.: by measurement of input and output, or by measurement of losses.

90. a. Method of Input and Output.—The input and output may both be measured directly. The ratio of the latter to the former is the efficiency.

91. b. Method by Losses.—The losses may be measured either collectively or individually. The total losses may be added to the output to derive the input, or subtracted from the input to derive the output.

92. Comparison of Methods.—The output and input method is preferable with small machines. When, however, as in the case of large machines, it is impracticable to measure the output and input, or when the percentage of power loss is small and the efficiency is nearly unity, the method of determining efficiency by measuring the losses should be followed.

93. Electric power should be measured at the terminals of the apparatus. In tests of polyphase machines the measurement of power should not be confined to a single circuit but should be extended to all the circuits in order to avoid errors of unbalanced loading.

94. Mechanical power in machines should be measured at the pulley, gearing, coupling, etc., thus excluding the loss of power in said pulley, gearing or coupling, but including the bearing friction and windage. The magnitude of bearing friction and windage may be considered, with constant speed, as independent of the load. The loss of power in the belt and the increase of bearing friction due to belt tension should be excluded. Where, however, a machine is mounted upon the shaft of a prime mover in such a manner that it cannot be separated therefrom the frictional losses in bearings and in windage, which ought by definition to be included in determining the efficiency, should be excluded, owing to the practical impossibility of determining them satisfactorily.

95. In auxiliary apparatus, such as an exciter, the power lost in the auxiliary apparatus should not be charged to the principal machine, but to the plant consisting of principal machine and auxiliary apparatus taken together. The plant efficiency in such cases should be distinguished from the machine efficiency.

96. Normal Conditions.—Efficiency tests should be made under normal conditions herein set forth and which are to be assumed as standard. These conditions include voltage, current, power factor, frequency, wave shape, speed and barometric pressure temperature, or such of them as may apply in each particular case. Performannce tests should be made under these standard conditions unless otherwise specified. See Sections 73-75.

97. a. Temperature.—The efficiency of all apparatus, except such as may be intended for intermittent service, should be either measured at, or reduced to, the temperature which the apparatus assumes under continuous operation at rated load, referred to a room temperature of 25° C.

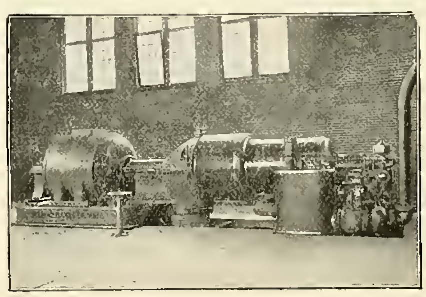
98. With apparatus intended for intermittent service, the efficiency should be determined at the temperature assumed under specified conditions.

99. b. Power Factor.—In determining the efficiency of alternating-current apparatus the electric power should be measured when the current is in phase with the voltage, unless otherwise specified, except when a definite phase difference is inherent in the apparatus, as in induction motors, induction generators, frequency converters, etc.

100. c. Wave Shape.—In electrical apparatus the sine wave should be considered as standard, except where a difference in the wave form from the sinusoidal is inherent in the operation of the apparatus. See Sections 79-83.

Textile Mills at Lawrence, Mass., to be Equipped with Steam Turbines

One of the fields of manufacturing into which steam turbines have been successfully introduced is that of the textile industry, where the operation



1000-KILOWATT TURBINE AND GENERATOR IN A MASSACHUSETTS TEXTILE MILL.

of this type of prime mover offers a number of advantages. In the erection of their new power plant at Lawrence, Mass., the Pacific Mills, which rank among the largest and best-known establishments of this character in the country, have had designed by Charles T. Main, mill engineer and architect of Boston, an equipment which will be in every respect a model of its kind.

Primarily, this is to consist of three Allis-Chalmers steam turbines operating condensing at 1,800 revolutions per minute, direct-connected to three-phase 60-cycle alternating-current generators, of the same company's design and build, which have a rated capacity of 3,300 horsepower. In addition there will be a 75-kilowatt engine-driven generator with belted exciter for night lighting, two exciters for the main generating units, and various auxiliary apparatus.

The steam-generating equipment consists of 12 72-inch boilers, built by the Bigelow Company of New Haven, Conn. These are to be installed in batteries of four. Steam will be supplied to the turbines at 150 pounds pressure and superheated 125° F. by Foster superheaters. Natural draft will be provided for the furnaces through a stack 9½ feet in diameter and 200 feet in height. No forced draft will be needed. When the plant is finally extended to the full capacity of 10,000 horsepower, which it has been laid out for, another large chimney will be erected on foundations already built for it.

The arrangements for handling coal at the plant are thoroughly up-to-date. By means of a spur track from the railroad coal will be brought directly to the storage bins, whence it will be lifted by clam-shell hoists, electrically driven, and taken directly to the furnaces as needed.

At the outset the power generated at the new plant will be used principally to supply what is known as the Upper Mill, but provision is being made for the extensive application of electric motor drive throughout the entire establishment, divided as follows: Yarn Mill, 1,500 horsepower; Upper Mill, 3,000 horsepower; Lower Mill, 3,000 horsepower, and New Mill, 3,000 horsepower.

The power plant will comprise three distinct parts, viz., a two-story generator room, a one-story boiler house, and a coal-storage house. In the accompanying illustration is shown one of the 1,000-kilowatt turbine and generator units. The Pacific Mills were incorporated under the laws of Massachusetts, with a capital stock of $3,000,000, and are very extensively engaged in the manufacture of cotton and woolen goods. Arthur T. Lyman is president.

New York State Conventions.

The twenty-fifth annual convention of the Street Railway Association of the State of New York, at Lake Champlain, N. Y., opened Tuesday, June 25th, with an address by the president, J. N. Shannahan of the Fonda, Johnstown and Gloversville Railroad Company. A number of members joined in the discussion of the live topics of the job-order system and New York shop practice. Wednesday's session was occupied in reading the papers assigned on the programme and in electing the following-named officers for next year: President, Thomas W. Wilson, International Railway Company; first vice-president, E. S. Fassett, United Traction Company; second vice-president, E. F. Peck, Schenectady Railway Company; treasurer, H. M. Beardley, Elmira Water, Light and Railroad Company; secretary, J. H. Pardee of J. G. White & Co.; executive committee, C. Loomis Allen, Utica and Mohawk Valley Railway Company; C. Gordon Reel, Kingston Consolidated Railroad; W. S. Darbee, Albany and Hudson Railroad Company; J. C. Calisck, Buffalo and Lake Erie Traction Company.

On Thursday, June 27th, the convention meeting place was occupied by the Empire State Gas and Electric Association to consider the relationship of the traction and lighting interests to the new Public Utilities law. There was a good attendance, and, in the absence of President Palmer, Mr. T. R. Beal presided. The sentiment of the meeting seemed to be that the companies in allied fields must work together, possibly through some joint organization, for, without concerted action, bad measures have slipped through in the legislation at Albany. Many regard the new law as unduly harsh and drastic.

Several papers were read and discussed briefly.

Telegraph Strike Settlement Hoped For.

The telegraphers' strike, which still affects only San Francisco and Oakland, is not very strenuous at present, although it is hinted in union quarters that if the companies do not capitulate soon a strike will be called in other cities. Sacramento, Los Angeles, Portland, Seattle and Chicago have been mentioned as such cities. Manager O'Brien of the Western Union in San Francisco says that he had 14 branch offices open last week, with a force of operators and that the remaining four will be open this week. He says that the value of the business is almost equal to that handled before the strike. W. S. Storror, general superintendent of the Pacific Postal Telegraph-cable Company, is quoted as saying that on several days last week the company sent and received as many messages as on an average day before the strike.

In the hope that they will be able to effect a settlement of the strike in San Francisco and Oakland, United States Commissioner of Labor Neill and M. J. Reidy, J. M. Sullivan and S. J. Konenkamp, members of the international executive board of the telegraphers' union, left on Monday for San Francisco.

Coupled with the new move came the announcement from New York that Attorney-general William S. Jackson made application early this week to Justice Platzek of the Supreme Court of New York County for the appointment of a referee to take testimony on the attorney-general's allegation that the Postal and Western Union Telegraph companies have formed a combination to increase rates of telegraph service in New York and other states.

COMMUNICATION.

Current Strength of Lightning Discharges.

To the Editor of the Western Electrician:

I believe that in most cases when lightning strikes the earth, or the discharge is between the earth and the clouds, there is a great quantity of electricity manifest. I have reason to believe that the discharge through the lower atmosphere breaks down the resistance of the same and allows the rush of a great quantity of positive electricity from the higher altitudes to the earth, similar to the coherer action in a wireless receiver circuit.

I saw a thriving locust tree near here that was struck by lightning and burned nearly to the ground during a thunderstorm. If one watches the discharges of a thunderstorm at night that go to the earth he can almost tell that there are great quantities of electricity manifest.

J. Holmes Wilson.

Carlisle, Pa., June 29, 1907.

The adjourned annual meeting of the Chicago Edison Company will be held on July 15th.

ELEMENTS OF ELECTRICAL ENGINEERING.

By Geo. R. Metcalfe.

XXIV. Central Stations.

Condensers.

In most large generating plants the engines are run condensing; that is to say, they are connected to an apparatus by means of which exhaust steam is condensed after passing through the engine, and as the exhaust piping system is not open to the atmosphere, but is tightly sealed against leakage of air, the steam being condensed produces a vacuum, which has the effect of increasing the steam pressure on the piston by an amount equal to the loss of pressure in the exhaust piping.

The degree of vacuum produced in the exhaust system varies according to the style of condenser used, and the amount and temperature of the cooling water. A practically perfect vacuum would be represented by the height to which a column of mercury would be raised, which is approximately 30 inches. In ordinary central-station practice a vacuum from 24 to 27 inches is usually maintained.

Condensers are built in numerous styles, but the two most commonly used types are known as surface condensers and jet condensers. The surface condenser collects the exhaust steam in a chamber which is surrounded by running water, which condenses the steam. In the jet condenser the steam is condensed by having a spray of water forced into the condenser itself, so that the cooling water is mixed with the condensed steam.

Either of these types of condensers will operate with practically the same efficiency, and the choice between them is usually determined by the amount and quality of the cooling water available. The surface condenser requires the use of very much more cooling water than the jet condenser, but it leaves the pure condensed steam at a high temperature available for boiler-feed water.

If the natural supply of water is impure but plentiful, a surface condenser should unquestionably be chosen. On the other hand, the jet condenser requires a much smaller supply of cooling water, and if the water supply of the station is paid for on a meter basis, the jet condenser would probably be chosen, although in the case of impure or very hard water, it might be found preferable to use the surface condenser, even with water supplied on a meter basis, and to provide some cooling arrangement, whereby the condensing water could be cooled and used repeatedly.

Devices for cooling condensing water are quite numerous, and generally consist of either long tables, one above the other, over which the water flows until it becomes relatively cool, or towers in which the condensing water is pumped to the top and is cooled by being broken up into a spray on falling by means of currents of air from blowers.

There are a number of other types of condensers on the market, some of which possess considerable merit; but the selection of condensers in any particular case must be decided by the amount, quality and cost of the water supply. For any given plant, such questions as whether the engines should be simple or compound, or run condensing or non-condensing, must be decided by the local conditions, among which the cost of fuel and the water supply are the leading factors.

Steam Turbines.

Within the last four or five years great strides have been made in the development of the steam turbine, and today this machine is very largely replacing reciprocating engines in central-station work. One of the most noticeable features of the steam turbine is its relatively small size, compared with reciprocating engines of similar capacity. In machines of large capacity, the steam turbine does not occupy more than one-third or one-fourth of the floor space required for horizontal reciprocating engines, and this leads at once to very apparent economy, namely, the reduction in floor space required, and a corresponding reduction in the size of the plant.

Aside from the question of size, however, there are several further advantages claimed for the steam turbine, among which may be mentioned uniform angular velocity of rotation, simplicity of operation, high steam economy at all loads and with widely fluctuating loads, and adaptability to high steam pressures and to superheated steam without the difficulties which these would introduce in the case of a reciprocating engine.

One noticeable characteristic of the steam turbine is its very high speed in comparison with the speed of reciprocating engines, and this high speed, as has previously been mentioned, has considerably reduced the size and weight of generators driven by steam turbines. Owing to these high speeds, turbine-driven generators are almost invariably direct-connected to the turbine shaft, as belt driving would become very difficult, if not impossible, at such speeds.

In many of the large turbo-generator units the speed and inertia of the moving parts is so great that the machines will continue to revolve for four or five hours after the load has been thrown off and the steam shut off of the turbine. There are several makes of turbines on the market which differ considerably in detail, but a general feature of all of them is a revolving wheel having blades or buckets, against which the steam impinges and turns the rotating part, either by impact or by expansion of the steam, or both. The rotating and stationary disks do not touch at any part; but have sufficient clearance between them for mechanical safety, and therefore the friction is confined entirely to the bearings.

The DeLaval turbine is one of the oldest machines of this type and consists of steam nozzles through which the steam passes to a row of vanes around the periphery of the rotating part. This design produces machines of extremely high speed, so that countershafts and special gears are required to reduce the speed to practical working rates.

The Parsons turbine consists of two principal parts, a stationary and a rotating part, each of which contains a number of elements. These elements consist of rings of blades, the blades being securely fastened to both the stationary and rotating part. The blades on the stationary part direct the current of steam against the movable blades, while the latter convert the energy of the steam into a movement of rotation, producing work. The work produced is thus due to the reaction of the steam on the movable blades.

The rotating drums which carry the rows of blades are mounted on a substantial steel shaft, and these drums are arranged in three groups, each group being larger than the preceding one, so as to allow for the expansion of the steam in passing through the machine. While the stationary and moving parts fit close together, there is no mechanical contact, so that the entire friction of the machine, except the friction of steam upon the blades, is confined to the bearings.

In this turbine the steam is taken in successive puffs instead of in a continuous stream, and the speed is regulated by a governor which controls the supply of steam through the main admission valve. At full load the admission valve remains open practically all the time, while at light loads it opens at quick intervals, and in case of overloads an auxiliary valve is brought into action which admits steam at boiler pressure to the second stage of the turbine.

The bearings consist of several concentric bronze sleeves between which films of oil are formed by means of capillary attraction. The lubricating system consists of a closed circuit, the oil being raised by a pump, operated from a worm gear on the turbine shaft, to an oil cooler, from which it passes to the bearings, and thence to a reservoir. The effect of this style of bearing and lubrication is that the weight of the rotating part is always carried upon the film of oil.

The Curtis turbine consists of alternate rings of moving and stationary blades and is divided into several stages, each stage being supplied with steam from sets of expansion nozzles. The machine being divided into several stages, thus makes the steam velocity at each of the successive nozzles less and less, and the division of the pressure between the different stages is proportioned so as to utilize the energy of expansion from the steam to the greatest degree.

Most of the large-size machines of this type are built with vertical shafts, and this has necessitated the use of a special step bearing to carry the weight of the rotating parts of both the steam turbine and the generator which is connected to it. The step bearing consists of cast-iron plates with a recess between them into which the oil is forced under pressure by means of a pump. The lubricating fluid must, of course, be forced between the revolving parts under sufficient pressure to keep them separated, and carry the revolving part upon the film of oil. Interruption to the supply of lubricating fluid, would, of course, permit the bearing to heat up and wear away rapidly. In these turbines the speed is regulated by the centrifugal governor, which automatically opens and closes the nozzle supplying the first stage of the machine with steam.

One of the most important features in any type of turbine is to secure perfect balance of the rotating parts. The effect of an unbalanced rotor operating at such extreme speeds can readily be imagined. Any unbalancing not only introduces serious difficulties in the bearings, but would be liable to burst the machine, owing to its high centrifugal force. From the nature of the construction, however, it is comparatively easy to attain a practically perfect balance.

It has been found that while fairly small clearance between moving parts is desirable, that nothing is gained by reducing the clearance beyond a certain degree. If, on the other hand, the clearance becomes too great, the effect will be noticed in the efficiency of operation. The friction of the steam against the blades has been found to wear away the material of the blades to considerable extent, and this wear on the buckets is more noticeable in the case of wet steam than with dry steam. Therefore, the use of superheated steam is of additional advantage in preventing undue wear of the buckets. The blades in almost all turbines, however, are arranged so that they can be easily replaced in case they become worn and broken.

[*To be continued.*]

Note.—This series of articles, intended to survey, briefly, the whole field of applied electricity for light, power and heat, was begun in the Western Electrician of February 2, 1907.

QUESTIONS AND ANSWERS.

Battery Charging.

S. R., Virginia, Minn.: To charge a certain battery the instructions call for 110 volts, with three amperes of current. Could it also be charged from a 220-volt circuit at 1.5 amperes?

Answer.

If a 220-volt circuit is to be used instead of one operating at 110 volts, as called for in the instructions, it will be necessary to insert sufficient resistance in circuit to take up the difference in voltages, that is, 220 — 110, or 110 volts. With three amperes current flowing this would mean, by Ohm's law, $R = \frac{E}{I} = \frac{110}{3} = 36\frac{2}{3}$ ohms. This could be obtained by using six 110-volt 16-candlepower lamps, these six lamps being arranged in parallel with respect to each other, the whole set then being placed in the charging circuit. Of course the three amperes will be required for charging, not 1.5 amperes.

Polarity of a Horseshoe Magnet.

J. J. R., Chicago, says that by putting a horseshoe magnet through a coil for the purpose of magnetizing it he caused it to show two south poles and a north pole at the bend. He desires an explanation of the phenomenon.

Answer.

This sort of magnetization would be produced if the horseshoe magnet was put through a coil of wire in which a direct current was flowing in such a manner that the coil encircled the whole magnet. With such an arrangement the two ends projecting from one side of the coil would have similar polarity, and the bend, projecting from the other, would have the opposite polarity.

In order to magnetize the horseshoe so that its legs shall be of opposite polarity (the usual condition) a small coil should be slipped on one leg and a current passed through the coil. A coil on the other leg wound in the opposite direction will reinforce the magnetizing power of the one coil.

A horseshoe magnet having such polarity as the inquirer describes is uncommon, because it is not a useful form of magnet and does not hold its magnetism so well as the horseshoe shape having opposite poles close together. This shape permits of a keeper being placed across the poles to preserve the magnetism. The tractive force on this keeper is the greatest that can be obtained with the magnet.

It is also stated in the inquiry that the south poles of the magnet attract the two poles of a compass, but will, however, attract the north pole much more readily. The reason for the south pole of the magnet attracting the south pole of the compass is that the magnet has a magnetic field strong enough to temporarily remagnetize the needle of the compass in a reverse direction.

This is the same principle which enables one to string a row of nails end to end hanging from a powerful magnet; each nail has an induced magnetism while it is in the big magnet's field and becomes a magnet itself.

If the compass needle had a stronger magnet it would not be overcome, but would be repelled when its south pole was presented to the south pole of the magnet.

Telephone Repeating Coil.

E. G. A., Mescalero, N. M.: How is a telephone repeating coil wound? Is it the same as a transformer? If so, in what proportion are the wires of each side? Does it make any difference on which side the grounded line or the metallic line is connected?

Answer.

A telephone repeating coil for the purpose evidently in view is wound with the turns in a ratio of one to one. It is identical in principle with the transformer. Either winding may be connected to the metallic or to the grounded line.

More Abbreviations.

G. D., Cleveland: Kindly tell us in your "Questions and Answers" column what "G. I." stands for in the name Stanley-G. I., and what do the letters I. T. E. stand for used in connection with the name for certain circuit-breakers?

Answer.

Since the General Incandescent Arc Light Company combined with the Stanley company the former's name appears abbreviated in the present corporate name, Stanley-G. I. Electric Manufacturing Company.

I. T. E., or "inverse time element," is a trade name referring to the feature of the quicker operation of a type of circuit-breakers when subjected to greater overloads; i. e., the time element varies inversely as the current.

Calculation of Wire for Transmission Line.

B. F. H., Junction City, Ore., wishes to run a line 10 miles to carry the current from a 50-kilowatt single-phase generator at 10,000 volts, and asks if a No. 10 bare copper wire would be large enough to carry the current. Also how much extra horsepower would be required to transmit the current the 10 miles.

Answer.

Assuming that the circuit will consist of the two No. 10 wires, 20 miles in all, and a step-down transformer with a 10,000-volt primary, there would be a current of about six amperes flowing when the power delivered was about 50 kilowatts. This current would be carried easily by a No. 10 wire.

The factor which is most important in determining the size of wire to use is the voltage loss in the line, which the company is willing to allow. With No. 10 wire and six amperes flowing the voltage loss would be about 5.3 per cent.; that is, the voltage would have to be 10,530 at the generator in order to be 10,000 volts at the transformer.

Let us assume some probable data and figure out actual conditions. Assume

10,500 volts generated.

10 miles of No. 10 open wire = 106 ohms.

1,200 ohms = resistance (R) of transformer.

900 ohms = reactance of transformer for a lamp and motor load of 50 kilowatts.

The current in the line = I.

Find the kilowatt input at the generator.

Find the kilowatts delivered at the transformer.

The current in the line under these conditions would be 10,500 divided by the impedance.

$$\text{Impedance} = \sqrt{(106 + 1{,}200)^2 + (900)^2} = 1{,}581$$

$$I = \frac{10{,}500}{1{,}581} = 6.62 \text{ amperes.}$$

The voltage (E) at the transformer would be $E = 6.62\ \sqrt{(1{,}200)^2 + (900)^2} = 9{,}940$. The kilowatts delivered by the generator would be

$$\frac{10{,}500 \times 6.62}{1{,}000} \times \text{the power factor.}$$

$$\text{The power factor} = \frac{106 + 1{,}200}{1{,}581} = .828.$$

$$\text{K. W.} = \frac{10{,}500 \times 6.62 \times .828}{1{,}000} = 57.2.$$

The kilowatts delivered at the transformer would be $I \times I \times R$.

$$I^2R = 6.62 \times 6.62 \times 1{,}200 = 52.56 \text{ kilowatts.}$$

This figure is somewhat above the 50 kilowatts demanded at the end of the line, but that is because the figures assumed for the problem are a little high.

To deliver, therefore, 52.56 kilowatts (at 9,940 volts) it would require 57.2 kilowatts (at 10,500 volts) at the generator.

The Installation and Operation of Alternating-current Generators.

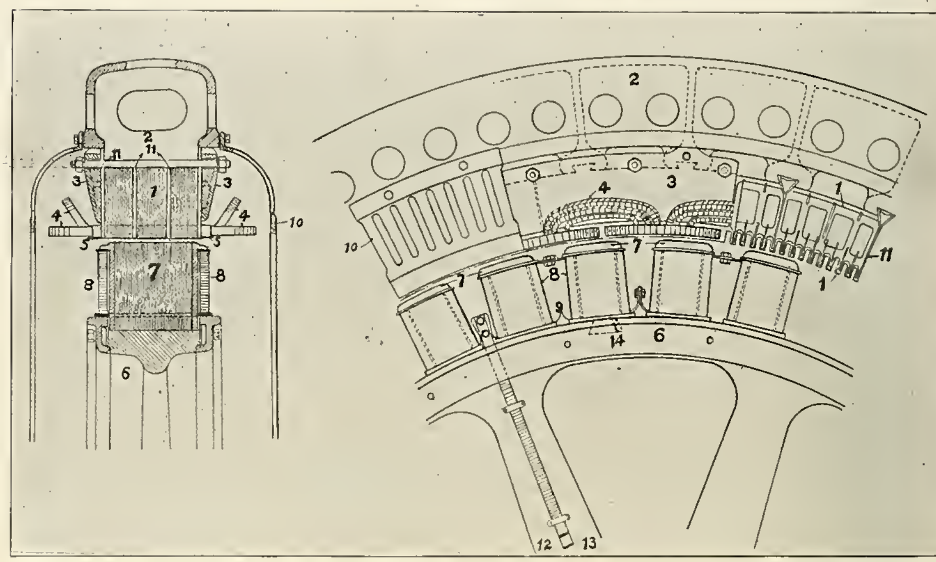
Part I.—Installation.

Engineers in charge of power stations, as well as students of electrical engineering, will be interested to read the instructions for installing and operating alternating-current generators recently prepared by Allis-Chalmers Company of Milwaukee, which contain much useful information and are, therefore, reproduced in part herewith.

At the outset it may be stated that all of the generators built by that company belong to the revolving-field class, having the armature, or part in which the current is induced, stationary. They are made in five types designed as "belted," "water-wheel," "engine," "flywheel" and "turbo," the last-named being for direct connection to steam turbines.

All the coils are of the same shape, and each side occupies only half a slot, one side lying in the upper part of one slot and the other in the lower part of another slot. The field coils of all except some of the smaller machines are of bare copper strip, wound on edge, with adjacent turns separated by tough insulating paper. In some small machines it is necessary to wind the field coils with square copper wire in order to admit of excitation at 120 volts.

The location of the generator is usually fixed beforehand by the position it must occupy relative to the engine or shafting. There is, therefore, little choice as to this, but it is always desirable to install alternators, or, in fact, any electrical machinery, in a clean, dry place where there will be plenty of light and room. Good ventilation is important, since the better the ventilation the lower will be the operating temperatures of the machine. There should not be any combustible material near the alternator, and the location should provide for sufficient headroom to permit taking the machine apart if necessary.



1. Armature core. 2. Stator yoke. 3. Armature end head. 4. Armature coil. 5. Armature coil stick. 6. Field spider. 7. Field pole. 8. Field coil. 9. Pole collar. 10. Winding shield. 11. Ventilating duct. 12. Field connection. 13. Field connections. 14. Pole keys.

FIG. 1. DETAILS OF ALLIS CHALMERS ALTERNATOR.

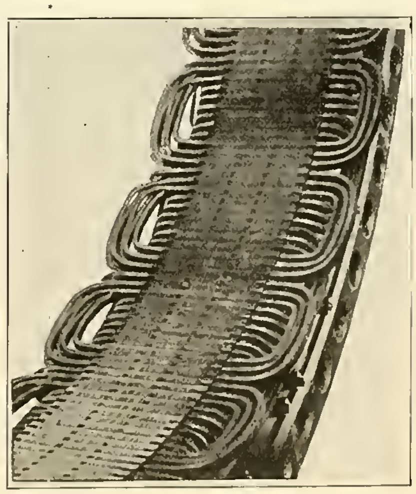


FIG. 2. CHAIN WINDING OF ALTERNATOR.

The mechanical construction varies to some extent with the size and type of generator, so that it is not practicable to give a description that will apply to all these machines. In most cases, however, the general arrangement is as shown in Fig. 1, which explains itself. The method of arranging the coils and interconnecting them varies with the number of phases for which the machine is built, the voltage, etc.

Fig. 2 shows a portion of the winding for a three-phase machine with coils arranged the same as in Fig. 1. For lower-voltage machines, where it is not necessary to have such high insulation, the winding is frequently of the two-layer type shown in Fig. 3.

The foundation on which an alternator rests should be firm and substantial, in order to prevent vibration and secure smooth running. Small-belted machines below 100 kilowatts can, if necessary, be set on heavy timber supports, but a concrete or brick foundation is recommended whenever possible. All machines above 100 kilowatts must be provided with concrete, brick or masonry foundation, concrete being the most suitable. Concrete for this purpose can be made in the following proportions: Sharp sand, 2 parts; broken stone, 4 to 5 parts; Portland cement, 1 part; all parts by bulk.

The foundation should be heavy enough to secure freedom from vibration, and in building it provision should be made for foundation bolts to hold the base, rails or sole plates of the machines. In making the foundation, place iron pipes in the approximate locations that the foundation bolts will occupy, using pipe having an inside diameter of at least two inches larger than the foundation bolts, to allow adjustment. Pockets should also be arranged in

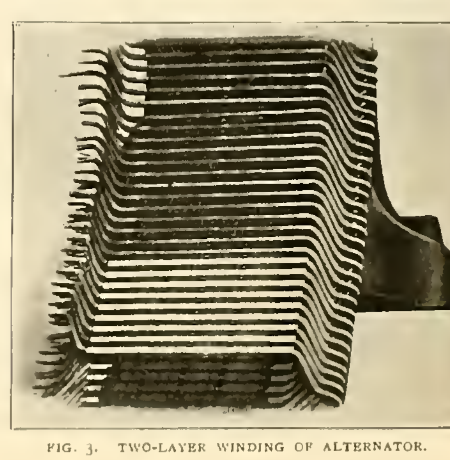


FIG. 3. TWO-LAYER WINDING OF ALTERNATOR.

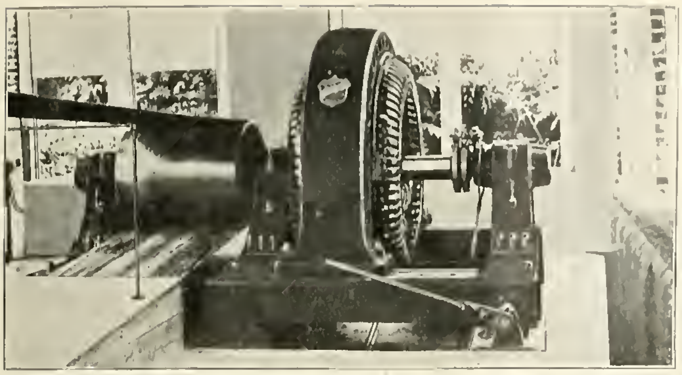


FIG. 4. BELTED ALTERNATOR WITH DEVICE TO COLLECT STATIC ELECTRICTY.

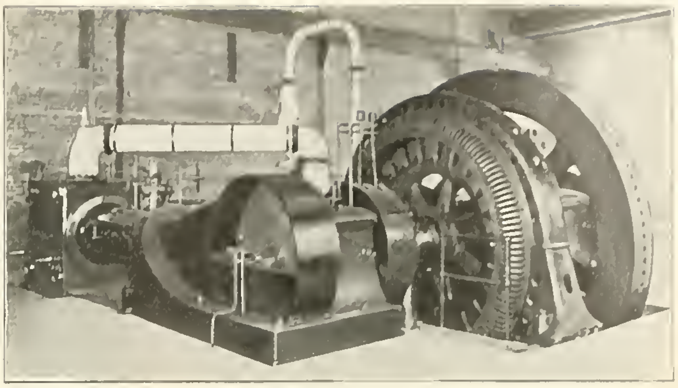


FIG. 6. ALTERNATOR DIRECT-CONNECTED TO HORIZONTAL ENGINE.

the foundation to give access to the anchor plates and bottom nuts on the foundation bolts. After the alternator has been permanently located, thin cement should be run into the pipes, thus fixing the bolts accurately in position. Foundation bolts should be located by templates made from outline prints of the machine. The top of the foundation should be leveled off as accurately as possible and cement allowed sufficient time to set before the machine is placed in position.

The National Board of Fire Underwriters favors the insulation of generators from the ground wherever it is feasible. Such insulation is generally provided by a substantial wooden frame or wooden stringers under the rails, the wood being well filled and varnished to prevent absorption of moisture. This is practicable with small-belted generators, but with heavy machines or those direct connected to steam engines or waterwheels complete insulation from the ground is practically impossible, and it is better to ground the frame positively by means of a heavy copper wire connecting the frame from a water pipe or other convenient ground. In other words, the frame of a machine should either be thoroughly insulated or thoroughly grounded, so that there will be no doubt about its condition.

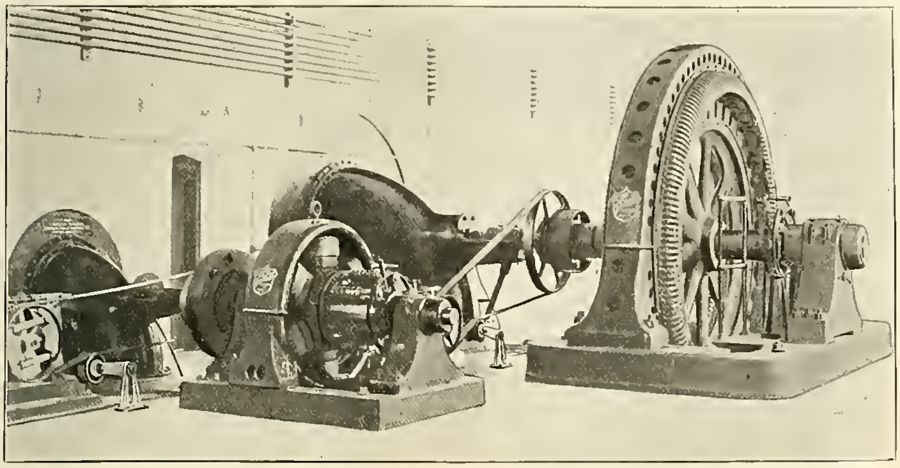


FIG. 5. ALTERNATOR OF WATERWHEEL TYPE.

With belted machines static electricity is frequently generated by the belt, thus charging the frame of the machine if the latter is thoroughly insulated from ground. This static electricity is generally removed by arranging a comb or series of metal points close under the belt and connecting them to the ground. The points can be easily supported on iron pipe, as shown in Fig. 4.

The generators must be thoroughly protected against lightning and high potentials due to static electricity. The lines should be equipped with lightning arresters, and in cases where high potential static electricity is liable to accumulate, dischargers should be provided to carry it off.

Setting up Belted Machines.

1. The rails should be placed in position, approximately leveled, and wedged up so that the weight of the machine will be distributed evenly.

2. If the alternator is small and comes completely assembled, it can now be set on the rails, carefully leveled and lined up with the driving pulley.

3. If the machine is of large size and shipped in two or more parts, place the base on the rails and set the stator in position, first making sure that the planed surfaces on the base and feet of the stator are perfectly clean and oiled to prevent rust. Most of the larger belted machines are arranged so that the stator can be shifted to one side to give access to the field and armature coils, and when the stator is first set on the case it is advisable to locate it so that it will be to one side of the field when the latter is placed in position. All bearing surfaces should be thoroughly cleaned before the shaft is placed in the bearings; if there are any rough or rusty spots on the journals they should be removed with crocus cloth. See that the oil wells are thoroughly clean. When placing the rotor in position watch the oil rings carefully to see that they do not get jammed and bent out of shape. After the rotor has been placed, put the caps of the bearing pedestals in position and bolt down firmly. The stator can now be slid into position over the rotor and bolted in place; if there are any dowel pins in the feet of the stator, see that they are in place before the cap bolts are screwed down. Fill the bearings with a good quality of mineral oil to the proper height as indicated by the oil gauge.

4. Put the pulley on the shaft and line the whole machine up with the driving pulley. If possible run the machine with a rather slack belt and adjust the alignment while running so that the belt runs on the center of the pulley and allows the rotor to oscillate freely in its bearings.

5. Tighten down the foundation bolts and "grout" the rails by making a thin, easy-flowing mixture of one part of Portland cement and one part of sand, together with sufficient water, and pouring it under and around the rails. Small clay dams can be used to keep the thin cement in place until it hardens. When the cement is partly set the surplus can be removed and the joint under the rails smoothed up.

Waterwheel-type Machines.

The foregoing directions regarding belted machines apply for the most part to waterwheel alternators also (see Fig. 5), except that the latter have no rails and the base is set directly on the foundation. In this case the machine must be lined up accurately with reference to the waterwheel so that the halves of the flange coupling will fit exactly. After lining up by means of wedges under the base, the foundation bolts should be tightened and the base well grouted in. Use plenty of wedges and place them under both inside and outside edges of the base, so as to give a firm and even support. In some cases where the waterwheel alternators are of large diameter and run at low speed no base is provided. The stator and bearing pedestals rest on sole plates bolted to the foundation in the same manner as described below for engine-type alternators.

Engine-type Machines.

With engine-type alternators (Fig. 6) the stator yoke either rests on an extension of the engine bed, as with some of the smaller machines coupled to high-speed engines, or on sole plates set on suitable foundations. The stator sole plates are made in two parts, the lower one being bolted to the foundation, while the upper plate is adjustable to facilitate centering the stator with respect to the field.

1. Locate the sole plates temporarily in position and support them on iron wedges to allow for further adjustment.

2. Place the lower half of the stator in position and level it approximately by means of the leveling screws in the upper part of the sole plate. In case the stator is arranged to shift sideways on the

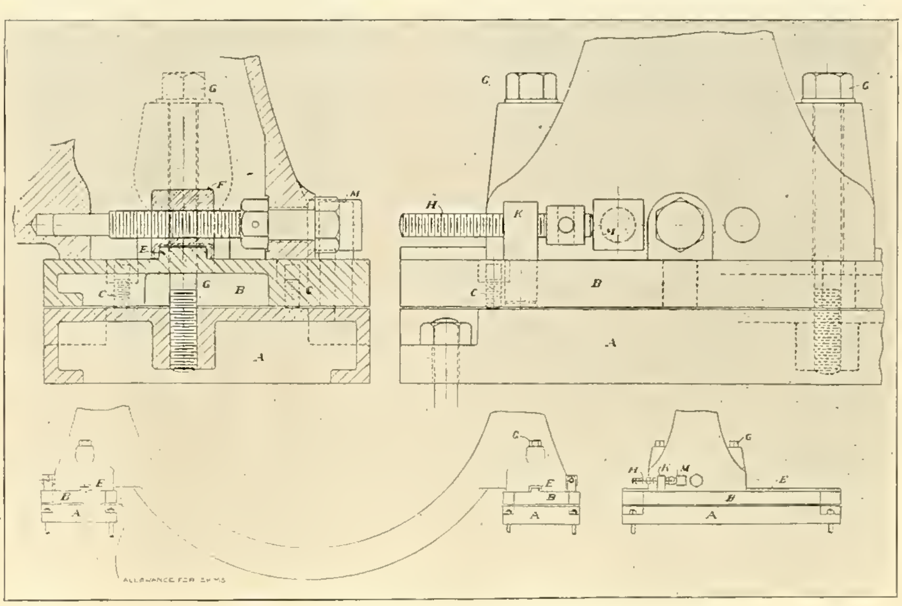


FIG. 7. ADJUSTABLE SOLE PLATE OF ALLIS-CHALMERS ALTERNATOR.

base or sole plates, set the stator to one side so that it will be away from the rotor when the latter is placed in position.

3. Locate revolving field and engine shaft in bearing, observing same precautions as given under belted machines. In case the engine shaft has not been pressed into the rotor spider at the factory and it is necessary to do this work on the ground, we will send special instructions. It is recommended that an expert machinist be employed to do this work.

4. Place the top half of the yoke in position, first making sure than all planed surfaces are perfectly clean. Carefully center the stator with respect to the field by means of the adjusting screws in the feet and sole plates, and measure the air-gap between stator face and pole pieces at a number of points around the circumference. It is very important to have the air-gap uniform, as otherwise the frame will be subjected to an unbalanced magnetic pull, causing bad operation.

In large waterwheel and engine-type alternators, where the stator is split it is usually necessary for convenience in shipping to disconnect and remove a few of the stator coils at the two partings in the frame. These must be carefully put in place and properly connected as per instructions furnished with the generator. The coils must not be bruised, and all connections should be neatly made and insulated to correspond with those for the other coils.

In aligning the yoke see that the center of the armature laminations is in line with the center of the pole laminations; if they are not in line there will be a side thrust on the shaft.

After the yoke has been finally adjusted insert shims between the upper and lower parts of sole plates so as to take the weight off the leveling screws. Drill and tap holes in the lower sole plate to receive the holding-down bolts for the stator, and bolt the latter in place. Fig. 7 (page 31) shows the construction of adjustable sole plates. (A) is the lower plate bolted to the foundation, and (B) is the upper adjustable plate; (C)(C) are the leveling screws. The yoke is held in line by spline (E), and by means of a bolt threaded into block (F) the yoke can be shifted in a direction at right angles to the shaft. For sliding the yoke sideways along the sole plate a jackscrew (H) turns in nut (K) and bears against a plug (M) that fits into a hole in the stator foot. Parts (H), (K) and (M) are removed after the stator has been shifted to its final position.

5. Grout in the sole plates and, after the cement has set, tighten the foundation bolts and carefully check over the alignment of the machine.

If at any time the engine bearings are adjusted or realigned, the air-gap between stator and rotor must also be checked over and the stator lined up, otherwise an uneven air-gap will result or the rotor may even rub on the stator.

COLLECTOR RINGS.

With small alternators the collector rings are mounted in place on the shaft and connected to the field windings. On large machines, especially engine-type, where there is no shaft, the rings are shipped separately, and in large machines both hub and rings are split so that they can be put in place after the rotor has been mounted in its bearings. See that the collector rings are fixed securely in position so as to run true, and connect rings to leads from the field winding, making sure that all contacts are clean and bolted up tight.

With large engine-type alternators and also with some of the larger waterwheel machines the brushholders are supported by a stand bolted to the vase or to a bridge fastened to the sole plates. On smaller machines the brushholder studs are supported by the bearing pedestal. See that all insulating bushings and washers on the brush studs are in place and that the studs are bolted up tight; also that the brushholder stand, if any, is firmly bolted to the bed or bridge and that it is properly lined up with the collector rings.

BRUSHES.

The brushes should be carefully fitted to the collector rings, first using coarse sand or garnet paper and finishing with fine sandpaper. While shaping the brushes hold the paper well down on the rings so as not to wear away the edge of the brush. See that the whole surface of the brush makes contact with the ring and that the finger presses squarely on the brush. The pressure should be adjusted by changing the position of the tension spring on the arm, and should be such as to give a good contact on the ring; a greater pressure improves the contact very little and only causes excessive friction loss, wear and heating of the brushes and rings. Good judgment and careful attention will soon show the best pressure to be used.

BEARINGS.

See that the oil wells are thoroughly cleaned and filled with a good grade of mineral oil. Fill up the wells to such height as will insure that the rings carry up oil. See that the oil-well covers are in place so that no foreign matter can drop into the bearings. When the machine is first started it is advisable to draw off the oil at the end of each day's run and fill up with fresh oil until it is certain that all fine particles of foreign matter are out of the bearings. The oil drawn off can be filtered and used over again. When a machine is first started it is advisable to run slowly for an hour and watch the bearings closely before running up to full speed.

WIRING.

In all wiring special attention must be paid to the mechanical execution of the work, and special precautions are necessary with the wiring for high-pressure alternators. In running the wires the requirements of the National Board of Fire Underwriters should be observed, and especial care should be taken to have all joints secure and thoroughly insulated. All wires should be of sufficient cross section to carry at least 25 per cent. overload without overheating. For wires larger than No. 2 B & S it is advisable to use stranded cable, as it is much easier to run than solid wire.

[*To be concluded.*]

Easy Lamp Changer.

Those who have incandescent lamps in high places out of reach of the hand will appreciate the Easy lamp changer. Fig. 2 of the accompanying illustrations shows the device holding a lamp which has just been removed from its socket. Fig. 1 shows the ease with which decorative lamps can be removed and replaced when out of reach.

The device is built on the same principle as the human hand. It has a set of artificial fingers which go over and grasp the lamp firmly while it is being removed or replaced in the socket. The rubber bands over the ends of the fingers prevent the lamp from slipping while it is being turned in. The double-coil spring permits the shaft or wrist of this hand-like device to be bent at any angle. This is accomplished by holding the pole firmly in one hand and pulling down the string with the other. By turning the pole to the right the lamp may be inserted, or it may be taken out by turning it to the left.

FIG. 1. EASY LAMP CHANGER.

The Easy lamp changer fits all lamps from six candlepower up to and including 32 candlepower. It does away with the necessity for heavy ladders. This is one of the specialties that W. N. Matthews & Bro. of St. Louis bought from the Pardridge Shade and Reflector Company of Chicago, Ill., recently.

Marshall Field & Co. Adopt Nernst Lamps.

The largest contract ever placed for lamps for store lighting has just been awarded by Marshall Field & Co. of Chicago to the Nernst Lamp Company of Pittsburg. It calls for 12,000 glower units for immediate delivery. The store will be equipped a section at a time, and on account of the vastness of the undertaking the complete installation will perhaps not be in operation until well along into the fall.

Perhaps no store in the whole world is better or more favorably known than the great merchandising establishment of Marshall Field & Co., but only those who have had the opportunity and time to walk leisurely over its 38 acres of floor space and view its displays of merchandise, collected from all sections of the world, are able to appreciate its magnitude. The store has a frontage on State Street of 385 feet and covers almost the entire block bounded by State, Washington and Randolph streets and Wabash Avenue. The average number of employes is 9,000.

RETAIL ESTABLISHMENT OF MARSHALL FIELD & CO.

While it does not rank as a regular department store, it handles a great variety of the better classes of goods, such as dry goods, millinery, men's and women's clothing and furnishing goods, carpets, furniture, wall hangings, leather goods, pottery, glassware, jewelry, bric-a-brac, books, shoes, toys, sporting goods, etc. There is scarcely a problem in store illumination that this establishment does not exemplify.

For some time the rebuilding of a large portion of the store has been in progress, and in order to have the entire property in keeping with these improvements, it was determined to install a new lighting system throughout.

Any change in the equipment of such a large store necessarily involves too great an expenditure to warrant the adoption of any system until thoroughly tried out, and so, at great expense, various modern systems of store illumination were installed in different sections of the store and put to an exhaustive test before a decision was reached. In having been chosen as best suited to the various requirements of this great store, the Nernst system has received a high mark of commendation.

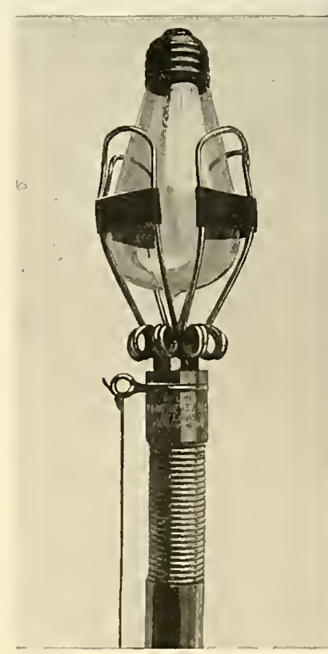


FIG. 2. EASY LAMP CHANGER.

Recognizing the importance of having a lighting system that would be in keeping with the architectural features and the general tone of the store, that would be agreeable and pleasing to the eyes of the customers and show up fine textures and delicate tints in their true values and at the same time be flexible enough to admit of a uniform value throughout, Marshall Field & Co., in trying out the various systems, subjected them to perhaps the longest and most exhaustive test ever made.

The 13 floors to be lighted vary in ceiling height from 14 to 10½ feet. Two-glower and three-glower lamps suspended on specially designed chain pendants hanging from three to five feet from the ceiling, according to height, will be used. The fixtures are particularly appropriate in design, and the lighting units will add materially to the appearance of the store.

Incandescent lamps to the number of more than 40,000, in low-hanging fixtures, are at present used. The current is supplied by the Chicago Edison Company. Messrs. D. H. Burnham & Co. are the architects in charge of the new-building construction, now practically completed. The new lighting system will be installed under the direction of Mr. F. J. Pearson, electrical engineer for Marshall Field & Co.

Westinghouse Storage Battery.

In its new storage battery, herewith illustrated, the Westinghouse Machine Company of East Pittsburg, Pa., has embodied what it has always advocated—the pure lead plate, formed by the electrolytic or Planté process, for both positive and negative. The usual tendency toward shrinkage in capacity of the negative is said to have been overcome in the new product, yielding a Planté negative that has indefinitely long life and the function of maintaining its initial and rated capacity. It is asserted that this negative will hold up under the most strenuous electrical conditions, no permanent injury being done the plate by light charge, light discharge, overcharge, over-discharge or reversal of current.

A type 7-S-5 battery, complete with sand tray and having a normal rating of 120 ampere-hours, is shown in Fig. 1. The parts of the same battery are shown in Fig. 2.

Fig. 3 shows a type S-4 positive grid with vertical and horizontal cross-sections. The parts adapted to become active consist in effect of a number of very small units (a-a), which are pure lead leaves or laminæ, joined at their ends only to round conductor ribs (b-b) which in turn end in the main stiffening ribs, or the frame of the

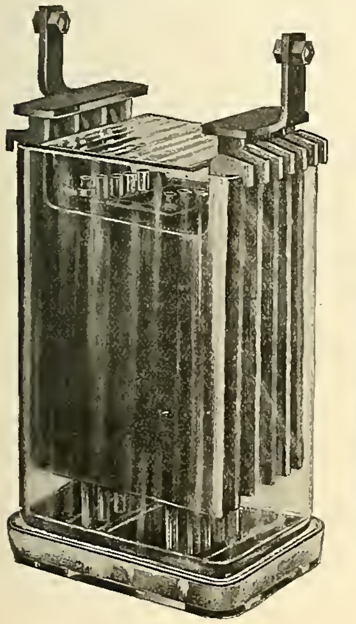


FIG. 1. TYPE 7-S-5 BATTERY COMPLETE.

plate. The leaves are grouped in panels three to four inches square.

The Westinghouse plate, including frame and leaves, consists of one homogeneous piece of chemically pure lead without joint or weld of any description. Upon the laminated surface is formed, from the lead itself, the active material—peroxide of lead. This coating of peroxide entirely surrounds each lead leaf. Each leaf remains a core of pure lead of sufficient size to furnish active material for replacing that gradually precipitated, and is also of sufficient section to provide ample conductivity during the long life of this type of plate.

The formed plate, showing how the space between lead leaves is filled with active material, is illustrated in Fig. 4. This plate is six by six inches and has a normal rating of 2½ amperes, eight hours.

In plates of more than four panels there are no horizontal framing ribs, but instead, there has been provided a thin corrugated sheet connecting the adjacent panels, as is shown in the illustration of a type S-8 positive plate at (A-A), Fig. 5. At each end of this expansion sheet a rectangular opening is provided, separating it from the vertical conductors, thus allowing all vertical growth to be taken up by expansion sheet, which, on account of being corrugated, adds strength to the panel transversely. The rectangular openings also allow immediate diffusion and consequent equalization of the density of the electrolyte on both sides of the plate, which materially aids in its uniform working.

The negative plate differs mechanically from the

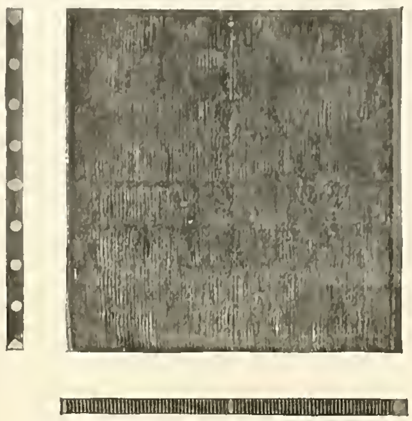


FIG. 4. FORMED PLATE, SHOWING SPACES FILLED WITH ACTIVE MATERIAL.

positive plate, in that there is a larger number of laminations in the negative, and, it being unnecessary to provide for longitudinal growth, the expansion spaces are omitted.

Co-operative Commercialism in the Electrical Field.[1]

By J. Robert Crouse.

Through the continued courtesy of your officers, yourselves and your special committees, it has been my pleasure on two previous occasions to raise the question of closer commercial co-operation for your consideration at Denver in 1905, and Atlantic City in 1906.

The conditions which suggested the idea, the organization which nurtured it, the trade relations existing and the essential points pertaining to its earlier development are of record in your previous proceedings, and will, therefore, not be again reviewed.

The force of the idea, the practical nature of the plans and the efficient results obtained are such, I confidently believe, as will increasingly commend the subject to your best sentiments and business judgment alike.

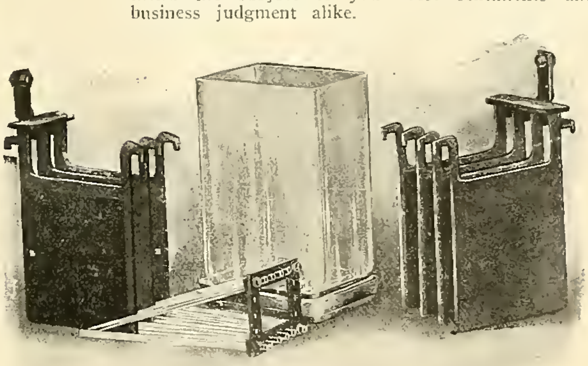


FIG. 2. TYPE 7-S-5 BATTERY DISSEMBLED.

May I ask you at the start to view the entire proposition as the product of the co-operation of many men who have been willing to venture their time and considerable sums of money in bringing to a practical working basis? The degree of its future success likewise will depend upon the extent to which it can effectively appeal to all the branches of the trade for both their moral and financial co-operation.

Objects.—The objects of this co-operative movement briefly stated are as follows:

First—The promotion of the increased and more extended use of electric current by the public for light, heat and power against all competitors for like service as an end in itself and as a means to the increased demand for electrical apparatus and supplies and the co-operative planning and execution of various means and methods effective to this end.

Second—The establishment of co-operative commercial relations, both moral and financial, among the different electrical interests from the manufacturer to the consumer to the end that each may contribute in some measure toward bringing about the above results desired in common by all.

The subject presents itself at once in two aspects: First, as a theoretical principle in business development; second, as a practical workable refinement in business organization.

Theoretical Aspect.—Commercial co-operation,

FIG. 5. TYPE S-8 POSITIVE PLATE.

which we are all dealing with daily, consciously or unconsciously, in the development and management of individual business, is a thoroughly accepted principle and a recognized factor in increasing productive and distributing efficiency.

It amounts to the recognition by increasing numbers of men of the fact that they can gain more individually by joining others in the prosecution of an enterprise than is possible in an equal degree by their segregated, conflicting, individual effort.

Within the memory of men present business has passed consecutively through the periods of individualism, copartnership, corporation, consolidation and association.

This rapid transformation in method has been based upon and in proportion to the recognition of broader grounds of common interest on the basis of which, notwithstanding necessary differences, more effective means for their prosecution has been undertaken.

Each advance has been in effect a refinement of the co-operative principle and has justified itself fully through tremendous increase in the

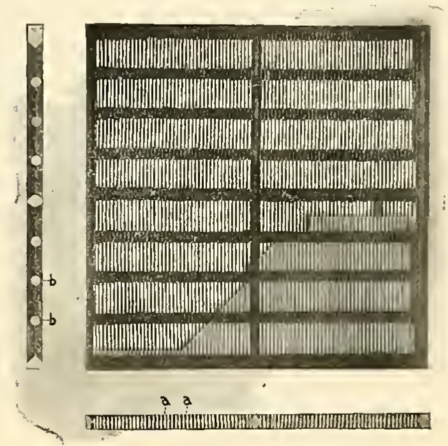


FIG. 3. TYPE S-4 POSITIVE GRID.

efficiency of production with more questionable gains in the field of distribution.

Summed up in a paragraph, this development has amounted in some directions to the reasonable restraint of such competitive effort as tends to defeat the real objects of more efficient production and distribution and in other directions to the stimulation of competitive effort in channels where the result is a gain to those ends.

It is to be observed that the field of manufacture or production has offered the widest play for enormous gains in the efficiency of production through specialization, co-ordination and co-operation.

Selling and distribution, on the other hand, have not made any comparable gains in efficiency, although refinement and complexity of organization have been steadily progressing.

All this massing and complexity in the distributing field has incited competitive neutralizing resistance, so that progress as a whole has been made at a maximum expenditure of money and effort.

Production has been subject to the advantageous

[1] Abstract of a paper read before the National Electric Light Association at Washington, D. C., June 7, 1907.

working of the economic law of increasing returns, while distribution has been rather subject to the limitations of the economic law of diminishing returns.

If, therefore, within a given business, such as the electrical business, a plan of co-operative commercialism can be found which will develop under the economic law of increasing returns and escape from the wastefulness of unrestricted competitive distribution which is subject to the economic law of diminishing returns—such a plan, I believe, must commend itself to your careful consideration.

Even this hasty review of the development of commercial co-operation leads inevitably to the conclusion that, as at each step its application has increased real efficiency, so its further extension along lines dictated by its past evolution must carry corresponding gains.

So much for what one may choose to call the academic side of this proposition, which will be disposed of with the practical statement with which we will all agree—that a theoretical proposition is practical when it works.

Practical Aspect.—The practical consideration of this question involves three propositions:

In the first place, as to whether we have not now reached a stage of business development where a community of commercial interests actually exists of which we are not taking full advantage. Whether by further extension and adaptation of commercial co-operation among ourselves we cannot more effectively and extensively influence the public to a larger and larger proportionate expenditure for electrical service of the $18,000,000,000 of wealth annually produced rather than that it should be stored in savings banks, expended on automobiles, pianos, talking machines, etc., to say nothing of the appliances and devices which immediately compete with cheaper and inferior service for light, heat and power.

Second—If the existence of such a community of commercial interest can be so established, the second proposition involves the question as to whether practical plans can be presented to reap the advantages.

Third—Assuming the first two propositions, the third point involves the question as to whether per unit of money and effort expended on the plans they will yield a better return than it is now possible to secure.

As to the first proposition, we have passed in the electrical field through all the various stages of commercial development and have reached the period of associations which exists in one form or another—city, state and national—in the central-station, contracting, jobbing and manufacturing fields.

An analysis of this broadening interest in co-operative or associated work is seen to rest upon an interdependence of commercial interests peculiarly strong.

First, this is noted as among the different services furnished for lighting, heating and power. The introduction of one service strongly disposes the users, as well as others, to the employment of the other two. The development of the lighting service immediately emphasizes the necessity for the development of the power and heating service, and upon the proper balance of the three largely hinges the future development of them all.

This community of interest seems clear when one considers that the electrical devices in which the public either is or can be interested are comparatively few in number for lighting, heating and power, and relatively small in money value, yet upon their increased sale and use depends, first, the success of the central station and the contractors, and second, that of the jobber and the manufacturer.

The market for us all, therefore, whether reached directly or through and against one another, is in the end this great money spending public, preoccupied, incredulous and indifferent to the advantages of electrical service, so apparent to ourselves.

This question, then, of popularizing and educating the public to the freest possible use of electricity for light, heat and power is a vital, existing community of interests to us all, whether we manufacture, job, construct or sell current.

We are, in fact, joint sellers of the final service. Here is the edge of the commercial wedge which we owe it to ourselves and to one another for the purest of commercial reasons to drive home by the most effective methods for the expansion of the market, common in this degree to us all.

As to the second proposition, involving the question of practical plans, the following are the plans already formulated which have been reviewed and favorably passed upon by your special committee of two years' standing as well as committees of all the representative associations in the electrical field. Some of them have been put into operation, but many of them remain for the future, and are contingent upon widespread moral and financial co-operation toward which we are aiming.

General Character of Plans.—Broadly speaking, the plans as formulated aim at the creation and extension of the market along three lines:

First—Through creating the favorable conditions and providing the proper facilities for the most rapid and flexible interchange of the best commercial ideas and methods throughout the non-competing branches of the trade; the contractors and the central stations in particular.

Second—By bringing to the effective support of the non-competing branches of the trade the further united commercial stimulus and backing of the competing branches, the manufacturers and the jobbers.

Third—The massing of the combined selling strength of all branches on the common market, the public through a national campaign of advertising and commercial publicity, exploiting the generic uses and advantages of electrical service, and by reaching in addition allied lines such as architects, builders, contractors, real estate dealers, etc., with subsidiary campaigns and personal work.

The successful execution of the detailed plans will increasingly generate the disposition on the part of everyone concerned to lend a hand, and this in turn would insure the further extension and prosecution of the movement to which at the present time there appears to be no visible limit.

Representatives in the Field.—The commercial work of the executive officer, as is obvious, would be along the lines of general supervision of the activities of the association, presenting it and its work before national and state associations of central stations, jobbers and contractors, as well as before associations of manufacturers, aiming to increase interest in the work and to stimulate greater co-operation in making the work increasingly effective. His time would also be devoted to a considerable extent increasing the membership of the association.

One representative would have immediate supervision of the detailed commercial work in the electrical field, spending the greater portion of his time in calling upon the lighting companies, jobbers and contractors in cities of 100,000 population and over for the double purpose of giving and receiving information about the latest selling means and methods. He should be able to properly address the soliciting force of the companies visited and to stir up increased enthusiasm and interest among them by reviewing the work of other companies and soliciting forces where the most progressive methods are followed and the best results secured.

If the suggestion already made is found to be practicable he can arrange for the interchange of expert solicitors from one company to another, which would doubtless be found to have a very stimulating effect upon the sales organization, and experience would undoubtedly suggest other lines of activity of a similar character which could be followed.

Where conditions would indicate the advisability he would arrange to give a dinner to the leading commercial men connected with the central-station, jobbing and contracting interests, at which the association's work could be presented under most favorable circumstances. Much good to the business would doubtless result from such all-round interchange of ideas, experience and improvement of acquaintance.

Such general subjects as co-operative advertising of electrical service in the local newspapers by all interests effected could be discussed, which seems to offer great opportunities in the few instances in which it has been tried.

He could use his good offices to further the interests of the co-operating advertising agencies where he believed their services would benefit the local interests.

He would make a point of furnishing the trade press with such commercial information secured in his work as would be stimulating to other companies for use in their new-business departments.

Finally, it would be his duty to turn in for permanent record a report of the general situation in each city, giving statement in detail as to the commercial conditions existing, so that in the course of time the progress made, as reflected by increased commercial activity, could be tangibly arrived at.

The work of a second representative would consist of the same lines of activity, except that it would be devoted to similar electrical interests in cities of from 10,000 to 100,000 population.

Under the direction of this representative would be three additional representatives, who would travel in cities of the population above noted.

All of these representatives, as well as everyone connected with the association, would make a point of urging upon such central stations as are not represented in the state and national associations, the importance of membership and the advantages to be gained from it.

Twelve representatives would work along the same general lines as before described, except that their work would be in cities of a population of 10,000 and under. Some special conditions are often met with in these cities which do not appear in the others; namely, the question of the establishment of day circuits, as well as frequently the existence of systems of rates, which are in themselves a hindrance to profitable business extension.

Referring to the question of day service in these cities, which is an important one, it may be noted that 67.78 per cent. of the central stations in Michigan and 65.6 per cent. of the central stations in Ohio do not maintain 24-hour service.

This condition prevails, as already noted, largely in cities of 15,000 population and below. The president of the Michigan Electric Light Association at the last meeting stated that many of such stations should be operating a 24-hour service, that there existed no sufficient reason why they should not. This offers, therefore, a very fertile field for effective work.

The detailed statistics in reference to this situation in the states of Michigan and Ohio may be assumed to be typical of conditions existing in other states.

Provision is made in the plans for a corps of expert solicitors—one for power work, one for heating and one for lighting. Under the direction of the first representative they would be employed in assisting such central stations or contractors as were found to desire it in starting an active commercial campaign. In this connection it has already been suggested by several of the smaller central stations that they would welcome an arrangement whereby they could secure the service of a solicitor for a part of his time. This suggests a line of work which, if found practicable, could be indefinitely extended. It could also doubtless be placed upon a self-sustaining basis after some experience had been gained in its operation.

Representative Among Electrical Contractors.—Provision is made for a representative who would devote his attention to the electrical contracting interests, co-operating with them along lines which might reasonably be expected to result in increased business. This work would be based upon an analysis of the commercial practices of the most progressive contractors, with the object of calling such methods as forcibly as possible to the attention of contractors generally.

He would also examine the conditions under which central stations and contractors are at present working together to the best advantage, with the object of making the basis of such relations known widely in both the central station and contracting fields.

For the purpose of creating as much interest as possible in the association and its commercial work the officers of the National Electrical Contractors' Association have offered the use of their trade paper for the establishment of a new-business department along the same general lines as those already maintained by the technical press, but naturally conformable to the special requirements of the contractors.

Representative Among Architects, Builders, Contractors, etc.—Provision is made for a representative whose work would consist of a broad and general study of the proposition of the wiring of property of all kinds, both old and new. He would make careful examination into the relations existing between architects, builders, contractors, real estate dealers and electrical interests. He would make it a point of getting in touch with the national, state and city associations of the architects, builders and contractors, with the object of presenting before them papers dealing with the subject, and emphasizing the very great present and prospective utility of electrical service for light, heat and power.

This would involve a strong recommendation of the policy of freely specifying extra outlets—floors, baseboards and walls—as well as separate circuits for heating and miscellaneous electrical appliances, which is now not so generally done as would be in the interests of both the owner or occupant and the electrical interests, which would directly profit.

He would prepare, at the same time, articles for the trade press of these different trades which would keep this subject before them in a live and instructive manner.

He would tabulate all the effective means and methods as now employed by central stations, contractors or others to secure the wiring of old and new construction work, and put this into the most effective and convenient shape for general distribution through the trade press and the special campaign of literature reaching these trades, as will be later referred to.

As he would be in touch with the latest practice in wiring and application of electrical devices, he would take charge of keeping the lists of applications of electric current up to date and issue them to the electrical trades and to the architects and contractors.

His work would put him in position to report to the press bureau any interesting or novel applications of electric service which would be written up and sent to the trade papers, reaching the trade which would be interested.

Results.—As to the results secured, a summary was made in December, 1906, which included reports from 934 central stations, each one of which had taken up (many for the first time) that year some one of the following commercial activities:

Organized new-business department.
Put out or added solicitors.
Began direct-by-mail advertising.
Began newspaper advertising.
Increased their advertising appropriation.
Opened up display and demonstration rooms.
Hung out their own electric sign.

This amounted in the aggregate for 1906 to an expenditure of $871,347.50, and with the reasonable assumption that it has continued for the five months of 1907, it would now aggregate $1,234,-408.95. Allowing 45 cents as a liberal estimate of the cost of securing a 16-candlepower equivalent of new or added business, this would result in 2,743,131 16-candlepower equivalents, or 137,-156.55 kilowatts.

Assuming that this business was added to the peak (or would eventually come to be), it would have created at $100 per kilowatt a demand for electrical and other apparatus and supplies aggregating $13,715,655, which would directly accrue to the benefit of the manufacturers, jobbers and contractors and aggregate sales of electric current for the central stations in the amount of $6,857,827.50.

Indicated by the barometer of incandescent-lamp demand, it may be said that this co-operative movement was started May 12, 1905, when the incandescent-lamp manufacturers appropriated the initial $10,000 for its execution. The gain in lamp sales for the country at large was five per cent. in 1904 over 1903; eight per cent. in 1905 over 1904; 20 per cent. in 1906 over 1905, and so far this year more than 25 per cent. over the corresponding period of 1906.

With due regard for the prosperous times which we have enjoyed, here is a result which rightfully must challenge your attention.

It has not been possible to get a complete tabulation of the results, some of which have just been indicated; and this should, therefore, be taken as an offset in the interpretation of the results as being traceable in a large degree to the co-operative movement. Viewed as a whole, the expenditures incurred in relation to the business which has been developed from the standpoint of the manufacturers alone is but 0.004 per cent. in relation to the added business. If the result be cut in two, it amounts to 0.008 per cent., or if one-fourth, to 0.016 per cent.

Prominent men in all branches of the electrical business freely concede that these results are largely traceable to this co-operative movement, and on the basis of the above percentages must more than make good the third contention—that per unit of time and money expended it demonstrates itself to be a remarkably efficient system of creating and extending the business from the standpoint of all branches of the trade.

I am neither desirous nor presumptuous enough to credit myself individually with more than a modest hand in bringing this about, for I think you must perceive that it has rather been the resultant effect of the idea of commercial co-operation here presented working through considerable numbers of other men.

When this proposition becomes understood on its merits for what it is really worth it will be discovered that we are simply making a practical application of the tremendous force of co-operative constructive work in the commercial field which has already so largely been perfected in production.

Special Points in the Organization.—The co-operative association through which it is proposed to prosecute and extend this work differs essentially from the prevailing association idea, in that it is directly modeled on the corporation, with salaried officers and employes devoting their entire time to it, with a board of directors of 27 from all branches of the trade; similarly an executive committee of seven and with co-operating committees from electrical associations of all kinds.

It amounts in fact to a corporation whose stockholders and members would comprise individuals, firms, corporations, etc., directly or indirectly interested in manufacturing, jobbing, contracting and in the sale of electric current. The tremendous commercial force which could be wielded by such an organization as it gradually developed must be, I think, apparent.

Conclusion.—In conclusion we have, I believe, disclosed in this co-operative movement the thread of an existing but unrecognized principle of common commercial interests running throughout the entire electrical business, which, with increasing interest and co-operation already manifest, can be woven by us all into a commercial cable of a strength and efficiency not hitherto attained or attainable along any other lines essentially different.

As in the field of science and invention as applied to production the effort of the electrical and mechanical engineer is directed to overcoming the inertia loss and waste of inanimate matter, so it seems to me it must be the serious duty and business of the commercial engineers to turn their attention to the reduction of the corresponding loss, waste and friction of unrestricted competitive distribution.

The task, as it has been mapped out, is too large for any one or group of us to undertake. It can only be accomplished through multiplying our effective commercial power through co-operation. Its success, therefore, is contingent upon its making a successful appeal to large numbers in all branches of the business so that they will be willing to equally share in the work and proportionately in the results.

Electricity itself applied to communication and transportation in the annihilation of time and distance has been and is the real instrument of all closer commercial co-operation and association upon which modern business development is based. I submit to you, therefore, that we, of all men, who are its immediate devotees, should be the first to recognize the essential unity existing in our own business, display our willingness to work the problem out together and secure finally the tremendous business benefits which surely must follow.

The New Telephone Building in Indianapolis.

The Central Union Telephone Company is preparing to occupy its new building in Indianapolis. The building is eight stories high and will be made general headquarters for Ohio, Indiana and Illinois, the Indiana division offices and the Indianapolis exchange. Many up-to-date features have been incorporated in the plans of the new building, including hospital service, rest rooms, libraries, lunch rooms, lockers, roof garden, etc. The entire building will be used exclusively by the company, except three stores on the ground floor. The building will supply its own heat, electric light and water by a plant installed in the basement, the water being pumped from deep wells.

The company handles from this point the organized Bell telephone business of Ohio, Indiana and Illinois, with the exception of Chicago, Cleveland, Cincinnati and Evansville. In more than 300 cities and towns in Central Union territory regular exchanges are operated, and the company's long-distance wires reach several thousand villages where toll stations are maintained. The year 1906 was a banner year in the telephone growth at Indianapolis, the Central Union adding more than 4,000 telephones to its five exchanges in the city.

GENERAL TELEPHONE NEWS

The Western Electric Telephone Company is making improvements to its system at Mason City, Iowa, which will cost about $75,000.

The Cimarron Valley Telephone Company of Cimarron, N. M., will be incorporated with a capital of $100,000 by Charles Spring and others.

The Wisconsin Telephone Company is to erect a building and put in a central-energy system at Neenah, Wis. The improvements will cost about $40,000.

The Lone Star Telephone Company of Wynoka, Okla., has made application for a charter. A. E. Golden, M. A. Golden and Frank M. Critz are interested.

The plan to send an investigating committee to New York to consider the popularity of that city's measured service and decide whether the flat rate shall be continued in Chicago was rescinded by the City Council this week. No further action on the proposed ordinance was taken.

A merger of the New Brunswick and Central Telephone companies of New Brunswick province, Canada, has been completed. The president of the united company is S. H. White, and Alfred Seeley is secretary-treasurer. The headquarters of the concern are at Fredericton, N. B.

The Supreme Court of Mississippi has handed down a decision to the effect that the telephone companies can condemn rights-of-way along the railway lines for telephone lines. This case has been fought by the Cumberland Telephone Company for some years, and the result is regarded as a victory for the telephone interests.

The following-named telephone companies have been incorporated recently: Ellsworth County Telephone Company, Ellsworth. Kan.; Central Telephone Company, Schuyler, Neb.; Farmers' Mutual Independent Telephone Company, Grand Saline, Texas; Holt Union Telephone Company, Manitou, Okla.; Farmers' Independent Telephone Company, Red Cloud, Neb.

The people of Durham, N. C., have carried before the State Corporation Commission the question of the proposed increase of telephone rates. The proposed rates are $3.50 for business houses and $2.50 for residences. In accordance with evidence produced it was declared that, prior to the sale of the Interstate telephone exchanges, or a majority of them, in the state, rates were much less than at present in the town of Durham, whence this complaint came.

The Providence Telephone Company of Providence, R. I., has been given an exclusive franchise in the city of Providence for six years, ending December 1, 1913. When the ordinance was sent to the mayor he vetoed it, but it was later passed over his veto by the council. The passage of this ordinance puts a stop to the agitation for an Independent telephone franchise for at least six years. The new ordinance carries with it a revision of existing telephone rates, making the new service considerably cheaper. Only 30 per cent of the stock of this company is owned by the American Telephone and Telegraph Company, and of the remainder about 61 per cent. is held in Rhode Island.

CORRESPONDENCE.

Continental Europe.

Paris, June 28.—The report of the Franco-Swis Company, which is one of the large electrical syndicates of the Continent, shows that it is in a prosperous condition. One of the main enterprises which is under the control of the syndicate is the Grenoble Light and Power Company, which is carrying out operations in the Alpine region of France, and controls a number of hydro-electric plants and a large network of power lines. This company is capitalized at $2,00,000, and is constantly increasing its plant. Another large French company which recently issued its report is the Rhone Hydraulic Power Company. It is now paying a dividend of four per cent., instead of the former three per cent.

A new form of telephone adapted for use with a diver's helmet has been tried in France at the government arsenal at Cherbourg. The diver can exchange conversation with the boat, which will be a great advantage over the usual system of signaling by pulling on the rope. A double telephone receiver of the strap form is placed on the diver's head, and the proper connections for the telephone wire are made by a watertight plug mounted on the outside of the helmet. The attendant in the boat has a portable telephone set, with dry battery.

Switzerland is to have a new electric line which will be of special benefit to tourists, as it will run through one of the most picturesque regions of the Bernese Oberland, which has been somewhat inaccessible hitherto. A concession has been recently asked for the new road, which will run from Gstaad to Lauenen, through a valley surrounded by mountain peaks and glaciers. Starting from Gstaad, which is a station on the Montreux-Bernese Oberland railroad, the road mounts, in a rather steep grade, to the terminal point at Lauenen, the length being about four miles. Direct current will be used on the road, as is already employed on the above-mentioned line, so that both roads can be operated together without difficulty. The difference of altitude between the terminal points is 620 feet, with a mean grade of 30 per cent. Motor cars on the trolley system will be used in this case taking current from the Montboron hydraulic plant. A sub-station will convert the alternating into direct current. The estimated cost of the road is $200,000.

Bids have been asked for an electric road in Switzerland which is to run between Fribourg and the two localities of Planfayon and Heitenried. The limit for presenting the bids for the project has now been increased to December 21, 1908.

There are three different forms of surface contact tramway now in operation at Paris. These are made necessary, as the trolley is not allowed within the city limits, so that the electric tramway lines are obliged to use the underground conduit accumulator or surface-contact systems. The Clairet surface-contact system is used upon a line of considerable length which starts from Place de la Trinité and runs through the northern suburbs as far as Enghien. The Diatto system is in operation along the Seine, and the line runs into the eastern suburbs. changing over to trolley, as is the case with all the lines as soon as they pass the city limits. A third system is the Dolter, which is used upon a tramway line passing through the Bois de Boulogne.

Hydro-electric affairs continue to be very active in Norway, where it is proposed to make use of the large amount of waterpower available. A large syndicate known as the Hydro-electric Company has made arrangements to utilize four lakes which lie at an altitude higher than the Tinnsjo Lake, and this will add to the volume of the latter to the extent of 225 million cubic meters. Another large company, the Rjukanfos Company, intends to raise the height of the dam upon the Mjos stream by six feet or more, and this will greatly increase the natural reservoir of the same name, which is said to be the largest existing at present. Some 800 million cubic meters will be added to it by this means. In addition to this it is proposed to carry out hydraulic work in the region lying to the east of Telemarken, which is unrivaled in Europe for such purposes.

A new telegraph line is shortly to be erected in the south Algerian region, and the government decided not long ago to increase the Beni Abbe's line and extend it as far as Adrar in the Touat region. The proposed line will be about 280 miles in length and the estimated cost is $300,000.

A. DE C.

New England.

Boston, July 6.—The official trip of inspection over the new Worcester and Springfield Trolley Air Line was made July 1st. The road was opened for public traffic on July 3d. It is planned at first to make the trip in 3½ hours, but later it is hoped that the running time may be reduced.

The Northern Construction Company of Hartford, Conn., has filed a certificate of incorporation. The capital stock is to be $75,000, and the directors named are G. Richard Nichols and W. Evans Smith of Philadelphia, and Arthur Perkins of Hartford. The purpose of the company is to construct electric railways, dams and sluices and to build engines, boilers and other appliances for the generation of power.

The arbitrators recently appointed by the mayor of the city of Boston to determine the cost of the electric arc lights supplied and to be supplied to the city by the Edison Illuminating Company for the period ending February 20, 1909, report that the company has received too much already and must refund to the city 4.6 per cent. of all the money paid from August 20, 1906, to July 1, 1907, and that the price for lighting the city shall, for the remainder of the period, be lowered by 4.6 per cent. from the present rate. The total saving to the city is $43,250 for the 2½ years.

The electrification of the steam tracks of the Middletown and Meriden branch of the Hartford division of the New York, New Haven and Hartford Railroad has been completed and a trial car has been run over the route. Regular service will be begun in a few days.

The New York, New Haven and Hartford Railroad Company has just installed an electric crane which promises immediate improvement in the handling of heavy freight. The crane commands two freight tracks for a distance of 200 feet and a paved way between them of the same length and 30 feet wide. There are four electric controllers, one for the gantry movement on the foundation. Another controls the trolley on the top girders which carry the hoists from side to side. The third controls the main hoist, while the fourth controls the small quick-acting hoist, which has a capacity of five tons. The main hoist will take care of the heavy loads. It can lift 35 tons and is operated by the best of Plows steel-wire cables, working with 10 strands over five movable pulleys. Power is supplied through a three-phase trolley system, the wire cables for this being adjusted on poles along the one side of the crane and at top level. B.

New York.

New York City, July 6.—Shortly after noon on July 1st the five commissioners who will form the Public Utilities Commission of the First District were sworn in and immediately after luncheon started on a tour of inspection, visiting the gas inspector's office, the gas commissioners' office, the rapid-transit commissioners' office and the railroad commissioners' office. At each office the official documents and other paraphernalia were officially turned over to Chairman Wilcox. Until further notice the Utilities Commission will make its headquarters at 320 Broadway.

For the purpose of systemizing the work, each member was assigned some particular line of duty. Travis H. Whitney of the Citizens' Union has been selected for the position of secretary of the commission, and Chief Engineer George S. Rice has been asked to continue temporarily in charge of the engineering staff.

Commissioner Bassett gave out a statement to the press that the members of the commission were going to put in a very strenuous summer and disregard the question of vacations. To this end the signboard on the doors of the new commission reads, "Public Service Commission, First District. Office hours, 8 a. m. to 11 p. m." It is expected that the office will be open every day in the year, including Sundays and holidays. Complaints can be made at any time, and all accidents must be reported to the commission without delay. During the week an extraordinary number of complaints and inquiries was received, and it would appear that, for the present, three meetings a day will be required in order to cope with the present condition of affairs.

The Up-State Commission also met on July 1st and spent a long day "looking over the ground." Several meetings have been held, with a view to perfecting an organization which can handle the various commissions which the Utilities Commission replaces. The offices will also be open from 8 a. m. till 11 p. m., as is required by the utilities law, and it is probable that the force will be divided into "shifts." Commissioner Stevens has been appointed chairman, but no selection has yet been announced as to secretary or counsel. A large number of applications which were made to the old boards have been turned over to the new commission, among these about 58 applications to eliminate grade crossings.

Although the board has not been in session a week, there seems to be a sentiment that the third-tracking of the "L" roads is the quickest method of relieving the present congestion, especially on the East Side, and it is reported that the Belmont-Ryan fight will be renewed to get the commission to pass upon this work, which was refused them by the old board. Mr. Behr, the inventor of the monorail system, has again made application to the new commission for a franchise to build his line to Coney Island.

Nelson P. Lewis, chief engineer of the Board of Estimates, has made a report to the mayor on the condition of the tunnels between Manhattan and Brooklyn. Mr. Lewis reports a considerable variation from the true grade line in the north tube, in one place as much as 23 inches too low, while the maximum distance above grade was found to [illegible] inches. The south tube he finds better, there being only five inches variation above and below grade. Flattening occurred in both tubes and was especially noticeable where there were sharp edges in the grade lines, and occurs mostly in the land sections. He also reports that by far the greatest number of broken plates occurred on the Brooklyn land section of both tubes, where the material was coarse sand and gravel, and the tubes were wholly or in part above water, which would indicate that the cracking was not due to the inability of the tubes to retain their proper functions after they were in position, but to the stresses to which they were subjected by the irregular course of the shield when it departed from the proper grade line and in the effort to bring it back to grade after such departure. To conclude, he states that "the experimental operation of trains which will precede the opening of the tunnel to the public travel will demonstrate its entire safety." Closely following Mr. Lewis' report came the assurance that the air pressure in the tubes will be withdrawn about August 1st and that the public may expect to have through service by October 1st.

Certificates of extensions of the Long Island Railroad were filed with the secretary of state and call for the extension of the Huntington Railroad from the terminal of the road at the Long Island Railroad tracks near the station at Huntington, thence to Babylon, and to Amityville, a distance of 15.53 miles. The Ocean Electric Railway plans several extensions to its present system at Rockaway Park, L. I. A certificate of merger of the New York and Long Beach Railroad Company with the Long Island Railroad Company has also been filed with the secretary.

The New York City Railway Company has notified Coroner Acretilli that henceforth in cases of homicide charged against its motormen when cars kill people the limit of bail will be $2,500. The company stated that it would apply for writs of habeas corpus, and in the event of that failing will leave the motormen in jail until they are either discharged or convicted. E. H. S.

Ohio.

Toledo, July 6.—The Lake Shore Electric has finally secured its right-of-way for double track from Fremont to Toledo. At the present time the road runs on a public highway, but before long a track will be built on the new private right-of-way.

Two electric railroads are having a great race over the entrance into Hicksville. The cause of the strife is the fact that the first road that gets its grade into Hicksville will get a $3,000 bonus in that city, and the first road running cars in that city will get another $3,000. The two competing roads are the proposed Morgan road from Fort Wayne, and the Defiance, Hicksville and Fort Wayne Railway Company.

Since acquiring the city lines at Lima, the Schoepf syndicate has announced its intention to erect a $50,000 building and station on the public square.

Plans and specifications are about completed for the electric arches soon to be installed along the public square in Mansfield.

Rev. A. B. Stuber of North Ridge, Lorain County, has organized a suburban road known as South Lorain and Eastern Traction Company. There is at present no street-railway line within three miles of his church. Father Stuber, who is president of the road, asked the Cuyahoga County Commission for the franchise last week.

A meeting of the stockholders of the Bruce Electric Company will be held July 30th in Columbus, Ohio, for the purpose of voting on the proposition to surrender the charter and abandon the corporate authority of the concern. The notices are signed by Frank L. Lindenberg, Robert L. Bruce, Fred Vercoe, C. N. McDonald and W. A. Hopkins of the company.

The Globe Electrical Company of Dayton, Ohio, was incorporated with a capital of $200,000. E. P. Matthews, C. F. Bual, O. H. Hutchings, J. C. Jones and T. C. Swisher are the incorporators.

Formal announcement was made in Cincinnati last week that the Columbia Gas and Electric Company will erect in that city another office building which will be a twin to the enormous building to be erected in Cleveland. H. L. S.

Michigan.

Grand Rapids, July 6.—The Michigan Power Company of Lansing is enlarging the old Piatt plant on Grand River and preparing to increase the amount of power which it can furnish. The company is now operating the concessions at Waverly Park, a street-railway amusement park near Lansing. A new survey has been made of the water rights on the Rifle River in Oscoda County, and it is said that capital is secured for a big power plant.

New dynamos and generators have been installed in the plant of the Citizens' Manufacturing Company at Standish. The company will light the city.

The Stover dam, which furnishes power for the electric-light plant at Mancelona, has gone out and the city is in darkness until it can be rebuilt.

Plans for the building of an electric road from Bay City to Caro, Bad Axe, Harbor Beach and Port Austin have been revived by the sale of the old Bay City and Caro franchise. It is said a bond issue has been arranged. By the terms of the franchise cars must be in operation January 1, 1908, but the Bay City Council has extended the franchise for one year.

Failing to secure an interchange of freight with steam roads out of Chicago, pending a ruling on an appeal to the Interstate Commerce Commission, the Grand Rapids, Holland and Chicago Railway will accept freight for points out of Chicago and transport to that city by boat at steam-road rates from Grand Rapids. Arrangements have been made for a pro-rata distribution with the Graham and Morton Transportation Company of the differential against Chicago.

The Michigan United and Detroit United electric railways are now handling express for the United States Express Company and making connections with the Pere Marquette and the Ann Arbor railroads for points east and south. L. W. B.

Illinois.

Peoria, July 6.—The secretary of state has licensed the Cairo Terminal Traction Company to incorporate, with the principal office in Cairo. The road is to be built from Cairo to the north line of Pulaski County, Illinois. Incorporators and first board of directors are L. E. Fischer of Danville, who is the general manager of the Illinois Traction Company, Dan Hogan of Mound City and W. S. Dewey, D. H. Sawley and H. F. Vogel, all of Cairo.

The law making a two-cent-a-mile rate the legal amount to be charged by all the steam roads, which went into effect the first of the month, does not apply to the electric interurbans now running in the state, according to a decision of the state board. This is the figure the electric roads have been basing their rates upon. No falling off of travel has been noticed by the roads. Holiday excursion rates for the Fourth were annulled, the rate of two cents a mile being a fare and one-third, based upon the old rate of three cents a mile.

The Illinois Traction Company has just gotten out a new folder covering the lines now operated and giving all the time-tables and such other information as might be useful to the traveling public.

A petition was introduced into the City Council of Pekin at the last meeting, asking that the Peoria Railway Terminal Company be asked to extend its tracks in that city and give the city local street-car service. The Terminal company will soon make application to the council for a franchise. It will also ask the City Council of Peoria for a franchise to give an entrance to the city.

The Peoria Gas and Electric Company will let the contract on July 15th for the new underground work it will put in this year. The intention is to put all its wires underground in the fire limits of the city. The company will construct about 30,000 duct-feet this year at an estimated cost of $100,000, the whole system as now planned to cost in the neighborhood of $300,000 when completed.

The DeKalb, Sycamore and Interurban Traction Company has certified to the secretary of state to an increase of capital from $100,000 to $1,500,000.

Many difficulties have been encountered in the construction of the Mackinaw-Lincoln line of the Illinois Traction Company. The original intention was to run through the town of Mackinaw, but on account of the elevation on which the town lies it has been decided to go around or a little to the west of the town. V. N.

Indiana.

Indianapolis, July 6.—Service on the new extension of the Fort Wayne and Wabash Valley Traction line, between Logansport and Lafayette, was commenced July 1st. There will be two cars each way per day until August 1st, when an hourly service will be inaugurated.

The first car to run over the new Indianapolis, Crawfordsville and Western Traction Company, commonly known as the "Ben-Hur" route, arrived in Indianapolis July 1st. In the car were President A. E. Reynolds, Vice-president Eli Baker and several directors of the company. Regular hourly service will be inaugurated July 10th.

Regular service over the Indianapolis and Western traction line between Indianapolis and Greencastle, by way of Danville, was inaugurated July 3d. The new terminal station at Greencastle has been completed.

A record-breaking Fourth of July crowd was handled at the Traction Terminal Station, Indianapolis, at least 30,000 people being brought in over the interurban lines, against 10,000 handled by the steam lines.

Complaint has been made to the Indianapolis Board of Public Safety by business men and residents of the streets upon which the interurban cars enter the city, stating that they are running their cars at a speed that endangers the lives of persons in the streets. They also object to the strong headlights being used within the city limits.

Additional ground adjoining the Indianapolis Traction Terminal Company's station has been secured by the company, and in a short time the terminal station will be enlarged so as to cover the entire half of a city block. Additional train sheds will be constructed and an express office and additional freight terminal station, in order to accommodate the increasing business.

After being held up for six months, the franchise for the Indianapolis, Columbus and Southern Traction Company to operate on Second Street, in Columbus, has been granted by the City Council by a vote of four to three. The traction company is completing a comfortable station in the city and doing everything else for the convenience of the traveling public. The citizens opposed the council denying the franchise any longer.

Fifty-two Brown County farmers have donated rights-of-way to the Grand Central Traction Company, which proposed to build a line from Indianapolis to Vincennes by way of Brown County. So anxious are the farmers for the road that they have placed $10,000 on deposit in the Nashville Bank to be used in aid of the construction of the line. There is much tunneling to do, and the hills of Brown County will make the construction of the road somewhat expensive.

A petition has been filed with the Board of Public Works and City Council of Terre Haute by the Terre Haute and Merom Traction Company to enter the city. The company proposes to build a line between Terre Haute and Merom, a distance of 18 miles.

The new 11-hour schedules for the car men of the Evansville electric railway were put in effect July 2d. At the same time the operation of cars around the new loop in the city began. It is understood that the new schedules, which grew out of the late strike, are satisfactory to the car men.

The Bedford Light, Heat and Power Company has increased the number of directors from three to seven and has issued bonds to retire the preferred stock.

During an electric storm June 29th lightning struck the power house of the Toledo and Chicago Interurban Company at Kendallville, putting one turbine out of commission and delaying traffic for some time.

According to information, a new natural-gas territory has been discovered on the Burns farm near Bridgeport, a few miles north of Vincennes. The several wells that have been brought in are proving to be gushers. The capitalists are flocking to the field, and all Southern Indiana is rejoicing at the prospect of a season of natural gas. S. S.

Northwestern States.

Minneapolis, July 6.—The Great Northern Power Company of Duluth, Minn., has completed the construction of its new concrete dam across Beaver River. The dam is 800 feet long and 14 feet high and will form a reservoir for the power dam on the St. Louis River.

The Keokuk, New London and Columbus Junction Interurban Railway Company proposes to build a trolley line from Keokuk to Columbus Junction, Iowa. Theo. A. Craig of Keokuk is secretary of the company.

The Crab Orchard (Neb.) Electric Company will increase its capital to $5,000.

Jos. A. Bortenlanger of Glenwood, Iowa, has applied for an electric-light franchise at Plattsmouth, Neb.

Clarence Miller of Osceola has purchased the electric-light plant at Shelby, Neb.

Work has been started on the new street-railway system at Mankato, Minn.

The American Motor Car Interurban Railway Company has filed articles of incorporation at Cedar Rapids, Iowa. The first line to be built will be from Waterloo to Muscatine or Davenport, with a branch from Independence to Belle Plaine. These lines will be operated by self-propelled motor cars.

The Madison and Interurban Traction Company has been succeeded by the Southern Wisconsin Traction and Light Company. The change is one of name only. R.

Pacific Slope.

San Francisco, July 3.—The strike situation is improving to all appearances. Only about 3,000 men remain out on strike, and the places of most of these have been filled. The California Cable Railroad Company has resumed the operation of its cable cars eastward on California Street, with exception of five blocks, where alterations in the grade are being made. The service on Hyde and O'Farrell streets is being maintained with four cars. Overtures have been made to Patrick Calhoun, president of the United Railroads of San Francisco, during the past week, looking toward a settlement of the street-railway strike, which has almost been lost by the unions. The heads of the Building Trades Council, Labor Council and other bodies representative of union labor, were included in the committee, the members of which were received by Mr. Calhoun as individuals. He still refuses to recognize the president of the Carmen's Union, although it is considered very likely that he would recognize a union to be formed out of the present force of about 1,000 employes and such of the members of the old union as would leave that organization and secure employment with the company as individuals. Many express wagons are still running, with union men, and their sympathizers as passengers, but the number of person riding on the cars is increasing every week.

The United Water and Power Company of California, articles of incorporation for which have been filed, purposes to construct a water-supply system and an electric power-transmission line from the mountains to San Francisco. The capital stock is placed at $2,500,000.

The City Council of Oakland, Cal., has awarded the electric lighting of the streets and public buildings to the Oakland Gas, Light and Heat Company for an additional year. A large number of arc lights are used in the city and outlying districts. Many triple-globe incandescent boulevard lamps are used on the principal business streets and reaching out along the shore of Lake Merritt

The City Council of North Bend, Ore., has granted a 30-year franchise to the Hewitt-Bell-Simpson syndicate for construction and operation of a gas and electrical plant.

The Forest Service has granted a permit to the Southern Pacific Company, of Kentucky, to construct a dam and power house in the Cascade Forest Reserve, conduit to be 1.62 miles long and power-house site to be five acres, for purpose of generating power for commercial use. This power development in the state of Oregon is understood to be intended for use in connection with the trains to be operated by electricity on some of the Southern Pacific lines running out of Portland, Ore.

Late advices from Ruskin, B. C., say that the Great Northern will be operating its trains by electricity before the end of 1909. An electric power plant is being built on Stave River, 35 miles from Vancouver, with an ultimate capacity of 100,000 horsepower or more. The river runs through a canyon at the lower end of which a dam will be built. Besides supplying power for the Great Northern, the promoters of the project expect to furnish power for commercial purposes in Puget Sound cities.

Application has been made for a franchise by the Northern California Development Company for a double-track belt line electric railway to extend entirely around the city of Redding, Cal., with the necessary cross-town lines.

Sealed proposals have been received at the office of Owen Woods, commissioner of the Board of Public Works in Tacoma, Wash., for the supply and erection of an electric power plant having a capacity of not less than 4,000 kilowatts. At present the principal supply of current for the use of the municipal electric-lighting system is purchased from an outside electric-transmission company, operating hydro-electric plants some distance from the city. The plant which it is proposed to erect in Tacoma is to comprise not more than four main units and also one motor-generator set. All machines are to be two-phase, 60-cycle. By whatever power it is proposed to operate, the corresponding bid includes every cost. In comparing efficiencies, coal is figured at $4.50 per long ton at Tacoma, and oil at $1 per barrel. Each proposal was required to state the cost of adding one main unit to the plant figured on. Proposals were required to include the services of an operating engineer for one year. A.

PERSONAL.

Mr. Fred M. Feiker of the General Electric Company, with headquarters at Schenectady, was a visitor in Chicago last weeek.

F. W. Brown, until recently with the Pere Marquette and Michigan Central railroads in Lansing, Mich., has been appointed general passenger agent of the Michigan United Railways (electric), with headquarters at Battle Creek.

C. W. Humphrey, formerly of the Northern Colorado Power Company and the Denver Gas and Electric Company as consulting engineer, has recently opened an office in the Rookery Building, Chicago, as a consulting and designing engineer.

Prof. Alexander Graham Bell has arrived at his summer residence at Baddeck, C. B., and has resumed his experiments with kites designed to support a man in the air. Professor Bell says that he expects to be able to make a practical demonstration in aerial navigation by August.

C. A. Hoppin has accepted a position with the Peoria Gas and Electric Company of Peoria, Ill., as chief engineer of the electric-light plant. The position is a new one. Mr. Hoppin is a graduate of the University of Illinois and received his practical training at the Allis-Chalmers works in Milwaukee.

Ralph D. Mershon sailed on July 2d on the Cunard steamer Coronia for England on his way to South Africa, in connection with the work of the Victoria Falls Power Company. Mr. Mershon expects to be absent from this country about 100 days. He will meet in South Africa a number of the directors and officials of the Victoria Falls Power Company and Mr. Arthur Wright of London, who is directly responsible for the engineering of the steam stations which the power company is said to be installing on the Rand. Mr. Mershon will be in consultation relative to the location of the steam stations and to the local distributing circuits therefrom. He will go from Johannesburg to Victoria Falls, passing on the way through the country in which will be located the transmission line from Victoria Falls to Johannesburg and the Witwatersrand.

Mr. D. N. Warwick, manager of the commercial department of the San Antonio (Tex.) Gas and Electric Company, is spending his vacation in Chicago and vicinity. He was formerly of Chicago and has many friends and acquaintances among the central station companies of the North, many of whom he will visit before returning. Mr. Warwick is an aggressive commercial manager and his advanced ideas have aided in making San Antonio one of the best lighted cities of the Southwest. His company has installed a large number of the latest current-consuming devices and carries a large motor load.

Nikola Tesla writes to the New York Times under date of July 2d to say that he is receiving many notices and inquiries on the subject of Martian signaling, mentioned in his letter in the Times of Sunday, June 23d. He refers those who have taken occasion to comment on this feature of the letter to his recent article in The Harvard Illustrated Magazine, which is all he cares to say now despite "tauntings and temptations." For particular reasons, he says, that he reserves his full technical report, descriptive of the apparatus and results for the records of old institutions—academies of science—of which he is an honorary member.

ELECTRIC LIGHTING.

The Brookfield (Mo.) Electric Light Company has suffered a severe fire loss.

Bonds have been voted for extending the electric-light plant in Tecumseh, Neb.

John Absher and associates are about to put in an electric-light plant in Armour, S. D.

John A. Showen has purchased the Stanberry (Mo.) electric-light plant at a cost of $18,000.

The Warrensburg (Mo.) Light and Power Company has been incorporated with a capital stock of $50,000.

The Rockdale (Texas) Water and Light Company has been incorporated with a capital of $50,000.

The Warrensburg (Mo.) Light and Power Company has succeeded to the business of the Magnolia Light, Heat and Power Company.

W. E. Lyons of Kansas City, Mo., who has sold his ice-manufacturing business, is applying for an electric-light franchise in Kansas City and Kansas City, Kan.

A municipal electric-light plant will be erected for the town of Franklin, La. This town is one of the oldest settlements in that part of the country. The plant will be of sufficient capacity to furnish electric light to the 4,000 or more inhabitants and electric power to several sawmills and sugar refineries. In addition, there will be a street-lighting system of 25 arc lights and 40 incandescents. Heine boilers, Harrisburg steam engines and Fort Wayne electric apparatus will be used. The plant is expected to be in operation early during the coming fall. The plans and specifications were prepared by Warren B. Reed, a consulting engineer of New Orleans. The complete contract is in the hands of Muralt & Co. of New York.

ELECTRIC RAILWAYS.

Articles of incorporation have been filed with the county clerk at Reno, Nev., by the Interurban Electric Railroad Company, with a capital stock of $100,000. Several citizens of Reno will subscribe to build a scenic park on a tract of land south of the city, owned by the Interurban Heights Company.

An all-round increase of 4½ cents per hour has been granted by the British Columbia Electric Street Railroad Company to all its motormen and conductors in Vancouver, Victoria and New Westminster. The pay varies from 20 cents per hour for the first six-months' men to 31½ cents per hour to those over 10 years in the service. The men had asked for from 24 to 35 cents.

An extension of 50 days' time has been granted by the Chicago City Council to the various factions of the Chicago Union Traction Company in which to complete the turning of their properties over to the Chicago Railways Company, so that the traction settlement ordinance may be accepted. It is understood that sufficient stock has been deposited to make the transfer and that the plan of reorganization is satisfactory, but several legal matters still remain for final adjustment.

Frank Gavitt of Whiting, Ind., has been granted a franchise for street-railway lines on Broadway, Fifth Avenue and Eleventh Avenue, Gary, Ind., in the face of efforts of the United States Steel Corporation to extend its control over public utilities of the town. The franchise extends over a term of 50 years and provides cars shall be in operation inside of two years. Four other persons were seeking to secure the franchise. Col. A. Murphy headed a delegation of residents who urged the trustees to grant the franchise to the company making the best offer. The Gavitt syndicate offered eight rides for 25 cents and agreed to pay five per cent. of its earnings to the city.

It is reported that American interests are planning the construction of the proposed high-speed electric railway between Budapest and Vienna, which will cost about $25,000,000. A third-rail system controlled by a Detroit company may be used. Starting from an underground station under the Rokus Hospital, in Budapest, the line will cross the Danube between Kaposztasmegyer and Bekasmegyer, and then proceed along the right bank of the Danube, crossing that river again in a direct line from Komaron, and entering Austrian territory at Deveny. After leaving Deveny the railway will cross the Danube once more between Grosz Entersdorf and Frendenau, and will terminate at the Karlsplatz, Vienna. The road will be 160 miles long, and some of the trains may make the run in two hours, or in half the time consumed by the Hungarian state steam road now operating between the Hungarian and Austrian capitals.

POWER TRANSMISSION.

The contracts which have been closed with the United States government for the waterpower for the generating of electric current for the big chlorination process mill in the Wonder mining district of Nevada provide for 2,000 horsepower throughout the year and 4,000 horsepower from March 15th to September 14th of each year. The water will be obtained from the 125-foot waterfall on Carson River, about 16 miles from Fallon. At this point three-phase generators driven by turbine wheels will be installed. The electric power will be transmitted 35 miles.

PUBLICATIONS.

The July number of Lux, a small magazine published by the Nernst Lamp Company, has, as usual, a large variety of good reading on the subject of correct lighting.

The latest edition of Fortschritte der Elektrotechnik, a quarterly record of the advance in electrotechnics, published by Julius Springer in Berlin, contains a complete comprehensive account of the progress of the art during the third quarter of 1906. Topics relating to the various branches of the electrical industry are classified with German thoroughness.

The Fort Wayne Electric Works has just issued three new bulletins, handsomely illustrated and containing some of the latest information on the subjects treated. Bulletin No. 1094 goes into the details and advantages of the company's belted direct-current generators, type LF. Bulletin No. 1095 treats exhaustively of enclosed alternating-current multiple arc lamps, and bulletin No. 1096 has to do with the interesting line of type A transformers.

The Warren Electric Manufacturing Company of Sandusky, Ohio, has issued an interesting bulletin, No. 30, on revolving-field alternators. Some excellent illustrations of the machines are given. In the electrical field the name Warren has become associated with the well-known inductor-type alternator, which for the last 10 years has held a leading position among users of alternating-current apparatus, but to meet a demand that exists for a lighter weight machine, this company has brought out a complete line of belt-driven waterwheel-type and direct-connected engine-type revolving-field alternators. These machines are made in either single phase, two phase or three phase, and, owing to the spacing of the coil slots, the same frame can be used for any phase desired by changing the armature coils. For example, if a customer purchases a single-phase 85-kilowatt alternator, he can at any time convert it into a 100-kilowatt two or three phase, by merely changing the armature coils.

The Oerlikon Company of Zürich, Switzerland, is sending out a number of handsomely illustrated pamphlets descriptive of its electrical products. One of these is devoted to a device for decomposing water electrolytically on a commercial scale. One cubic yard of hydrogen and half as much oxygen are obtained by the expenditure of 4½ kilowatt-hours. The machines are made in several sizes, the largest being capable of disassociating about 79 pounds of water per hour. The gases produced are very pure, and may be obtained at comparatively high pressures.

SOCIETIES AND SCHOOLS.

The annual convention of the American Street and Interurban Railway Engineering Association will be held at Atlantic City, N. J., during the week beginning October 14th. Data sheets have been sent to general managers and engineers, with the request that they be filled out, giving accounts of the work done in maintenance and inspection of electrical equipment. As usual, the "Question Box" will be valuable in bringing many miscellaneous matters before the convention. S. W. Mower, general manager Southwestern Traction Company, London, Ont., and the secretary and treasurer of the association, writes that this will be the greatest street-railway convention the world has ever known, and urges all electric-railway men to make other plans secondary to attending it.

TELEGRAPH.

The Western Union Telegraph Company is getting ready to open up business on the Colorado Southern Railroad. A force of workmen is now engaged west of Baton Rouge, La., putting up the poles. The workmen have had a difficult time in some places erecting the poles, and have been forced to work in water waist deep in pushing the construction of the line. The Western Union company will also build a line on the Southern Pacific Railroad from Lafayette to Baton Rouge.

The Dean Rapid Telegraph Company of Kansas City, Mo., has been organized to introduce a system of high-speed telegraphy invented by Robert L. Dean. Using a machine with a keyboard similar to a typewriter, the sending operator first prepares a perforated strip which is fed into the transmitting apparatus. This sends the message over the wire to a receiving device which makes a record to be read at leisure. Actual transmission over the wire may be accomplished at a rate of over 1,000 words a minute, it is said. A metallic circuit was first necessary, but the company says that the system has lately been operated with a grounded return on a 900-mile line.

MISCELLANEOUS.

The taxpayers of Medicine Hat, Alb., have voted favorably on a by-law to provide $50,000 for a fire-alarm system.

The United States Geological Survey announces preliminary statistics of the production of minerals in the United States in 1906 as follows, the quantity and values being given: Pig iron, 25,307,191 long tons, $505,700,000; aluminum, 14,910,000 pounds, $4,262,286; Portland cement, 46,463,424 barrels, $52,446,186; natural cement, 4,055,797 barrels, $2,423,170; sheet mica, 1,423,100 pounds, $252,248; scrap mica, 1,489 short tons, $22,742; nickel, cobalt, molybdenum, titanium, uranium, vanadium and tantalum, $64,660; tungsten, $393,667.

TRADE NEWS.

The Lord Electric Company of New York announces the recent removal of its office, factory and construction department to 213 West Fortieth Street, New York city. In the new location the company is in better condition than ever before to take care of the wants of its customers.

BUSINESS.

The Monarch Telephone Manufacturing Company of Chicago has just installed a 600-line magneto-multiple switchboard at Robinson, Ill., for the Crawford County Mutual Telephone Company. The installation was in charge of Mr. F. J. Travis.

Queen & Co., Philadelphia, Pa., manufacturers of scientific instruments, have published a large hanger illustrating their testing sets. The tests executed by the sets illustrated include measuring resistances, measuring insulation resistances, comparing electromotive forces, checking up voltmeters, checking up ammeters, measuring battery resistance, testing out grounds, etc. Queen & Co. will be pleased to send one of these hangers to anyone interested.

The Boston cable clip consists merely of two pieces of steel wire and a strap of sheet zinc, eliminating rivets, pins or buttons and consequently breakage from these sources. It is adjustable to different sizes of cable, the straps being furnished in different lengths. Being wholly adjusted by hand, it is more easily and firmly attached than any form demanding the use of pliers. This simple and strong clip is illustrated and described in a little folder just issued by the Chase-Shawmut Company of Newburyport, Mass., the sole manufacturer.

It is learned through General Manager J. M. Kartholl that the largest business in its history is at present being enjoyed by the Reliance Instrument Company, 60-68 West Van Buren Street, Chicago, which has recently doubled its floor space. Besides manufacturing the "Reliance" volt and ammeters and doing extensive repair work on meters and spark coils, the company devotes considerable time to the building to order of lines of special apparatus. Energy, good faith and conscientious work are apparently the keynotes of the company's success.

The Edison Manufacturing Company of Orange, N. J., quotes from a letter from Mr. James Craig, the owner of the winning boat in the recent race from New York to Bermuda, as follows: "You will no doubt be interested to know that the Ailsa Craig (winner of the James Gordon Bennett Cup), for race from New York to Bermuda, was equipped with your Edison V-type cells and spark coil, and they served the purpose properly." The Edison Company thinks that if a battery has any weaknesses, a run of 771 miles is pretty sure to expose them. The Edison Manufacturing Company has some booklets on the battery problem, which can be secured for the asking.

ILLUSTRATED ELECTRICAL PATENT RECORD.

Issued (United States Patent Office) July 2, 1907.

858,363. Telephone Exchange. Clarence A. Anderson, Lindsborg, Kan. Application filed May 18, 1903.

Switching is accomplished by electrical impulses in one direction, while those in the reverse direction effect control and release.

858,377. Electromagnetic Register. Isidor Fluegelman, Philadelphia, Pa. Application filed June 7, 1906.

An armature attracted by an electromagnet operates a pawl engaging the ratchet wheel of a mechanical counter.

858,391. Primary Battery. Charles E. Hite, Burlington, N. J., assignor to the Hite Electric Company. Application filed December 23, 1905.

This primary cell is divided at its upper extension into a number of compartments open at the bottom and top, the space beneath them forming a reservoir, from which fresh electrolyte is conducted to take the place of exhausted fluid.

858,392. Primary Battery. Charles E. Hite, Burlington, N. J., assignor to the Hite Electric Company. Application filed December 28, 1905.

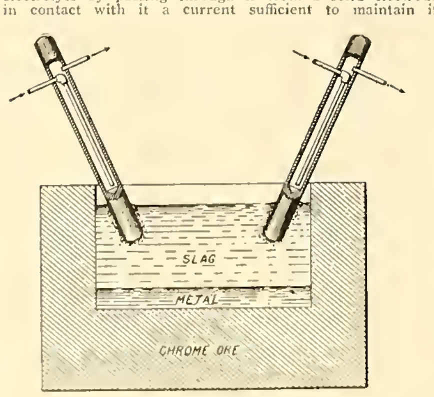
A number of pairs of electrodes are packed in porous depolarizing material, the whole forming with the porous coating a solid block through which the electrolyte percolates.

858,399. Controller. Michael Kelly, Hammond, Ind., assignor to Frank S. Betz, Chicago, Ill. Application filed September 22, 1906.

The controller comprises a base, resistance coils and a series of contact members, and is apparently designed to control therapeutic currents.

858,400. Electric-furnace Process. Franz von Kügelgen and George O. Seward, Holcombs Rock, Va. Application filed January 31, 1905.

The method consists in electrolyzing a pyro-conductive electrolyte by passing through it from a solid electrode in contact with it a current sufficient to maintain it molten, and cooling the electrode sufficiently to cause a portion of the electrolyte to be chilled in a protective but conducting coating thereon so that it becomes the working electrode. (See cut on next page.)



NO. 858,400.—ELECTRIC FURNACE.

858,425. Method of Control for Electric Motors. Norman W. Storer, Pittsburg, Pa., assignor to the Westinghouse Electric and Manufacturing Company, Pittsburg, Pa. Application filed July 24, 1905.

This method of operating a number of electric motors consists in first connecting them in series and then in parallel, preventing the current supplied to the motors from exceeding a predetermined amount regardless of their circuit relations, and preventing a change in the circuit relations of the motors from series to parallel when the current exceeds a value less than the aforesaid amount. (See cut.)

858,454. Telephone System. Edwin B. Heaford, Omaha, Neb. Application filed December 31, 1906.

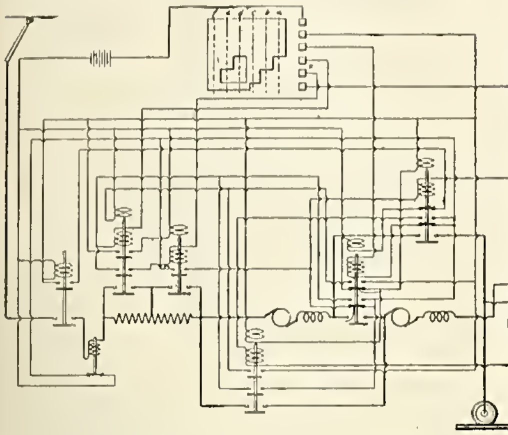
A resistance and impedance circuit bridge the springs of the jack and are inductively related to the cut-off relay, around which is a high resistance shunt.

858,467. Automatic Device for Starting Motors. Walter J. Richards, Milwaukee, Wis. Application filed January 23, 1903.

Eighty-one claims were allowed on this device, which combines a fluid pump, motor means for intermittently driving it and a pressure system supplied by the pump, with a numèbr of valves, some of which are electromagnetically operated. (See cut on next page.)

858,468. Controlling Apparatus. Walter J. Richards, Milwaukee, Wis. Application filed April 11, 1904.

This control apparatus is designed to operate a pump as long as the pressure in the reservoir is below a predetermined value. The control is by auxiliary contacts on a pressure gauge pointer, which close the operative connections.



NO. 858,425.—CONTROL OF ELECTRIC MOTORS.

858,469. Fluid-pressure System. Walter J. Richards, Milwaukee, Wis. Application filed October 6, 1904.

This is a variation of the principle of the preceding patent, adapted for the control of alternating-current motors.

858,470. Fluid-pressure System. Walter J. Richards, Milwaukee, Wis. Application filed November 19, 1904.

When the reservoir pressure reaches a predetermined maximum, the valves of the pump are rendered ineffective by electromagnetic means, independently of the motor operation.

858,471. Controlling Apparatus for Pressure Systems. Walter J. Richards, Milwaukee, Wis. Application filed January 3, 1905.

In a fluid compression and storage equipment are electromagnetically controlled unloading means normally effective to unload the compressor, actuated only after the motor has reached normal speed whereby the compressor becomes effective.

858,474. Attachment for Electric Meters. William L. Saunders, Denver, Colo., assignor of two-thirds to Daniel K. Hickey, Denver, Colo. Application filed June 27, 1905.

This is a casing to inclose the portions of the wires extending between the meter and the wall and having apertured projections, and screw bolts securing it, with a cord whose extremities may be sealed, extending through the apertures.

858,476. System of Control for Electric Motors. Otto E. Schairer, Pittsburg, Pa., assignor to the Westinghouse Electric and Manufacturing Company, Pittsburg. Application filed August 2, 1905.

For controlling a number of electric motors by connecting them either in series or in parallel relation, there are means for preventing the supply of more than a predetermined amount of current to the motors when connected in series, and other means that both prevents arrangement of the motors in parallel until after the current has fallen below a predetermined amount and thereafter prevents the current supplied to the motors from exceeding such an amount.

858,478. Controller for Storage Batteries and Similar Purposes. Frank L. Sessions, Columbus, Ohio, assignor to Joseph A. Jeffrey, Columbus, Ohio. Application filed October 29, 1903. Renewed November 9, 1906.

Means are described for combining two or more sources of electric supply, in series or in parallel, by electric translating devices.

858,481. System of Control for Electric Motors. Norman W. Storer, Pittsburg, and William Cooper, Wilkinsburg, Pa., assignors to the Westinghouse Electric and Manufacturing Company, Pittsburg, Pa. Application filed July 24, 1905.

Two or more electric motors have their circuits controlled by electrically operated and sustained switches, besides a switch for interrupting the circuits of the controlling magnet windings when the current supplied to all the motors exceeds a predetermined amount.

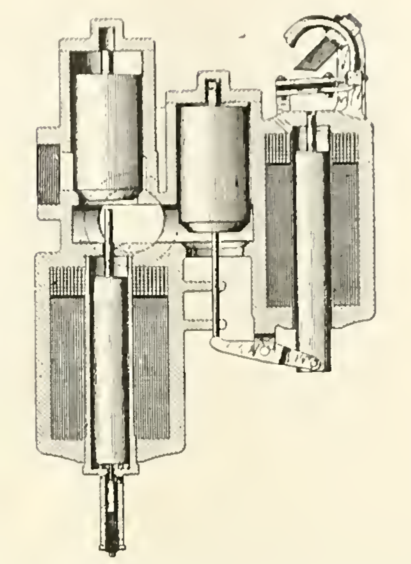
858,507. Process of Electric Welding. Weston M. Fulton and John S. Brown, Knoxville, Tenn., assignors to the Fulton Company, a corporation of Maine. Original application filed June 23, 1901. Divided and this application filed May 18, 1906.

The method consists in keeping the surfaces of the metal welded in contact, and passing an electric current from continuously moving electrodes through the parts, maintaining the contact-surfaces of approximately uniform conductivity by cleaning successive portions and thereby maintaining a uniform temperature of the parts to be welded.

858,554. Wireless Transmission. Harold A. Yarnell, Los Angeles, Cal., assignor to the Pacific Wireless Telegraph Company, Los Angeles, Cal. Application filed April 23, 1906.

An aerial capacity is connected to one terminal of the spark producer and a reservoir comprising an elongated subterranean chamber contains an elongated plate of great area insulated from the walls of the chamber and connected to the other terminal.

858,563. Galvanic Battery. Benjamin J. Blameuser, Chicago, Ill. Application filed January 20, 1906.



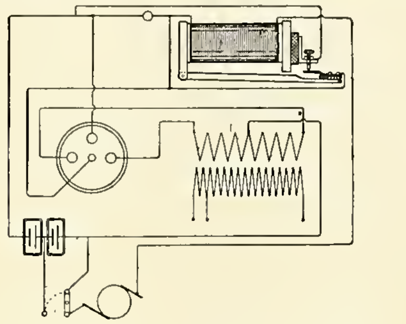
NO. 858,467.—AUTOMATIC DEVICE FOR STARTING MOTORS.

One element has a hollow body portion pendent in the container and provided with an opening. The receptacle has a laterally enlarged lower part on which the edges of the body portion of the element rest. A cap or cover of insulating material closes the opening.

858,569. Space Telegraphy. Sewall Cabot, Brookline, Mass., assignor to the Stone Telegraph and Telephone Company, Boston, Mass. Application filed November 5, 1906.

For purposes of secrecy in transmission there is included what the inventor terms a "weeding-out" circuit, based on principles of resonance.

858,574. Alternating-current Rectifier. William B. Churcher, Cincinnati, Ohio, assignor to Kenton Dunham, Cincinnati, Ohio. Application filed August 4, 1905.



NO. 858,574.—ALTERNATING CURRENT RECTIFIER.

The rectifier is primarily based on the action of a polarization cell. A primary coil, a secondary coil and a relay are necessary to its operation. (See cut.)

858,591. Circuit-controlling Means. Ellsworth E. Flora, Chicago, Ill., assignor to the Zorge Safety Railway Equipment Company. Application filed October 11, 1906.

Electrical circuits completed by the car wheels and axle operate relays to actuate semaphore or other signals.

858,606. Indicator. Earle L. Kelzer, Catella, Alaska, and Wesley P. Rodgers, Seattle, Wash. Application filed March 1, 1907.

A signal lamp on an elevator-car is controlled by an electromagnetic circuit-closer operated by projecting abutments in the shaft.

858,611. Electric Signaling Apparatus. William W. Lovett, Los Angeles, Cal. Application filed November 12, 1906.

A telephone set is connected to a cable wound on a reel, through the bearings, so that the cable may be unrolled while maintaining telephonic connection with the free end.

858,621. Process of Electrically Reducing Oxide Ores. Albert J. Petersson, Alby, Sweden. Application filed October 30, 1906.

858,622. Method of Carrying Out Metallurgical Reduction and Melting Processes. Albert J. Petersson, Alby, Sweden. Application filed October 30, 1906.

858,623. Process of Continuously Producing Carbide from Lime and Carbon. Albert J. Petersson, Alby, Sweden. Application filed October 30, 1906.

All three patents describe the technical process in the operations as titled by use of the electric furnace.

858,632. System of Electrical Operation. Joel C. Slaughter, Dallas, Tex., assignor to the Electric Auto-Transformer Company, St. Louis, Mo. Application filed May 9, 1903.

A transformer is arranged to raise the voltage supplied by a generator during reduced loads and thereby allow the field excitation to be reduced so as to permit operation at greater economy. The transformer may be disconnected, allowing the generator to feed directly into the line when the use of the transformer does not effect an economy.

858,637. Telephone Attachment. William H. Stinson, De Funiak Springs, Fla. Application filed March 13, 1905.

Apparently to furnish a record of the number of calls received, this invention provides that for each call a ball shall drop into a receptacle, to be held there until counted.

858,668. Receiver for Electrical Oscillations. Peder O. Pedersen, Copenhagen, Denmark. Application filed June 28, 1906.

The receiving apparatus for a wireless system comprises a circuit of vibration having inductance and capacity, and a contact device adapted to close the circuit of vibration directly at one position of its throw and to complete a divided circuit, containing a wave indicator, at the other position.

858,676. System of Electrical Operation. Joel C. Slaughter, Dallas, Tex., assignor to the Electric Auto-Transformer Company. Application filed March 12, 1903.

To control economically the electrical generation in an alternating generator system during reduced loads, the field excitation of the generator is decreased, and simultaneously the output of a voltage raising device in the generator supply circuit is adjusted to maintain a predetermined voltage.

858,687. Ignition System for Explosion Engines. Richard Varley, Englewood, N. J., assignor to the Autocoil Company. Application filed May 31, 1906.

Regulation is secured through the slipping of friction wheels, when the normal pressure is decreased by a centrifugal device.

858,688. Vibrator Adjustment for Induction Coils. Richard Varley, Englewood, N. J., assignor to the Autocoil Company. Application filed April 8, 1907.

This vibrator for induction coils comprises a pivoted member having a pair of resilient leaves and a screw having a reduced portion with terminal shoulders embracing the leaves, with means for adjustment.

858,692. Electric Cloth-cutting Machine. Edward M. Waring, New York, N. Y. Application filed August 5, 1905.

This electric-cutting machine is a combination of a vertically reciprocating knife, an electric motor for driving it and abrasive wheels driven at will by friction with the armature of the motor.

858,699. Outlet Box. Leon W. Bossert, Utica, N. Y. Application filed February 10, 1906.

858,700. Outlet Box. Leon W. Bossert, Utica, N. Y. Application filed April 25, 1906.

The feature of the first box is a fixture stem supported off the rear of the box by curved legs. The second box has a series of removable plugs entirely severed from the wall and held in place by projecting lugs.

858,718. Electric Furnace. Paul L. T. Héroult, La Praz, France, assignor to the Societe Electro-Metallurgique Francaise, Froges, Isère, France. Application filed April 18, 1906.

The base plate serves as a current terminal, being made of cast iron with rods of wrought iron extending into the body of the furnace.

858,720. System of Electrical Distribution. Albert S. Hubbard, Greenwich, Conn., assignor to the Gould Storage Battery Company. Application filed February 21, 1903.

The system utilizes a combination of storage cells, generator, booster work circuit and adjustable resistances.

858,730. Electric-current Interrupter for Ignition Systems. Leon J. Le Pontois, New Rochelle, N. Y., assignor to the Polyphase Ignition System Company. Application filed December 11, 1905.

The contact points are immersed in a bath of a non-volatile and electrically non-conductive liquid. Cams positively reciprocate one of the terminals toward and away from the other, which is yieldingly supported.

858,732. Trolley Pole Controlling Device. William Lile, Venice, Ill. Application filed June 28, 1906.

When the trolley-wheel leaves the wire, the effective abutment for the spring is destroyed and the pole allowed to drop.

858,734. Magnetic Separator. Thomas J. Lovett, Chicago, Ill. Application filed October 9, 1906.

In combination are a rotary electromagnet and conveyer belt movable at different relative speeds, and chain belt engaging wheels rotating upon the same axis as the magnet, operating to maintain the chain belt close to, but out of contact with the magnet.

858,739. Combined Portable Telephone and Telegraph Instrument. Frederick W. Medhurst, Hobart, Tasmania, Australia. Application filed March 8, 1907.

An arrangement of combined telephone and telegraph sets to secure compactness and portability is described. Either is available by throwing one switch.

858,767. System for Party Lines in Telephone Exchanges. Julius M. Storkerson, La Crosse, Wis. Application filed April 25, 1906.

The line has two limbs; of the two relays associated with each line one has contacts to connect the line to the second relay and is also adapted to connect the line to one of the series of multiple jacks. The other relay has contacts to connect the line to another series of multiple jacks.

858,775. Night-service Attachment for Telephone Lines. Clarence E. Ackerman, Vernon Township, Shiawassee County, Mich. Application filed September 27, 1905.

An arrangement of switches in magneto exchanges that any subscriber by a switch grounding one terminal of his instrument may call the doctor or other special line without disturbing central.

858,780. Electric Furnace Process of Making Low-carbon Metals or Alloys. Frederick M. Becket, Niagara Falls, N. Y., assignor to the Electro

Metallurgical Company. Application filed January 30, 1906.

The process of producing low-carbon ferro-alloys consists in smelting a charge of ore, a reducing agent and a source of iron by a large electric current carried by a carbon electrode of relatively small sectional area, and cooling the electrode and protecting it from oxidation throughout a considerable portion of its length.

858,793. Railway Traffic Controlling Apparatus. Clyde J. Coleman, Rockaway, N. J., assignor to the Hall Signal Company. Application filed November 7, 1904.

The system of signaling includes fluid pressure apparatus to operate signals, the valves of which are actuated by magnets controlled by a thermopile, which receives its energy from a source of heat arranged to beat the motive fluid.

858,797. System of Electric Control. Wolfgang E. Ebert, St. Louis, Mo. Application filed December 1, 1905.

A system of electrical control, comprises a number of receiving units, a series of contacts at each electromagnetic devices at the receiving units controlling the contacts and of which the circuit is normally completed.

858,819. Support. William B. Oliver, Sharon Hill, Pa., assignor to the Oliver Manufacturing Company, Philadelphia, Pa. Application filed June 15, 1906.

858,820. Support. William B. Oliver, Sharon Hill, Pa., assignor to the Oliver Manufacturing Company, Philadelphia, Pa. Application filed June 15, 1906.

858,821. Adjustable Support. William B. Oliver, Sharon Hill, Pa., assignor to the Oliver Manufacturing Company, Philadelphia, Pa. Application filed September 13, 1906.

858,822. Telephone Stand. William B. Oliver, Collingswood, N. J., assignor to the Oliver Manufacturing Company, Philadelphia, Pa. Original application filed June 15, 1906. Divided and this application filed January 15, 1907.

These four patents describe forms of telephone stands or supports arranged to hold the instrument in easy and comfortable position. Details of construction are described.

858,836. Telephone Extension-arm Appliance. Burton W. Sweet, Cleveland, Ohio, assignor to the Century Telephone Construction Company, Buffalo, N. Y. Application filed September 22, 1906.

A removable mounting appliance for the telephone, comprising bracket and socket members adapted to be secured rigidly to the telephone and to the extension-arm.

858,846. House-wiring Conduit System. Harry Alexander, New York, N. Y. Application filed March 22, 1906.

A conduit system to be permanently located in a building, the system comprising a number of intercommunicating conduits embedded in partitions along the locus of the probable locality for an outlet.

858,862. Primary and Secondary Battery. Thomas A. Edison, Llewellyn Park, Orange, N. J., assignor to the Edison Manufacturing Company, West Orange, N. J. Application filed January 10, 1906.

The present cell described by Mr. Edison is reversible, as well as being available for a primary battery. It employs electrodes of zinc and nickel hydroxide in an electrolyte containing silicate of potash.

858,909. Electric Bell. Nelson H. Raymond, Brooklyn, N. Y., assignor to Alice C. Patterson, New York, N. Y. Application filed August 24, 1905.

Claim of novelty is made for the contact post which is fastened to the base in a new manner.

858,910. Armature Banding Apparatus for Lathes. Charles Remelius, New York, N. Y., assignor to the Columbia Machine Works and Malleable Iron Company, Brooklyn, N. Y. Application filed March 22, 1907.

A reel and swing-arm are borne on the tool-carriage of the lathe, and apply the banding wire automatically.

858,925. Burglar Alarm. Carlos Van Bergh, Winnipeg, Manitoba, Canada. Application filed December 22, 1906.

A number of conductors are suspended to form a curtain, adjacent members being insulated. Contact of any two sets a continuous-ringing alarm into operation.

858,928. Ignition System for Explosion Engines. Richard Varley, Englewood, N. J., assignor to the Autocoil Company. Application filed April 5, 1907.

An ignition system for explosion engines, using a coil having a vibrator, and also an additional or auxiliary vibrator coil, to operate in the primary circuit.

858,941. Electromagnet. George Baehr, McKeesport, Pa., assignor to the National Tube Company, Pittsburg, Pa. Application filed April 4, 1907.

An electromagnet comprises a core with parallel side pieces at the ends and a number of pole pieces carried by each side-piece. The adjacent pole pieces are separated from each other and of alternating polarity.

858,944. Telephone Receiver Holder. Henry S. Bepler, Allegheny, Pa. Application filed September 26, 1906.

A telephone receiver holder formed from a single piece of wire doubled upon itself.

858,953. Automatic Time Switch. Herbert H. Churchill, Pueblo, Colo., assignor of three-eighths to Earnest E. Churchill and two-eighths to Harry P. Vories, both of Pueblo, Colo. Application filed February 27, 1906.

A crank under constant stress for throwing the switch is released by clock mechanism at a predetermined hour.

858,955. Electrically Heated Tool. Walter G. Clark, New York, N. Y., assignor to the Parker-Clark Electric Company, New York, N. Y. Application filed October 6, 1906.

A handled tool having sockets with walls which are conductors of heat but not of electricity, and electric heating means in direct contact with the socket walls.

858,956. Electrical Spark-timer Device. Robert Clarke, Mount Vernon, Ohio. Application filed May 28, 1906.

In combination are a traveling contact roller having beveled edges, a pair of contact rings adjacent the path of the roller and having beveled edges forming a guide groove for the roller, the beveled edge of the roller making a continuous rolling and wiping contact with the beveled edges of the rings.

858,984. Telephone Transmitter. Newman H. Holland and George W. Kauser, Chicago, Ill., assignors to Ernest H. Stolz, Chicago, Ill. Application filed July 28, 1906.

A transmitter comprising a sensitive diaphragm secured at its edges, a ring-shaped member bearing upon it, a second diaphragm more rigid than the first spanning the member and adapted to receive vibrations from the first diaphragm through the member and transmit them to a microphone.

859,011. Electrotherapeutic Apparatus. Nelson H. Raymond, Brooklyn, and Joseph C. Vetter, Coney Island, N. Y., assignors to Alice C. Patterson, New York, N. Y. Application filed August 24, 1905.

A medical induction coil is arranged inside of a case, with a ratchet to operate the sleeve.

859,018. Transportation System. Franklin S. Smith, Philadelphia, Pa., assignor to the Electric Carrier Company, Camden, N. J. Application filed November 21, 1906.

An electric transportation system including a fixed member having windings to be connected with a source of alternating current, a movable member adapted to be inductively energized by the fixed member, and means carried by the movable member for causing energization of the windings of the fixed member when in the immediate vicinity.

859,019. Electric Transportation System. Franklin S. Smith, Philadelphia, Pa., assignor to the Electric Carrier Company, Camden, N. J. Application filed March 11, 1907.

An electric transportation system consisting of a fixed member, tracks adjacent to and parallel with two of its opposite faces, and movable members adapted to be connected with a source of alternating current supply to occasion their movement in opposite directions upon the tracks.

859,021. Means and Apparatus for Producing High Vacuums. Frederick Soddy, Glasgow, Scotland. Application filed July 13, 1906.

After subjecting a vessel to preliminary exhaustion, a reagent introduced into the vacuum is heated by electrical means to absorb the condensed and occluded gases.

859,029. Electrical Apparatus. Joseph C. Vetter, Coney Island, N. Y., assignor to Alice C. Patterson, New York, N. Y. Application filed August 24, 1905.

A compact arrangement of medical battery, induction coil and interrupter is described.

859,056. Rail Bond. Thomas C. Folsom, Tampa, Fla. Application filed October 23, 1906.

A rail bond for a rail having a cavity in its base, opening upward through one of the flanges, has a terminal with a slotted tapered tongue fitting in the cavity, which is completely filled by a mass of solder, locking the slotted portion of the tongue in place.

859,062. Spark-gap Apparatus. Walter W. Massie, Providence, R. I. Application filed January 16, 1906.

The spark-gap rods of the enclosed gap have openings for the passage of a cooling medium.

859,115. Illuminating Attachment for Sights for Ordnance. George N. Saegmuller, Rochester, N. Y. Application filed April 9, 1907.

A small electric light, by an arrangement of lenses and prisms, illuminates the reticule or cross-hair in the telescope sights for long-range guns.

859,132. Smelting Process. Frederick T. Snyder, Oak Park, Ill., assignor to the Electric Metals Company, Chicago, Ill. Application filed June 11, 1906.

859,133. Smelting Furnace. Frederick T. Snyder, Oak Park, Ill., assignor to the Electric Metals Company, Chicago, Ill. Application filed June 18, 1906.

859,134. Smelting Process. Frederick T. Snyder, Oak Park, Ill., assignor to the Electric Metals Company, Chicago, Ill. Application filed June 25, 1906.

859,135. Metallurgical Process. Frederick T. Snyder, Oak Park, Ill, assignor to the Electric Metals Company, Chicago, Ill. Application filed June 30, 1906.

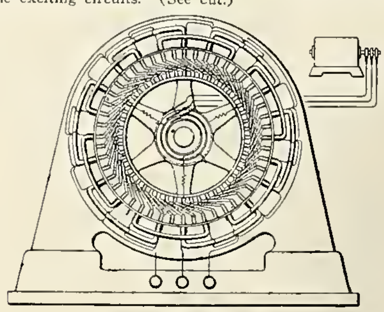
859,136. Electric Furnace. Frederick T. Snyder, Oak Park, Ill., assignor to the Electric Metals Company, Chicago, Ill. Application filed June 30, 1906.

859,137. Electric Furnace. Frederick T, Snyder, Oak Park, Ill., assignor to the Electric Metals Company, Chicago, Ill. Application filed July 25, 1906.

The foregoing patents, six in number, relate to the technical details of construction and operation of electric furnaces for the smelting and reduction of ores and the manufacture of certain chemical products.

859,143. Method of Generating and Distributing Electrical Energy. William Stanley, Great Barrington, Mass. Original application filed October 27, 1903. Divided and this application filed January 20, 1904. Renewed April 26, 1907.

A method of generating alternating currents in an alternating-current system consists in exciting the field of the generator by low frequency polyphase alternating currents setting up thereby a rotating magnetic field, inducing alternating currents of normal frequency by the field thus produced and by relative mechanical rotation of the field structure and armature such as to cause the field to slowly cut the exciting circuits from front to rear and cause the low-frequency currents to react upon the exciting circuits. (See cut.)



NO. 859,143—GENERATION AND DISTRIBUTION OF ELECTRICAL ENERGY.

859,147. Automatic Alarm Device. Louis Strodtbeck, Middletown, Ohio. Application filed January 18, 1907.

An electric-alarm circuit is closed by the falling of a valve when the flow through a pipe ceases.

859,163. Controlling and Braking Device for Electric Elevators. Parvin Wright, Los Angeles, Cal. Application filed January 19, 1905.

The cable mechanism opens one of the limit switches when the elevator reaches its limit of movement in either direction. A brake for the cable mechanism, and means acting to set it, with a magnet for releasing the brake, are connected in both of the operating circuits and allow the brake to set on operation of either limit switch.

859,178. Process of Treating Liquors by Electricity. Christian H. C. Koch, Chicago, Ill., assignor to the Chicago Distributing and Trading Company, Chicago, Ill. Application filed September 5, 1902.

The process of treating liquors consists in confining the liquor in a wooden receptacle, the complete interior surface of which is wood, so that nothing but the wood comes in contact with the liquor, then applying electrodes at opposite points on the exterior and connecting the electrodes in an electric circuit through which a current is passed, transmitting the current to the liquor in the receptacle through the wood which is in contact with the liquor.

859,181. Fan Support. Montezuma Scott, Chicago, Ill. Application filed September 10, 1906.

Two vanes are rotatably supported by the base of the apparatus and connected with two arms fixed parallel by a link which carries a member fixed to it and extending at a right angle to be engaged by a projection in the rotation of the table.

859,182. Rail-spread Detector for Railway Trains. Joseph A. Shires, Denver, Colo. Application filed February 16, 1907.

Provision is made for a car axle to be endwise extensible to press flanges against rail. By the breaking of an electric circuit the spreading of the rails may be detected.

859,186. Controller. Louis J. Monahan, Oshkosh, Wis. Application filed July 11, 1906.

Rigid with the handle is a contact collar comprising a ring with brass segment on its periphery adapted to be sleeved on the crank and revolve under and in contact with the brush under the tension of a spring.

PATENTS THAT HAVE EXPIRED.

Following is a list of electrical patents (issued by the United States Patent Office) that expired July 8, 1907:

431,551. Electric Ceiling Block. W. C. Bryant, Bridgeport, Conn.
431,559. Magneto-electric Machine. A. E. Colgate, New York, N. Y.
431,564. Apparatus for Cutting Electrical Conduit Pipes. S. P. Denison, Brooklyn, N. Y.
431,597. Electric Signaling Apparatus. G. B. Lehy, Medford, Mass.
431,598. Signaling Apparatus. G. B. Lehy, Medford, Mass.
431,617. Apparatus for Preparing Electric Accumulator Plates. C. F. Pollak, Paris, France.
431,618. Regulator for Dynamo-electric Machines. G. A. Polson, New York, N. Y.
431,633. Conduit for Electric Railways. J. H. Wehrle, Newark, N. J.
431,634. Electric Railway. J. H. Wehrle, Newark, N. J.
431,649. Electric-motor Apparatus. S. C. C. Currie, Philadelphia, Pa.
431,651. Private-line Telegraphy. P. B. Delany, South Orange, N. J.
431,652. Railway Signal. S. T. Dutton, Worcester, England.
431,711. Electric Railway. S. H. Short, Cleveland, Ohio.
431,720. Electric Railway. R. M. Hunter, Philadelphia, Pa.
431,721. Means for Attaching and Detaching Electric Lamp Bulbs. S. J. Jacobs, New York, N. Y.
431,742. Galvanic Battery. C. R. Goodwin, Paris, France.
431,784. Printing Telegraph. G. B. Scott, Lakewood, N. J.
431,793. Automatic Telegraphy. F. Anderson, Peekskill, N. Y.
431,794. Automatic Telegraph. F. Anderson, Peekskill, N. Y.
431,823. Electric-railway Motor. F. J. Sprague, New York, N. Y.
431,879. Apparatus for Electrical Conversion. E. N. Dickerson, Jr., New York, N. Y.
431,962. Transfer-connecting Apparatus for Multiple Switchboards. E. M. Barton, Chicago, Ill.
431,968. Process of Forming Porous Pots for Voltaic Batteries. C. R. Goodwin, Paris, France.
431,977. Electric Railway. R. M. Hunter, Philadelphia, Pa.
431,979. Automatic Fire-alarm. H. E. Jacobs, Milwaukee, Wis.

WESTERN ELECTRICIAN

EVERY SATURDAY

Vol. XLI. CHICAGO, JULY 20, 1907 No. 3

The Manufacture of Nitrogenous Products by the Use of the Electric Arc.

Nitrogen and its compounds are the important constituents of explosives and fertilizers, and large quantities are used in mining and chemical operations. For centuries nitrogen has been chiefly derived from great natural deposits, such as the saltpeter beds of Chile. It is only in recent years, following Sir William Crookes' notable presidential address before the British Association for the Advancement of Science, that scientists have sought to discover methods, possible on a commercial scale, for drawing on that almost inexhaustible ocean of nitrogen and oxygen, the atmosphere On the occasion mentioned Sir William Crookes made the alarming prophecy that it is only a matter of time before the world will be facing starvation, owing to the extraction of nitrogen compounds from the soil to such an extent that wheat will no longer grow, while the sources of natural fertilizers must surely soon be exhausted.

As everybody knows, air is a mixture of four-fifths nitrogen and one-fifth oxygen—an explosive mixture, it might be said, for both the fuel and the oxydizer are in intimate contact. But the ignition temperature is very high, and even after being ignited the combustion is so feeble that not enough heat is generated to raise adjacent masses to the point of combination, so the action does not proceed through the mixture. This happy circumstance alone saves us from the alarming possibilities of a universal explosion following a summer's flash of lightning. For after severe lightning it has been observed that the rain shows a slight acidity from nitric acid generated by the electrical discharge. Under the electrical conditions of high temperature equal volumes of oxygen and nitrogen are combined to form the colorless gas, nitric oxide (NO). Exposure to oxygen changes this to the brown, pungent nitrogen peroxide (NO_2), which is very soluble in water, with which it combines to form nitric acid.

The above are, in brief, the chemical reactions, and the task of the investigators was to simulate artificially the natural phenomenon, using the high-tension electric arc to take the place of the lightning discharge. The experiments of Bradley and Lovejoy in America and of Birkeland and Eyde in Norway, were the first to advance to commercial proportions. The former's plant at Niagara Falls (described and illustrated in the Western Electrician of October 11, 1902) was abandoned two years ago, but the Birkeland-Eyde factory is now operating in Norway, manufacturing fertilizers principally.

After several years of work and study to overcome the weak points of preceding methods, Chicago inventors have recently fitted out a demonstration laboratory (Fig. 1) to produce on a commercial scale nitric acid from the atmosphere with the aid of the electric flame. The method and apparatus include some very interesting improvements over the other processes.

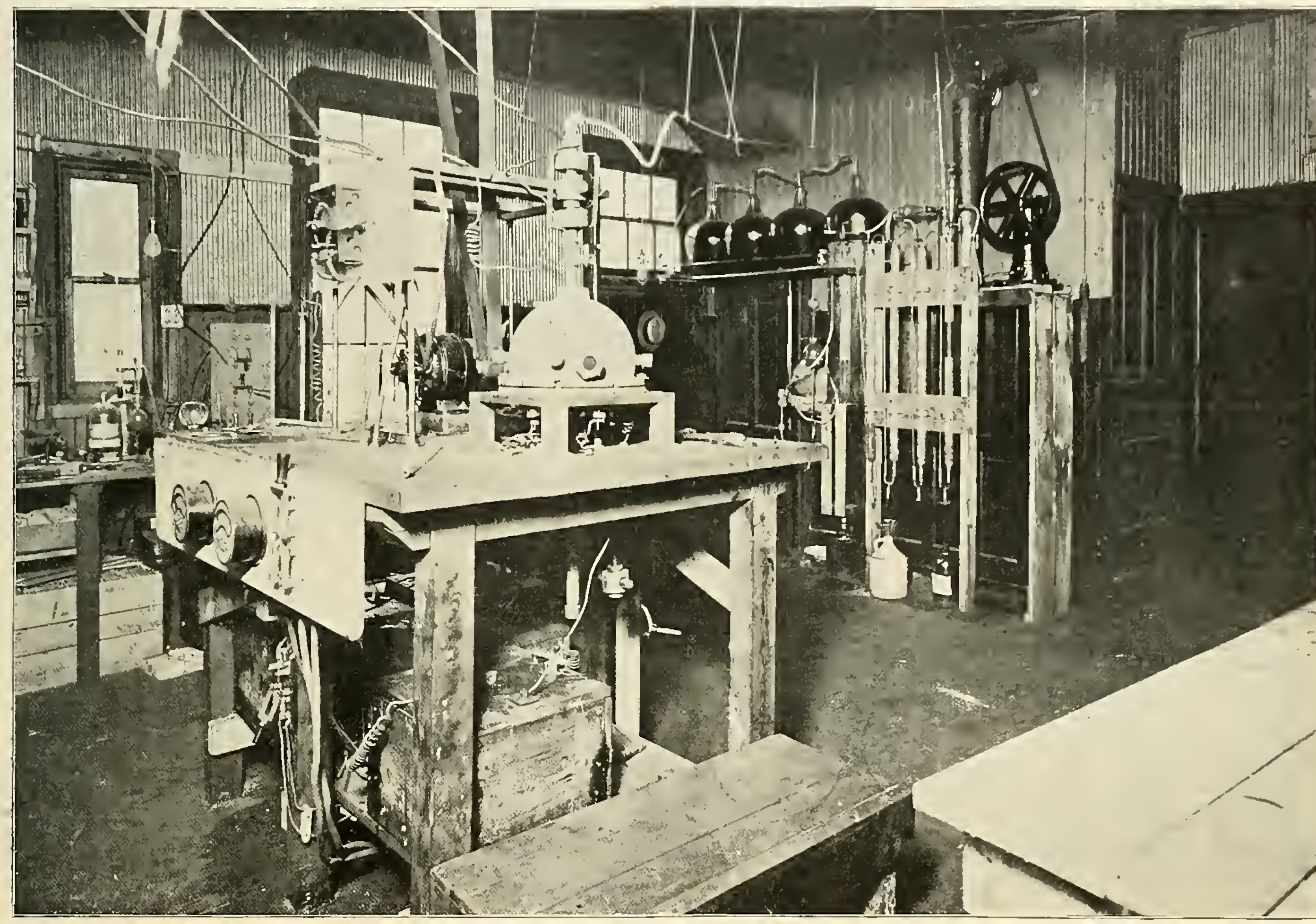


FIG. 1. GENERAL INTERIOR VIEW OF A CHICAGO LABORATORY WHERE NITRIC ACID IS PRODUCED BY THE ELECTRICAL METHOD.

In order to discover what character of flame best produced the desired nitric oxide, the products at different lengths, voltages and current intensities of the arc were analyzed. The results showed definite conditions for the maximum production of NO. A short length of the arc gives mostly nitrous oxide ("laughing gas"). As the flame is drawn out, more of the nitric oxide is made, until finally, when the arc breaks, the brush discharge which follows is almost entirely productive of ozone. Thus it will be seen that during the drawing out of the arc, only a fraction of the range is effective in nitric-oxide manufacture.

Previous experimenters, in order to expose as much air as possible to the arc, arranged to draw it out to its extreme length and smallest cross-section. In order to accomplish this, it was necessary to draw out, break and reform it many times a second. This was effected either mechanically, by separating the electrodes, or magnetically, by forming an intense magnetic field across the arc, causing it to lengthen and break. By both methods, in the light of the experiments carried out by the inventors of the new process, it would seem that during hardly one-third of the time it operated was the arc effectively producing nitric oxide.

The cue for improvement was to bring the flame to its most efficient form as quickly as possible, and so maintain it while exposed to the gases. A pressure of 33,000 volts was indicated as the proper potential to employ, and is obtained by transforming the 220-volt 60-cycle lighting current. A form of spark gap was developed, on the principle of the horn arrester, with upwardly diverging electrodes. When the current is turned on, the spark bridges the short gap at the bottom, and quickly rises and lengthens, until it reaches the upper ends, which are properly spaced so that the spark shall continue steadily and at its most efficient length.

Fig. 2 is from a photograph showing the flame and the form of electrodes. The camera shutter remained open while the arc bridged the short gap at the bottom and climbed up the electrodes until it finally established the steady intense flame shown at the top, which is the normal appearance during operation. Some idea of the time required to run up the electrodes is afforded by the bright spots along the edges, due to the alternations. Each spot shows the positive end of a spark, and since the frequency was 60 cycles per second, adjacent spots occurred one-sixtieth of a second apart. The 20 or so spots indicate that this spark ascended in about one-third of a second.

As a result of the arc immediately establishing its condition of greatest effectiveness, the inventors assert that many careful tests have shown that under identical conditions, and using the same power, the steady flame produces four times as much nitric oxide as the other forms.

It has seemed to the inventors of the earlier processes, necessary to blow the air past the combining flame in a rapid, continuous blast. The present system reverses this procedure, and by an arrangement of valves, the air is held in the chamber in contact with the flames. The advantage gained is that the temperature rise which the air undergoes, simply increases its pressure without rarefying it, so that more molecules are in contact with the flame to be acted on than if the air were allowed to expand freely.

Fig. 3 is a diagrammatic sketch of the apparatus now set up and operating at the inventors' laboratory, while Fig. 1 is a photograph of the apparatus, which may be examined in connection with the sketch. In each illustration the hemispherical vessel prominently shown is the combustion chamber, from which the delivery line is seen to lead to the combining vessels (large glass bottles or carboys), and thence to the long dissolving tubes at the right of these bottles. The transformers, one for each of the four flames, are to be seen under the table in Fig. 1. The air in the hemispherical chamber (which is shown more plainly in Fig. 4) is acted on by the flames. Meanwhile its expansion, due to the heat, is prevented by the electrically closed valve above, and the inwardly opening check valve below. The two commutators (see Fig. 3) differ by a few degrees and are rotated slowly by the small induction motor; one closes the primary circuit of the transformer supplying the flames, the other controls the outlet valve. (A small direct-current generator is really used instead of the battery indicated, but for large installations the valve will be mechanically operated.) The valve circuit is broken a second before the flames are extinguished, allowing the gases, under pressure, due to the heat, to escape into the line leading to the combining vessels. Now, when the flames are put out, the temperature of the remaining chamber contents falls rapidly, shrinking and sucking a fresh charge through the inlet check valve.

As the hot gases escape from the pressure of the chamber into the tube leading to the combining vessels (the row of large bottles shown in Fig. 1), the expansion requires nearly all of the excess heat, so that the gases coming from contact with the flames are cooled down to within a few degrees of the temperature at which they entered the intake several seconds before. How well the principle actually operates is shown in the photographs, where it will be seen that the gases leaving the intense heat of the chamber are led through the rubber tubing, which has been in position six months.

It is to be remarked that former methods, by which the gas left the flames hot and at low pressure, required cooling apparatus (on account of later reactions) to absorb the heat, which, of course, in the first place, came from the arc. The small increase in temperature of the gases leaving the flames over the outside atmosphere, in the present process, of itself shows that most of the energy of the arc is utilized in combining rather than heating the gases. The inventors say that the intermittent method, as now used, secures a gain of [illegible] per cent. over the method of a continuous rapid flow.

An excess of air over the amount which the flames will act upon is taken into the chamber, so that the gases leaving it are a mixture of NO, free oxygen and free nitrogen. In the combining vessels the free oxygen combines with the NO, producing the brown gas NO_2. The mixture of NO_2, nitrogen and any residue of free oxygen is allowed to bubble up through water in the tall tubes shown at the right in Figs. 1 and 3, where the NO_2 dissolves, forming nitric acid, while the free nitrogen escapes to the air.

The inventors are now occupied with a new process of separating oxygen from the air, in which the materials will be used over and over again, requiring only power. The air entering the chambers will then be enriched, so that its constituents are in proper proportion to be entirely converted, thus avoiding passing the surplus inert nitrogen through the apparatus.

FIG. 2. ELECTRIC FLAME FROM DIVERGING ELECTRODES USED IN PRODUCTION OF NITROGENOUS COMPOUNDS.

A concentrated form of the acid is secured (see Fig. 3) by spraying distilled water through an atomizer into a vessel filled with nitrogen peroxide (NO_2).

Of course, after securing the acid any other nitrogen compound may be manufactured. The product by this method is chemically pure, since nothing but air has entered into its making. The concentrated acid is as clear as water. When started, the operation is continuous and automatic, requiring little attention. Since the raw materials are air and water, practically the only operating expense is for the power.

A single generating unit has been in operation six months with complete success, and a battery of six chambers, with a capacity of one ton a day, is now being installed at 269 South Marshfield Avenue, Chicago. The process and apparatus are the invention of Mr. William Thomas, whose name has been well known to mechanical and electrical engineers for a number of years. He has been assisted by Mr. Gerald G. Barry, and the two, with others, have formed a manufacturing Company with downtown offices and the laboratory on South Marshfield Avenue.

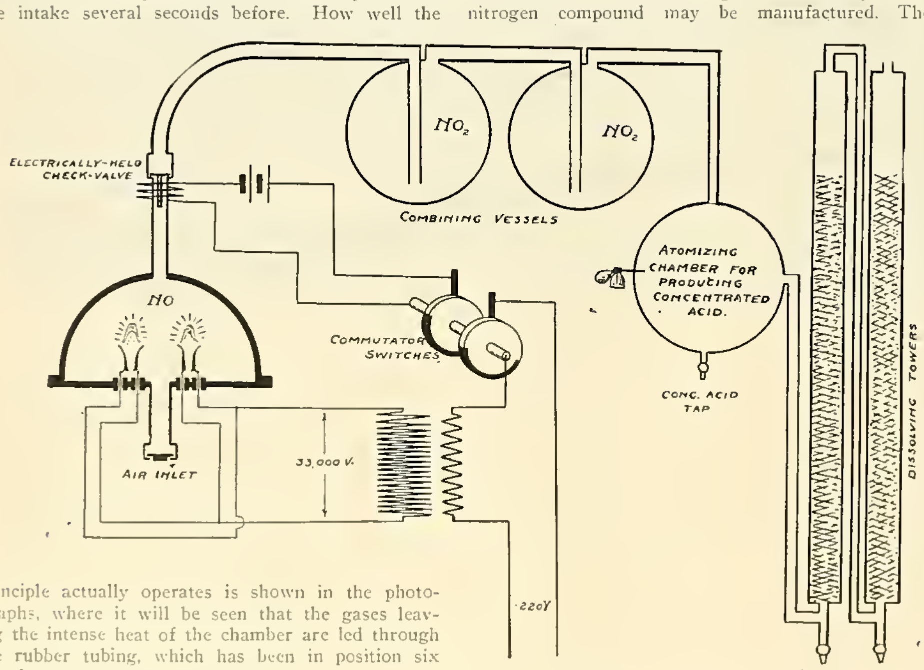


FIG. 3. DIAGRAM OF APPARATUS FOR ELECTRICAL PRODUCTION OF NITRIC ACID.

Proposed Consolidation of the Chicago Edison and Commonwealth Electric Companies.

Official action has been taken by the directors of the Chicago Edison Company which will undoubtedly result in the consolidation of the Chicago Edison and Commonwealth Electric companies of Chicago under the name of the Commonwealth Edison Company, with capital stock of $30,000,000. The two existing companies do the central-station business of Chicago, each in its own territory, and are controlled by the same interests, with the same list of officers, headed by Mr. Samuel Insull as president. This organization will undoubtedly be unchanged in the new company.

The present capital stock of the Chicago Edison Company stands at $13,614,165; that of the Commonwealth Electric Company is $10,000,000. The bond and debenture issues are about $8,000,000 for the Edison company and $8,500,000 for the Commonwealth company. It is proposed to increase the capital stock of both companies to $15,000,000. This will make the $30,000,000 stock of the consolidated company. The arrangement is such that practically $24,000,000 of the new stock will be issued in exchange for old Chicago Edison stock. In other words, the Chicago Edison stock is turned in at 160. As for many years this has been an eight per cent. stock, and as it is proposed to pay five per cent. dividends on the new stock, the dividend returns to Chicago Edison stockholders will be the same.

The annual meeting of the Chicago Edison Company was held on June 10, 1907, and adjourned until July 15, 1907, when the proposal for the consolidation was made public. Formal action on it was not taken, however, but a further adjournment was taken until September 16, 1907, when the proposition of the board of directors of the Edison company will be submitted to the vote of the stockholders. The proposition is in the form of resolutions adopted by the directors of the Chicago Edison Company on June 25, 1907, which are as follows:

"Whereas, The capital stock of the Chicago Edison Company is expected presently to be $15,000,000, divided into 150,000 shares of the par value of $100 each; and

"Whereas, The capital stock of the Commonwealth Electric Company is expected presently to be $15,000,000, divided into 150,000 shares of the par value of $100 each, which stock of said Commonwealth Electric Company is understood to have been pledged in whole or in part by its holders as security for the payment of the gold mortgage bonds of said Chicago Edison Company now outstanding to the principal amount of $6,000,000; and

"Whereas, It is believed that an early consolidation of said companies would be of advantage to stockholders and to the public generally; now, therefore, it is hereby

"Resolved, That the board of directors of this company desires a consolidation of this company with the Commonwealth Electric Company; that a proposition to effect such consolidation be submitted to a vote of the stockholders of this company at the adjourned session of the annual meeting, July 15, 1907, or at a future adjourned session thereof; that notice of the intended submission, as above stated, of a proposition for such consolidation be seasonably sent to the stockholders of this company, with a request for their attendance or their proxies; and that the consolidation of said companies be recommended to the stockholders of this company upon the following principal terms, that is to say: The name of the consolidated corporation to be Commonwealth Edison Company, and its total capital stock to be $30,000,000, divided into 300,000 shares of the par value of $100 each, 50 per cent. of such total capital stock to be issued in exchange for Chicago Edison Company stock, share for share, 30 per cent. to be issued (subject to the above-mentioned pledge) in exchange for Commonwealth Electric Company stock now held by certain individuals for the ultimate benefit of stockholders of the Chicago Edison Company, and the remaining 20 per cent. to go into the treasury of the consolidated company and to be issued and disposed of by its board of directors as and when said board may think advisable for the interests of the company.

"Resolved, Further, as this board is at present advised, that the existing mortgage of the Com-

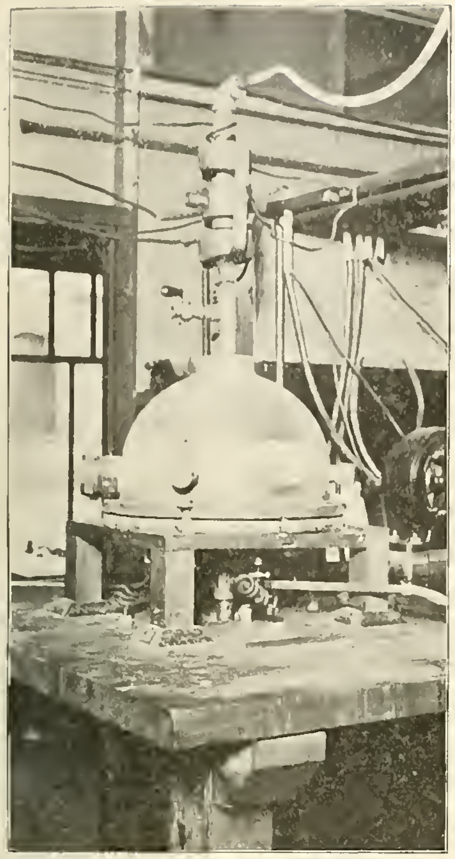


FIG. 4 ELECTRICAL PRODUCTION OF NITROGENOUS COMPOUNDS — COMBUSTION CHAMBER CONTAINING FOUR ARCS.

monwealth Electric Company should be adopted and used, as it may be, to cover future bond issues of the consolidated company; that the outstanding mortgage bonds of the Chicago Edison Company should be redeemed and canceled, as they may be, after 1910; that until such redemption the shares of stock of the consolidated company to which the stockholders of the Chicago Edison Company will be entitled upon consolidation should be represented by dividend-drawing trustees' certificates of the Merchants' Loan and Trust Company, trustee under the mortgage of the Chicago Edison Company, instead of by the usual stock certificates; that the first quarterly dividend of the consolidated company on the basis of present plans and the present outlook should be payable November 1, 1907, and be 1¼ per cent., so that stockholders of the Chicago Edison Company, through their interest in the Commonwealth Electric Company, may continue to receive the same aggregate dividends as at present."

Coincident with this announcement comes another to the effect that the two existing companies have made a still further reduction in the price of electric current to consumers. The reduction is one cent a kilowatt-hour (from 9 cents to 8 cents, net), on the low-rate portion. The low rate is secured after 30 hours' use of the maximum demand in a month. The high rate is 14 cents a kilowatt-hour, and applies, of course, to those who do not use the 30 hours of maximum demand in a month. About 95 per cent. of the companies' customers are on the maximum-demand system, and it is figured that the average reduction to them in their bills will be four per cent. The new rate will take effect August 1st. It is noteworthy that in two years the Chicago central-station companies have reduced the high-rate price for current from 20 to 14 cents and the low rate from 10 to 8 cents a kilowatt-hour. It is the policy of the companies, while keeping up the properties and paying a reasonable return to shareholders, to reduce the rates as fast as the growth of the business will warrant.

Philadelphia Street-railway Plan.

Mayor Reyburn of Philadelphia has signed the ordinance which, it is said, virtually makes that city a partner of the Rapid Transit Company. By the agreement the city is to receive one-half of the net profits after the annual dividend of six per cent. has been declared. In lieu of certain obligations of paving and repairing streets, the traction company agrees to pay $500,000 yearly and to contribute amounts to the sinking fund enabling the city to acquire the franchise after 50 years. The city is to share the company's debts, provide it with credit, and surrender many of its rights, among them the power to revoke franchises or compel wires to be laid underground, and the collection of license fees.

Commercial Lighting from Municipal Plants in Kentucky.

In deciding that municipal electric light plants in that state may sell "surplus power" to commercial users, the Court of Appeals of Kentucky, in the case of Overall against the City of Madisonville (102 Southwestern Reporter, 278), handed down an opinion of more than ordinary interest.

The court points out that public ownership of public utilities has been a political as well as a legal question for some time. It seems to have been a political question long before its legality was doubted. We read that Hezekiah, king of Judea, established and maintained by public authority a city waterworks plant in the city of David. (2 Kings, chapter 20, verse 20.) And who has not heard of the famous public baths of ancient Rome?

The public lighting of the streets of cities is of modern origin. Yet the necessity for lights in a city is scarcely less now than the necessity for water. Indeed, private wells and cisterns, and resort to natural streams by individuals for their necessary water, could easily replace public waterworks, and more justly, perhaps, than could private property owners light the adjacent streets and public places. It is found that light is not only essential to the safety of travelers, to prevent their coming in contact with obstructions, but it performs a most valuable office in preventing crime. It is known that crime thrives best in darkness. A good light is the equivalent of a good policeman in preventing certain forms of crime. It is therefore universally held now that it is clearly within the police power of cities, even without express authority to provide public lighting of their streets at the public expense.

Where a city is given the power, either expressly or by necessary implication as an incident to its police power, to light its streets, and where the precise method is not expressly provided, it may either hire another to furnish the lights, or may furnish its own lights. The power to do the thing unreservedly gives the city the discretion in the choice of means it will adopt.

Here the question was: Has a city of the fourth class the power to install and own its own lighting plant, to be operated both to light the public places of the city, and to furnish lights to its inhabitants as a commercial enterprise?

Whether a municipal corporation, an arm, as it were, of the state government, set up for government purposes only ought to be privileged to engage in a purely commercial business, is a question of politics as well as, perhaps, of constitutional power. It involves the requiring of every citizen, who is a taxpayer, to contribute to the enterprise, to become a member of it in a sense, whether he wills to or not. Whether it is a governmental function to embark the public revenues in a commercial enterprise in order to cheapen a commodity of very common use, or which is even a necessity, may be a disputable question; but there is no doubt that the lighting of the public streets and places is a purely governmental matter. If the municipality may build and operate its own light plant for that purpose, and it may, it ought to be permitted to sell the surplus of its product as it would be to sell any of the horses bought for its fire department when they are no longer needed in the public service, or to sell anything else it rightfully had, but had no further use for. So it is now held that they may sell such surplus property or product.

It is true the courts generally rest their decisions as to the power of the municipality to produce and sell lights to its citizens as well as to furnish its own upon the theory of the dual nature of a municipal government, in which it is part public and part private. This distinction, though, is rapidly disappearing, and exists now perhaps more as a fiction of the law than as a fact. Towns are now organized for governmental purposes only, no longer for the enjoyment of exceptional privileges granted as a favor by the sovereign. They levy taxes for governmental purposes, and can levy them for none other. Hence any expenditure of the public money must be in furtherance of a public benefit in its nature governmental. In Kentucky a great many towns and cities own and operate their own light and water plants. In nearly every instance they furnish light and water to the inhabitants as well as to the public places.

In no instance of which the court is aware has it been held by any court, or allowed by an act of Legislature, that a municipality could go into a commercial business purely as an enterprise of gain. It is always allowed or supported by the reason that it has the right to make or store the product for its public use. Common sense and good business allow that it should sell its surplus to its inhabitants, rather than waste it. In this way it is enabled, too, to accomplish the main purpose, the public purpose, by enabling it to own and economically to operate a plant for that purpose. A city, doubtless, would not be allowed to act as a bond broker. Nevertheless, it may invest its sinking fund, which it is allowed and required to have in certain contingencies, in commercial bonds, and necessarily to sell them. Its prisoners may be required to work in its workhouse. May not the product of their labor be sold? The situations all seem to the court to be analogous. The main feature in each is a clearly governmental power and duty. The other or added feature is incidental, and allowed as a sensible and necessary concomitant of the main purpose.

The court thinks that the city had the power to install a light plant to furnish public lighting, and, incidentally, as was proposed, light to its inhabitants.

Street Arches in Houghton.

In Houghton, Mich., a committee of business men arranged with the lighting company for a number of arches of incandescent lights which were strung across the principal streets as a part of the Fourth-of-July celebration. The extra light from these lamps caused such an improvement in the attractiveness of the city that the decoration has not yet been removed, and the business men are so "enthused" over the scheme that an effort will be made to secure a rate from the central station and keep the lights on the streets.

Lighting companies may find a suggestion in this incident to "start something" at their own expense, with the expectation that the feature will be retained by the business men of the town.

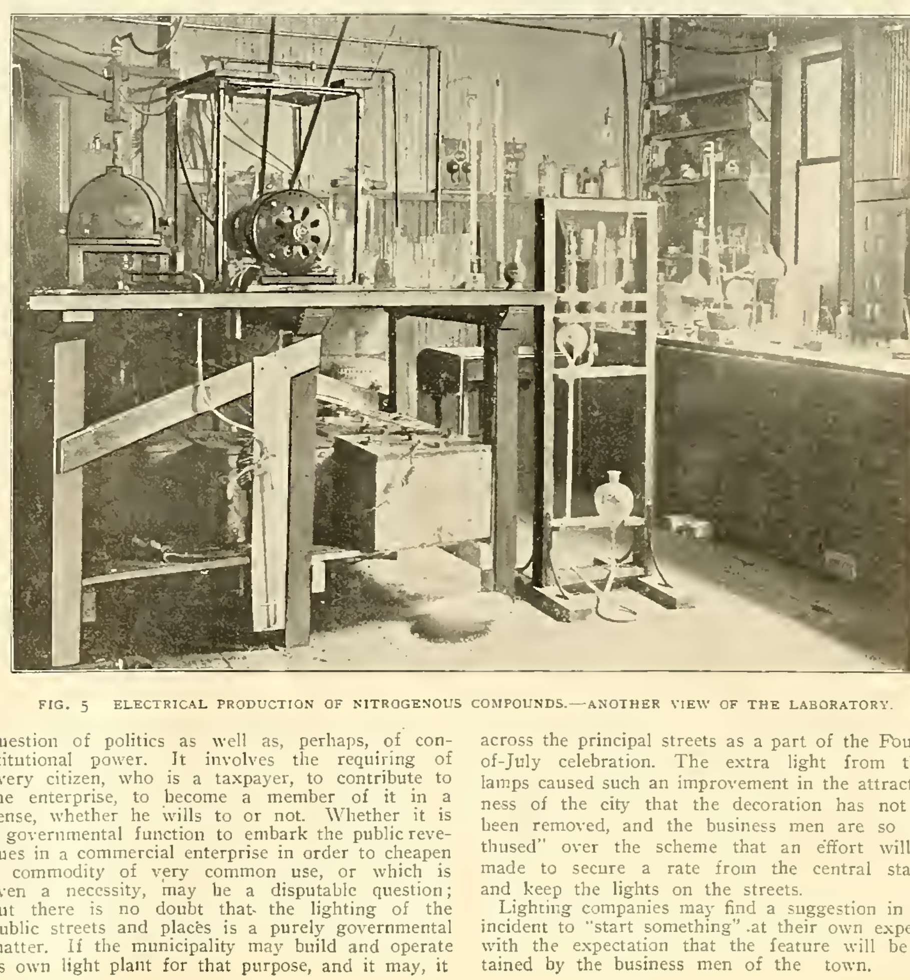


FIG. 5 ELECTRICAL PRODUCTION OF NITROGENOUS COMPOUNDS.—ANOTHER VIEW OF THE LABORATORY.

Multiple-solenoid Railway Signal System.

A new form of electromagnetic signal device is now in use on the City Belt Railroad of Paris where experiments are being made. It acts upon what is known as the multiple-solenoid principle. An electromagnet which has but a single winding can only give a short stroke, and this is a disadvantage in case it is desired to operate a signal or a switch by the direct pull of a solenoid. The new arrangement gives a stroke which can be made as long as desired and at the same time shows some other improved arrangements. As regards single-solenoid systems, it is noted that upon starting, when the greatest pull is wanted, they give the smallest power, and the maximum is reached at the end of the stroke when a small effort would be sufficient. It has been necessary therefore to obtain a greater pull at the start by increasing the number of ampere-turns, and this naturally makes the apparatus much heavier and besides needs the use of rather complicated devices to overcome the effects of self-induction.

Mr. Guedon, general inspector of the Paris Belt lines, has devised the apparatus here described. The parts are entirely enclosed in a waterproof iron casing, which takes up but a small space, and it is mounted upon the pole which carries the semaphore or other railroad signal. The device, Fig. 1, consists of an electromagnet of the sectional form (A) which is placed in a separate cylindrical case of sheet iron bolted onto the main box. Four separate solenoids form the combination magnet, and it carries a core (B). To the core is fastened a chain which passes around the pulley (C). The latter is provided with a special system of magnetic locking, which will be described.

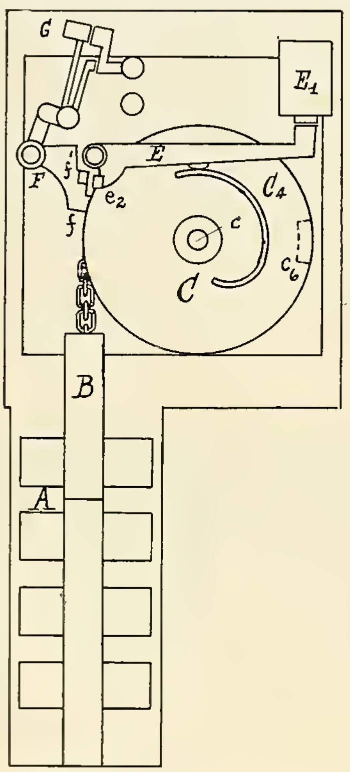


FIG. 1. MULTIPLE-SOLENOID RAILWAY SIGNAL SYSTEM.

Behind the pulley, a circular disk carrying a set of contacts is used to close the circuits of the four solenoids in succession.

Referring to Fig. 2, which shows the connections of the circuit, it is noticed that the solenoid which has just been excited is placed in short-circuit, which suppresses the sparking entirely during the operation of the device.

Both pulley and disk, Fig. 1, are keyed to a shaft (c) which passes out of the box at the rear and carries a sheave of smaller diameter mounted on this part. A steel cable runs from the sheave to a sector, which is mounted about six inches from it, and the sector is thus turned about. As the sector is mounted directly upon the shaft of the signal, the latter is operated in turn. The pulley (C) carries a cam of special form (C_4), which, when in the position of rest, with the signal closed, applies a lever (E), turning about a shaft, against the electromagnet (E_1). A locking cam (f) carried on the lever (F), which turns about a shaft, is allowed to fall into a depression (c_6) placed on the periphery of the pulley, when the latter has revolved.

The piece (F) is made to operate a quick-break switch with carbon shunt (G), and this switch makes connection between the line coming from the signal station and the circuit of the solenoids (A). On the contrary, the electromagnet (E_1) is always in shunt upon the main line, this connection being a fixed one

Normally the circuit remains closed by means of a counterweight, and the electric maneuver takes place in order to open the signal, or to show a free track. When it is desired to open the signal the operator at the distant station uses a special switch to close the circuit of the apparatus. Current passes in the top electromagnet (E_1), Fig. 1, which is connected on the line, and also in the solenoid set (A) by means of the switch (G), the latter being closed at this time.

The solenoid core (B) is attracted by each of

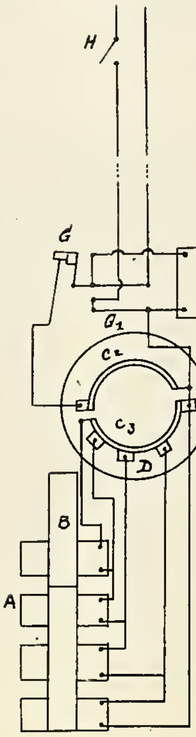


FIG. 2. MULTIPLE-SOLENOID RAILWAY SIGNAL SYSTEM.

the solenoids in succession (see Fig. 2) and descends with a slow movement, drawing upon the chain and causing the rotation of the main pulley. This makes the sheave outside of the box act on the sector, and it turns about by 90 degrees, throwing the signal into the free position. When the movement is finished, the cam (f), Fig. 1, of the stop-lever falls into the depression (c_6) which is now opposite it. The switch (G) is quickly opened and the circuit is broken in the solenoid set (A), all the while keeping the current on the line leading from the station and consequently in the top electromagnet (E_1). The latter thus holds the armature (E) even when this is no longer supported by the cam (C_4), which has now been shifted along with the main disk.

To place the signal in the stop position, it is only necessary to open the circuit. The electromagnet (E_1) lets fall the armature, and its lever, which is heavy, acts at the end (e_2) against the part (f′) of the lever (F). This raises the cam out of the slot of the disk and sets the latter free, causing the signal to operate by means of the counterweight. It is to be noted that the result which is obtained mechanically by means of the cam and the slot (c_6) gives an absolute security, quite independent of the magnet armature. During this time the cam (C_4) has lifted up the lever (E), which is now in the position ready for having its armature held by the electromagnet as soon as the current is thrown on the line.

Grate Position as Affecting Smoke Production.

Professor Breckenridge of the University of Illinois is quoted as declaring that the smoke nuisance in the cities of this country is entirely unnecessary. "Burning coal smokelessly is not a question of patented furnaces or boilers," he is reported to have said. "In fact, very little depends on the type of boiler. The essential thing is to have the boiler placed so that the flame from the coal does not touch it." This, it is explained, produces proper combustion, and it is only necessary to learn the length of the flame and lower the grate to the proper point. The professor says that for two years the 2,000-horsepower heating plant of the university has been operated without smoke and at an actual saving of $5,000 a year over a commercial plant of the same size operated carelessly. This ideal condition can be duplicated in any plant in the country, he avers.

A New Electrical Process of Drying Cables.

A new process of drying out cables of the multi-conductor class, such as are used by the telephone and telegraph companies in aerial and underground work, is the subject of a patent recently issued to Mr. W. B. Hale, formerly a well-known Chicago electrical engineer, now general manager of the Mexican Telephone and Telegraph Company.

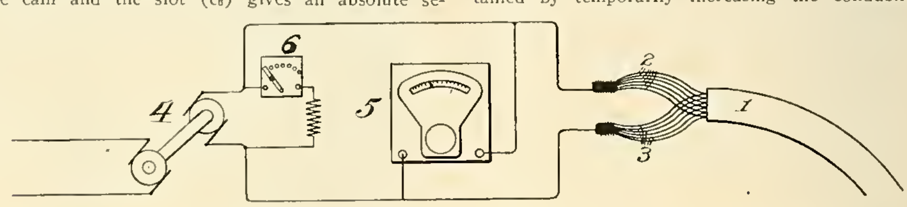
Owing to the increased capacity effect which follows the use of paraffine or other compounds to impregnate the insulation between the conductors, a form of cable which depends upon the insulating qualities of dry paper has come into large use. But when moisture gets into this by reason of negligence in sealing ends or joints the excellence of transmission is seriously impaired. The common method of drying has been to pass a strong current through the conductors, raising their temperature sufficiently to vaporize the moisture, which is then withdrawn by means of an air pump applied to the end of the cable. Besides requiring the use of special apparatus the process is somewhat slow and expensive.

As shown in the accompanying drawing, the new method is to fan out the conductors into two groups, each comprising a wire from every pair in the cable.

The two groups are connected to a generator capable of giving the required range of voltage, one group being connected to each terminal, and an electromotive force is established between the members of each pair of conductors of the cable sufficient to cause a flow of current through the moisture remaining in the insulation, electrolytically decomposing the moisture. As decomposition progresses the insulation resistance gradually increases, and in order to maintain a flow of current strong enough, that is, above the critical value required for electrolysis, the impressed electromotive force may be gradually raised, but not of course beyond the dielectric strength of the cable.

Regulating the voltage by means of a field regulator (6) or otherwise, so that the voltmeter (5) connected across the terminals indicates an electromotive force of say 100 volts, the voltage may be gradually increased at intervals of half an hour or so, as the insulation resistance rises, due to the decomposition of moisture, until the resistance is increased to the required value. This may take, say, from two to six hours.

The increase in voltage is, of course, limited by the dielectric strength or breaking-down point of the cable being dried; and if the insulation resistance is still below the desired value when this limit is approached the intensity of current required for electrolysis may then be further maintained by temporarily increasing the conductivity



A NEW ELECTRICAL PROCESS OF DRYING CABLES.

of the moisture remaining in the insulating medium by means of heat. This may be produced by applying an alternating electromotive force from a suitable generator to the two groups of wires (2) (3) to develop the heat in the dielectric itself by molecular action set up therein; or strong current may be passed through some or all of the conductors of the cable to heat the conductors by the I^2R effect. To facilitate the drying out of the cable any or all of the foregoing means may be employed; but ordinarily a cable would have sufficient dielectric strength to withstand the voltage required to produce the necessary electrolyzing current without resorting to the heating process.

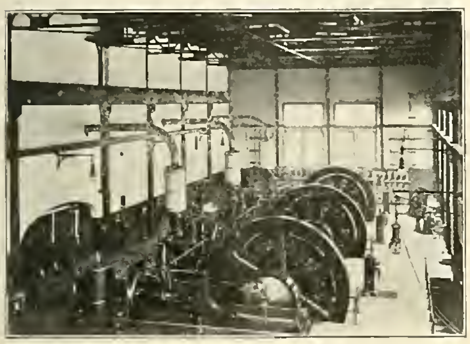
The above arrangement is not the only application of the principle that may be employed. For example, the electrolyzing current may be passed from all the wires to the metallic sheath of the cable, from one layer of wires to another, from one wire to another, or from any group of wires to a single wire or to another group.

Additions to Traction Facilities of Harrisburg, Pa.

The Central Pennsylvania Traction Company of Harrisburg, Pa., operating 64 miles of electric railways, began in January, 1906, the construction of its new power plant at Harrisburg, from which power was being furnished on the various lines under the company's control by the last of May. At that time the new station took the entire load and, as a result, three of the company's old stations, which had hitherto been in use, were abandoned. Owing to a large increase in the number of cars in operation and from alterations in the schedule, this station is now furnishing an average of 60 per cent. more power than was required to operate the system a year ago.

The steam and electrical equipment in the power house, which is one story in height, built of concrete, 175 by 102 feet, comprises three Reynolds horizontal cross-compound condensing Corliss engines, heavy-duty type, each direct-connected to a 650-kilowatt 600-volt Allis-Chalmers direct-current generator. These units, shown in the accompanying picture, have a capacity of 50 per cent. overload for short periods, giving a maximum capacity for the entire plant of approximately 4,500 horsepower.

The main switchboard, consisting of 12 panels, is connected by a direct feeder line to each of



STREET RAILWAY POWER PLANT AT HARRISBURG, PA.

the 12 sections into which the traction company's lines are divided.

An unusual and interesting feature of this plant is found in the means taken to furnish ample water supply directly from the Susquehanna River, which is some distance from the power house. A five-foot tunnel has been bored in the solid rock 30 feet below the surface of the ground, extending from the plant in a direct line under the yards of the Central Iron and Steel Company to the river. From the river bank a 36-foot iron pipe is extended to a point in the stream where the best quality of water is to be obtained. This water-supply tunnel is built and used jointly by the traction company and the Central Iron and Steel Company.

Parliamentary Committee Recommends Ratification of Berlin Wireless Conference.

Under date of July 5th the London correspondent of the Western Electrician writes as follows: "I learn that the committee of the House of Commons which considered the wireless-telegraph convention of 1906 has decided by a bare majority of one to recommend the ratification of the convention by the British government. At the moment of writing the official text of the report has not been made public, although one newspaper has published some clauses which are said to be in the report. From these it would appear that the evidence of the Marconi Company has had some effect, for although the committee thinks that the Marconi Company is unduly alarmed as to the deleterious effects of the ratification of the convention upon its business, it yet suggests, so it is affirmed, that if afterward it is demonstrated that the company's finances are adversely affected, then compensation on the basis of three years' average profits, calculated upon British stations only, should be awarded."

Electric Fans for the Isthmus.

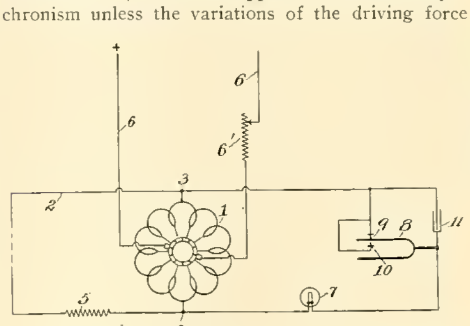
The purchasing agent of the Isthmian Canal Commission, Washington, D. C., is calling for proposals until July 30th for a large number of electric fans. Of these, 75 are to be three-speed ceiling fans, and are to be equipped with four-point regulating switches. In addition, there are to be 10 16-inch ventilating fan motors, complete with speed controllers, for use in ventilating the hotel kitchens, and 10 swivel and trunnion frame desk and wall bracket fans. All the motors must be designed to operate on 100-110-volt direct current circuits.

Electrical Synchronizing With a Tuning Fork.

The accompanying diagram shows the principle of operation of a synchronizing device based on the idea of referring the number and position of the alternations to the constant rate of the vibrations of a tuning fork. The drawing shows the windings of a rotary converter receiving current to operate the machine over the direct-current mains (6) (6) leading to the brushes and having the alternating-current circuit led out to the terminals (3) (4). The tuning fork (8) shown is electrically driven at a constant rate of vibration. However, any other device which makes and breaks the circuit at regular intervals may be used if desired. The small condenser (11) is placed as a shunt across the point of interruption merely to prevent sparking at the contacts and plays no part in the synchronizing.

The operation of the device may be described as follows: The tuning fork is made to vibrate at the desired frequency, and the rotary transformer or other machine is adjusted by varying the torque of the driving motor to have a tendency to run at a speed to produce an alternating current of greater frequency than the frequency of the tuning fork; but if the tuning fork is vibrating it throws the load of the lamp (7) or other suitable resistance on the machine (1) each time the fork engages one of the contacts (9) (10). If now the prong of the tuning fork engages contacts (9) or (10) at the instant that the alternating-current wave is passing through zero, little or no current will flow through the lamp (7) and little or no load will be thrown on the machine (1). If by the next time that contact occurs at (9) or (10) the machine has increased in speed, so that the contact occurs when the wave has a value other than zero, a current will flow through lamp (7) which will be proportional to the instantaneous height of the wave. The machine (1) will now receive a load each time contact occurs at (9) or (10) which will tend to stop a further increase of speed.

If the motor element is adjusted to drive the generator element at a speed considerably in excess of synchronism, then the height of the wave at the instant of contact will be required to be still greater to produce the necessary retarding effect. In other words, the retarding effect or synchronizing load will increase in proportion as the machine (1) tends to run above the speed of synchronism. When the driving force of the machine varies or the load thrown on the alternator is varied the phase relation of the alternating wave and the making of contacts (9) (10) varies in a similar manner. The synchronizing force thus automatically increases and diminishes to care for a tendency to a varying speed. The speed is thus held constant, and the apparatus holds in synchronism unless the variations of the driving force



ELECTRICAL SYNCHRONIZING WITH A TUNING FORK.

or the loads thrown on the machine (1) exceed the magnitude of the greatest possible synchronizing force.

It is practical to arrange this synchronizing force, the inventor says, so that the apparatus will hold in synchronism even when the driving forces vary as much as 40 to 50 per cent. A little consideration will show that an important feature of the invention is the employment of a resistance—such as the lamp (7), for example—which will decrease with increasing current through it, thereby greatly strengthening the synchronizing force.

The method has been patented by Edwin F. Northrup of Philadelphia and is assigned to the Leeds-Northrup Company.

Electrical Voting at the Automobile Club of America.

By Howard Greene.

Now that the Automobile Club of America has taken possession of its magnificent new clubhouse in New York, all its doings reflect the spirit of modernism and progress. One of the most recent innovations is in the method of balloting when new names are proposed for membership. The time-honored custom of blackballing an undesirable applicant is still followed, but he is now blackballed by electricity.

To be more explicit, it was found that when a

ELECTRICAL BALLOTING APPARATUS.

number of names had to be voted upon in the old-fashioned way, with real black and white balls and a ballot box, the time required was considerable. So Dr. Schuyler Skaats Wheeler, who is first vice-president of the club and its consulting engineer as well as head of several committees, devised the electrical balloting apparatus illustrated herewith. The whole system is portable and can be packed into a carrying case with a handle on top, so that when not in use it can be put out of the way.

The voting apparatus consists of a set of double push-buttons, an annunciator and a battery for supplying the current to operate the annunciator drops. There are two drops in the annunciator, one white and the other carrying a black disk—the dreaded black ball. The push-buttons are set into little blocks of polished wood, two in each block, one white, operating the white drop and the other black, dropping the black ball.

While the voting is going on a curtain is drawn over the face of the annunciator, and every member presses one of the buttons in the little block he holds in his hands; this he can do entirely unseen. When all have voted the curtain is raised, and if the black ball is still "hung up" the applicant is passed. If the gloomy disk has been released by some member there is absolutely no way of knowing or even guessing who did it.

The four dry cells required to operate the annunciator are placed in the lower part of the carrying case, and the annunciator and buttons are stowed in the upper part when not in use. A cable is carried around the table, and from it smaller cables branch off to connect with the push-buttons. Voting by electricity is far more rapid and secret than the old-fashioned method.

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CORRESPONDENCE relating to electricity or any of its practical applications is cordially invited, and the co-operation of all electrical thinkers and workers earnestly desired. Clear, concise, well written articles are especially welcome; and communications, views, news items, local newspaper clippings, or any information likely to interest electricians, will be thankfully received and cheerfully acknowledged.

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DEPARTMENTS.

DATES AHEAD.

Illuminating Engineering Society (first annual convention), Boston, July 30th and 31st.

International Association of Municipal Electricians (twelfth annual convention), Norfolk, Va., August 7th to 9th.

Ohio Electric Light Association (annual convention), Toledo, August 20th to 22d.

Canadian Electrical Show, Power Building, Montreal, September 2d to 14th.

Colorado Light, Power and Railway Association (annual meeting), Savoy Hotel, Denver, Colo., September 18th, 19th [illegible].

Central Electric Railway Association (regular meeting), Columbus, Ohio, September 26th.

American Street and Interurban Railway Association and affiliated societies (annual convention), Atlantic City, N. J., October 14th to 18th.

LIGHTNING and the protection of electrical structures against lightning formed the subject of a lecture by Dr. C. P. Steinmetz which was one of the distinctive features of the recent Washington convention of the National Electric Light Association. The address, delivered without notes and with the unbroken flow of language which is characteristic of the speaker, was highly instructive and very interesting. It is probably safe to say that every person who listened to the lecture obtained a clearer idea than he had before of the phenomena of electric discharges in the atmosphere, while the second part of the discourse, relating to practical methods of protecting electrical circuits from lightning, was likewise lucid and valuable. The lecture was reported by the official stenographer of the association, and the Western Electrician takes pleasure in laying before its readers, in this issue, the first installment of this classic in the popular exposition of electrical science.

SIR WILLIAM CROOKES excited some alarm several years ago, when, as president of the British Association, he expressed the fear that there might be a world-famine in wheat, owing to the exhaustion of wheat-growing soils and the rapid diminution of commercial supplies of nitrates used to replenish the plant food taken from the soil. He pointed out, however, that an inexhaustible store of nitrogen is at hand in the atmosphere if only we could utilize it, and he suggested that this source might be drawn upon, where electricity is cheap, as at Niagara Falls, by burning the nitrogen of the air, by means of the intense heat of the electric arc, to form some compound that could be utilized as a fertilizer. Fortunately Sir William's gloomy apprehensions have not been realized, but his presidential address received wide attention and set many investigators at work on the subject, as attentive readers of the Western Electrician are aware. One of the latest of these electrical processes for producing nitrogenous compounds is that of Mr. William Thomas of Chicago, described and illustrated elsewhere in this issue. The method and apparatus employed are of unusual interest. Nitric acid is the resulting product, and there seems to be not the slightest doubt of the technical success of the process, although its commercial feasibility still remains to be demonstrated.

PRESENT indications are, that the two central-station companies of Chicago will be consolidated in a few months. It is an open secret that the Chicago Edison Company, serving the central portion, and the Commonwealth Electric Company, supplying the surrounding part of the city, are under one management, so that the consolidation will make no difference to the city or to the consumers, but will, on the contrary, make for simplicity in bookkeeping and add to the convenience of all concerned. The two companies are to be merged in a new company, to be known as the Commonwealth Edison Company, thus retaining both names. The capital stock is to be $30,000,000, so distributed that the Chicago Edison shareholders will receive the same actual dividend returns as at present, although the dividend rate will be less.

It would seem that there can be no valid objection to the consolidation of these fine properties, which have been brought to such a high state of efficiency under Mr. Insull's administration. No interest, public or private, will be adversely affected, we believe, and a rather cumbersome double-barreled organization will be greatly simplified. If the consolidation is made, Chicago will be electrically served literally, as it has been for several years in effect, by one central-station company. The contrast with the days when every neighborhood had its electric-light station is marked and is an indication of salutary progress.

WHILE the National Civic Federation, by the report of its committee on public ownership, has not "settled" that vexed question, it is unfair to criticize it on that account, as the Chicago Daily Tribune does, when it says: "It [the Federation] determined to investigate and settle, once for all, the municipal-ownership question. It has failed ingloriously." It is extremely unlikely that the Federation had any expectation of "settling" such a large question of political economy as that of public ownership. We do not recall that it made any profession of such a determination. But it has conducted a valuable investigation (from the results of which the Western Electrician has given brief quotations), and has accumulated a mass of data on the subject valuable to the student. Both sides have had a fair hearing and have given free expression to their ideas. It is not particularly strange that the private-ownership and the public-ownership men on the committee should still retain their respective views. We may believe that the advocates of the two methods are honest and that they express to the best of their ability conclusions arrived at after an investigation hitherto without precedent in this country for thoroughness. The ordinary citizen can read both sides by the summaries of the report given in the papers and can draw his own conclusions. For this valuable opportunity the National Civic Federation is entitled to hearty thanks.

The committee has been engaged for more than eighteen months in its work, and 25 accountants, engineers and others have been engaged on the work. The full report, in three volumes, will appear within a month.

NEW-BUSINESS PROPAGANDA, as known in electrical circles in the United States, is a little too snappy, alert and enterprising to meet with the entire approval of conservative British municipalism. Mr. S. E. Fedden, chief engineer and manager of the Sheffield (England) municipal electrical undertaking, said his say on the subject two or three weeks ago as president of the Municipal Electrical Association at the annual meeting in that city. And this is a part of what he said:

"The average man's (prospective consumer's) receptivity has been dulled by masses of printed matter, and his eyesight dimmed by countless posters and signs in which art and truth are variable quantities. So I do not think that we shall be well advised to take too seriously the exponents of the new publicity who are arising among us, each with his own particular method for stunning the unsuspecting public.

"Can we not approach this problem in our own way, as we have so many in the past, and however commercial we become by the decree of modern conditions, yet keep out enterprises free from the taint of mere huckstering?"

Mr. Fedden's reasoning is not very convincing. If the average prospective customer in England has suffered dulled "receptivity" by reason of a campaign for new business, he must be a very dull fellow, or else the effort to sell electricity to him was badly bungled. As to the sneer at "huckstering," it would be perhaps too severe to say that the remark is an appeal to British snobbishness; but at any rate it is merely trivial.

Diligence in business is commended in Holy Writ, and why should not the purveyor of electricity be just as diligent in his business as any other person who has a manufactured product to sell? Of course, he should aim to increase his business by every honorable means in his power—by advertising of various kinds, by personal solicitation, by demonstrations, by electric signs at night and earnest argument by day—in short, by every legitimate method he can think of. The campaign for new business is a great educational movement—not alone to get people generally to know what electricity will do for them, but to educate the central-station man himself to new habits of thought, a renewed ardor and enthusiasm for his business and a realization that his individual profit will be best secured by an honest effort for the electrical uplifting of the community in which he lives.

But, after all, these are considerations that will not appeal to the average municipal-corporation man. As a matter of fact, the municipality should have no direct interest in selling electricity; that can be more wisely left to private enterprise. If it generates electricity at all, let it confine itself to lighting the streets. In the present case the point is that it is unfair for the president of the Municipal Electrical Association to rail at a healthful and most beneficial enthusiasm which he seems totally to fail to understand.

Lightning and Lightning Protection.[1]

By Charles P. Steinmetz.

Part I.

1. Lightning Phenomena in the Clouds.

The first man who attacked the problem of lightning and lightning protection a century and a half ago was our great citizen, Benjamin Franklin. He gave us the lightning rod, which is now universally recognized as the most effective and only protective device for isolated points, as steeples, chimneys, etc. The next step in advance was made by Faraday, who showed that in the interior of a perfectly conducting body no electric disturbances can be produced by outside electric forces. This led to the most effective protection possible against lightning or electric disturbances, the use of a grounded metal cage, "Faraday's cage," enclosing the structure which is to be protected, whether a building against lightning, or a delicate instrument against electric fields.

In its simplest form Faraday's cage, applied to a transmission line, is the ground wire above the line, and the protection afforded by it is the more complete the more the overhead ground wires represent the condition of an enclosing cage of perfect conductivity. That is, a system of wires above and on the sides of a transmission line is superior to a single wire; a wire of high conductivity is superior to a small iron wire. Here I especially desire to draw the attention to the second requirement of the Faraday cage, high conductivity. Thus, it is not sufficient merely to have any kind of overhead grounded wire regardless how small, but high conductivity of the grounded conductor is essential in many cases of atmospheric disturbances.

In the last 10 years transmission voltages have crept higher and higher; transformers have been built, of considerable size, of still higher voltages, so that exact data on the action of voltages up to 300,000 are now available, and approximate data for potentials above a million volts. It is found that air has a definite and fixed breakdown strength; that is, just as a beam breaks mechanically, as soon as the stress in it exceeds a definite value, the breaking strength of the material, so air breaks down by a disruptive spark, as soon as the electric stress in the air, or the potential gradient, exceeds a certain value, which is about 100,000 volts per inch. The disruptive strength of air is, over a wide range, proportional to the pressure, that is, at two atmosphere pressures it is twice as high, or 200,000 volts per inch; at one-quarter atmosphere it is one-quarter, or 25,000 volts per inch. Only at very low pressures, where the distances between air molecules become appreciable, this law ceases, and the disruptive strength increases again, and seems to become infinitely great in a perfect vacuum.

The striking distance in the air between needle points has been investigated up to 300,000 volts, and found that for high voltages it is very nearly 10,000 volts per inch, that is, a discharge of 30 inches in length between needle points requires 300,000 volts. If between two needle points the potential difference is gradually increased, at relatively low voltages the disruptive strength of the air at the needle points is exceeded; the air at the points breaks down and becomes conducting and luminous, as "brush discharge," so that the terminals are not the needle points any more, but the whole space of approximately spherical shape, which is covered by the brush discharge. As the result thereof, for high voltage, no appreciable difference exists in the striking distance between needle points and between spheres, the centers of which approximately coincide with the needle points, as long as the diameter of the spheres is small compared with their distance. With increasing potential difference between needle points, the brush discharges spread out against each other, until only about 40 per cent. of the space between the needle points is free, and then a disruptive spark passes.

Naturally, as soon as determinations of spark voltages became available, attempts were made to estimate the voltage of a lightning flash, considering, in a lightning flash, the discharge as that in a uniform field, similar to that between needle points, and so requiring about 10,000 volts per inch. In this case, a lightning flash of two miles, or about 10,000 feet length, would require a potential difference of about 1,200,000,000 volts. The existence of such voltages in the clouds does not appear possible; a potential difference of 1,000,000,000 volts would produce a brush discharge of about one-half mile in length before the final lightning flash occurs. In the brush discharge the air is electrically broken down and conducting. But it is also mechanically and chemically broken down, that is, the molecules dissociated, and recombined after the discharge in all possible combinations. That is, we get ozone and get nitric acid, and a lightning flash produced by 1,000,000,000 volts may be followed by a deluge of nitric acid. This, fortunately, is not the case.

An estimate of the voltage and the current in a lightning flash would not yet give the energy, if the duration of the discharge is not also known. We can, however, get an approximate estimate of the magniture of the energy of the lightning flash indirectly, from photometric considerations, and eliminate the consideration of the duration of the flash by the integrating feature of the human eye for impressions of very short duration. An impression on the human eye persists for some time, about 0.1 second, and any phenomenon of shorter duration than 0.1 second thus appears to last 0.1 second. Hence the effect on the eye by a lightning flash would be about the same whether the flash lasts 0.1 second or is of a 100 times greater intensity, but lasting a thousand times shorter time. This means that the eye would see a lightning flash about in the same manner as if its light and so probably its energy were spread uniformly over 0.1 second.

The illumination given by a brilliant lightning flash is about of the same magnitude as good artificial illumination, perhaps one foot-candle, since at night time in a well-lighted room, the light of a lightning flash is still quite appreciable. Estimating roughly, one volt per candle-foot, a lightning flash illuminating a space of two miles square, or 10^8 square feet, with one foot-candle would consume 10^8 watts, and as this is the illumination as averaged by the human eye over 0.1 second, the energy is 10^7 watt-seconds, or 10,000 kilowatt-seconds. The energy of a large lightning flash, estimated from its light, so would be of the magnitude of 10,000 kilowatt-seconds. This value, while considerable when expressed in electric quantities, is by no means so very great. Reduced to heat measure, it only equals the latent heat of evaporation or condensation of about nine pounds of water.

As seen, an estimate of the voltage of the lightning flash from length and disruptive potential gradient of the air does not give reasonable values; that is, the lightning flash cannot be a single discharge, as that of a Leyden jar. An estimate of the voltage so may be attempted in a different manner.

Lightning flashes usually occur within thunder clouds, and only rarely from cloud to cloud or from cloud to ground. They, therefore, seem to be rather due to equalization of potential differences within the clouds than discharges between oppositely charged bodies. Lightning occurs mainly when rapid condensation of moisture takes place in the air, and the electric phenomena seem to be the more intense the greater the rapidity of condensation, or rain formation. Thus, the atmospheric electric disturbances seem to be connected with the condensation of water vapor to clouds and rain.

There exists normally a potential gradient in the air. That is, a potential difference exists between the air at different elevations, reaching sometimes several hundred volts per foot, so that we can estimate as a fair average, a natural potential gradient in the air, in vertical direction of about 100 volts per foot. A point of 100 feet above the ground may show a potential difference of about 10,000 volts against ground. Usually the higher strata of the air are positive against the lower. The cause of this potential gradient, whether terrestrial or cosmic, is of no interest to us here, but merely its existence.

It is of interest to investigate what effect must be expected from our well-known physical laws, from the condensation of moisture and agglomeration of the moisture particles to rain drops, in an atmosphere having such a potential gradient.

Assuming water vapor in a higher stratum of the atmosphere to condense to moisture particles, these moisture particles have the potential of the air in which they float; that is, have a considerable potential difference, perhaps hundred thousands of volts, against ground, and so contain an electric charge against ground. These moisture particles conglomerate with each other to larger moisture particles and ultimately rain drops. By the collection of n^3 particles into one, the diameter of the particle has increased n-fold. Its capacity has also increased n-fold (the capacity of a sphere being proportional to the diameter). The particle contains, however, the accumulated charges of n^3 smaller particles, and n^3 times the charge, with n times the capacity, gives n^2 times the potential. It follows that with the conglomeration of the water particles, their potential must increase rapidly, proportional to the square of their diameter. The conglomeration of moisture particles in the clouds is, however, very uneven, due to the uneven distribution of moisture, as is plainly seen by looking at any cloud. Dense or dark parts, representing considerable condensation, and so considerable moisture content, alternate with light parts, in which little or no condensation occurs. As a result, starting with a uniform potential in the stratum of the air, where condensation begins, differences of potential distribution by necessity result from the differences in the condensation of water vapor to moisture and the accumulation of the moisture particles to larger ones; that is, the denser portions of the cloud are at a higher potential than the lighter portions. Thus, starting with uniform potential, and so zero potential gradient in the air at the moment of the beginning of condensation, potential differences and so potential gradients appear.

Such potential differences in the clouds increase with increasing agglomeration of moisture particles to rain drops, and the potential gradient so rises. Let us assume the low potential gradient of 100 volts per foot in the cloud at the beginning of agglomeration of moisture particles. The collection of n^3 such particles to one rain drop of n times the diameter and so n times the capacity, but containing the static charge of n^3 particles, gives n^2 times the potential, and since the distances between the particles are now n times as large, the potential gradient has increased n-fold. That is, by conglomeration of water particles, the potential gradient rises proportional to the diameter of the particles. Estimating then the average size of moisture particles as 10^{-4} inches at the beginning of agglomeration, when the potential gradient in the cloud is about 100 volts per foot, then the breakdown potential of the air, of between 100,000 and 200,000 volts per foot, would be reached when the drops have reached about 0.1 to 0.2 inch diameter, that is, the size of rain drops.

Potential gradients in the cloud gradually rise until somewhere the disruptive strength of the air is reached, and a discharge passes, equalizing the voltage at this spot. This, however, causes a greater potential gradient at the end of the discharge, exceeding the breakdown strength of the air, and so causes a second discharge, following over the path of the first; then a third and so on, until all of the potential differences or unequalities of the potential distribution in the cloud are leveled down by a series of successive discharges. The phenomenon is so similar to that of a landslide, setting off another and another landslide. Or it can best be pictured by representing the unequal moisture distribution in the cloud by a relief map built of wet sand, the dense portion of the cloud, and so portions of high potential, being represented by the hills, the light or low potential portions of the cloud by the valleys of the relief map. As soon as the sand dries, somewhere, where the declivity is very steep, that is, the potential gradient very high, a slide occurs; this causes another slide and so on until the whole configuration of sand settles down to a flat and smooth shape, the hills are leveled off and the valleys filled.

The existence of such successive discharges following each other after appreciable intervals of time in the same path has been shown by the photographs of lightning flashes taken with a rotating camera. In this case, by the motion of the camera, the successive flashes are recorded side by side, and sometimes more than 40 successive discharges have been counted, the whole phenomenon lasting about 0.6 second, that is, quite an appreciable time.

It follows that lightning flashes in the clouds, of several miles' length, occur without any considerable potential difference between the ends of the flash, but result from the disruptive equalization of the unequal potential distribution in the clouds, caused by unequal vapor density and so unequal condensation and conglomeration of moisture particles.

This also explains the relatively small tendency to discharges between cloud and ground across a space in which no condensation takes place, and so no unequal potential distribution supplies the power of the discharge. Although the distance between cloud and ground is smaller than the distance traversed by a lightning flash in the clouds, and the average potential difference between cloud and ground probably greater than the potential differences in the clouds, a discharge to ground probably occurs in general only where by a heavy downpour of rain a range of high potential is carried bodily part way down to ground. This also may explain that lightning discharges to the ground are usually followed by the heavy downpour of rain.

Estimating then the disruptive strength of air under discharge conditions in an un-uniform field, and at the reduced air pressure in the clouds, as 100,000 volts per foot, the average potential gradient in the path of the lightning discharge through the clouds would be about 50,000 volts per foot. This gradient, however, would not be unidirectional, but the potential would rise from a low, or even negative, value at a light portion of the cloud to a maximum value at a dense position, then decrease again, that is, give a gradient in opposite direction to a light position, etc., and the potential gradient would vary from nothing at a maximum potential point to a maximum equal to the breakdown strength of air at the starting point of the discharge to zero at a minimum potential point, etc.

To estimate the current which discharges in the lightning flash, the conductivity of air in the path of the discharge, and the diameter of the discharge are required, and both are unknown, so that any estimate must be very approximate only. The specific resistance of gases and vapors decreases with increasing temperature and with decreasing pressure. It is a few ohm-centimeters at atmospheric pressure and the high temperature of the magnetite or carbon arc, and is also a few ohm-centimeters at the low temperature and low pressure

1. A lecture delivered before the National Electric Light Association in Washington, D. C., June 5, 1907. Dr. Steinmetz spoke extemporaneously. This report was taken by the stenographer, but has been subjected to the author's revision.

of a high-current Geissler tube discharge. The mercury arc stream also gives a specific resistance of a few ohms. The temperature of the air in the lightning discharge probably is moderately high, but the pressure also not far from atmospheric, so that 100 ohm-centimeters may not be far from the true magnitude of the resistance. Estimating one to two feet as diameter of the discharge path and 100 ohm-centimeters as the specific resistance, and allowing for the inductance, gives, with an average potential gradient of 50,000 volts per foot, a current of about 10,000 amperes.

The heating effect and the magnetic effect of lightning strokes also point to the passage of currents of some thousand amperes.

Assuming then the average potential gradient in the lightning flash as 50,000 volts per foot, the current as 10,000 amperes, a lightning flash of two miles' length would represent a power of 5×10^9 kilowatts. Estimating the energy of the discharge as approximated from the photometric consideration as 10,000 kilowatt-seconds, the duration of the discharge would be $10^4/5 \times 10^9 = 2 \times 10^{-6}$ second, or two-millionths of a second.

The discharge probably is oscillatory. In view of the high resistance of the discharge path the damping effect must be very great; that is, a very large part of nearly all the energy is expended in the first half wave; the discharge consists of only one or very few half waves. With a duration of the discharge of 2×10^{-6} seconds, assuming two half waves as average, gives 500,000 cycles.

The frequency of oscillation of the lightning flash so appears as of the magnitude of half a million cycles.

Since the velocity of propagation of electric disturbances is the velocity of light, or 188,000 miles per second, the wave length of a discharge of 500,000 cycles is $\frac{188,000}{500,000} = \frac{3}{8}$ mile, or about 2,000 feet.

A wave length of 2,000 feet means that the current in the discharge flows in one direction for 1,000 feet, in the opposite direction, that is, with opposite potential gradient, in the next thousand feet, etc. That is, in our former discussion the average distance through which the potential gradient has the same direction, or the distance between maximum and minimum, between densest of lightest parts of the clouds, is about 1,000 feet. This agrees fairly well with the appearance of the clouds to the eye and it also agrees in magnitude with the distance over which the wind velocity varies in gusts, as shown by Professor Langley in his investigation on the "Internal Energy of the Wind."

It appears herefrom that the varying wind velocity as measured by Professor Langley, that is, the gusty character of the air currents, results not only in an internal mechanical energy, which the bird utilizes for soaring, but also results in unequal moisture distribution, and so, when condensation occurs, in an "internal electrostatic energy" of the thunder cloud, which discharges as lightning.

With an average length of the half wave of 1,000 feet and 50,000 volts per foot as potential gradient the potential differences in the clouds would be of the magnitude of 50,000,000 volts. These are values which appear reasonable.

Assuming that an electric flash drains the electric energy of the cloud within a radius of about 100 to 200 feet from the path of the discharge, this affords a different method of estimating the magnitude of the energy of the lightning flash. Assuming, for instance, saturated air at 40° C. mixing with air at 0° C., condensation of a part of the moisture occurs which can easily be calculated, and also the electrostatic capacity. With a wave length of 2,000 feet and a potential gradient of 50,000 volts per foot, from the capacity follows the energy of the electrostatic charge which discharges as lightning flash. This is found under above assumption as of the magnitude of 10,000 kilowatt-seconds, and so agrees with the results derived from the photometric considerations.

To conclude, then, as approximate values of magnitude of the electric quantities in a lightning flash may be estimated:

Average potential gradient, 50,000 volts per foot at the moment of discharge.

Average potential difference between different points of the cloud, 50,000,000 volts.

Average current in the discharge, 10,000 amperes.

Average duration of the discharge, $\frac{1}{500,000}$ second.

Average frequency of discharge, 500,000 cycles.

Average energy of the discharge, 10,000 kilowatt-seconds, or 7,000,000 foot-pounds.

[*To be continued.*]

About $325,000 is to be spent this summer by the Little Rock (Ark.) Railway and Electric Company in paving streets and improving tracks. Manager Hegarty has 200 men at work on track improvement and about 300 more are doing the paving.

Cheap Power from Muskegon River.

Eight cents a kilowatt-hour for electric lights is the rate agreed upon between the Grand Rapids ordinance committee of the Common Council and the Grand Rapids and Muskegon Power Company as the basis of negotiations for a franchise. The company owns the big dams on Muskegon River, illustrated in the Western Electrician last week. It is working with the Grand Rapids Edison company and the new franchise will take the place of that of the latter company, which company now charges 12 cents a kilowatt-hour for lighting.

The proposed franchise further provides for a rate of two to three cents per horsepower-hour for a 25-horsepower load; 25 to 75 horsepower, 1¼ to 2 cents; 75 to 150 horsepower, 1⅛ to 1¾ cents; more than 150 horsepower, 1 to 1½ cents. The minimum charge for light is fixed at 50 cents a month, and the minimum for power is $1. All lines carrying over 7,500 volts are to be strung on private property, except where necessary to cross streets. The poles of the company may be used by the city or any other corporation and no charge will be made the city for the use of the poles.

The franchise is to run for 20 years, and an annual fee of $500 is to be paid. The ordinance if passed by the council will make the franchise effective October 1st. The rates are among the lowest in the country. They are proposed by the city officials at the suggestion of J. B. Foote of the power company.

Copper Down to 22 Cents.

On July 9th and 10th the price of copper exhibited a sharp decline, dropping from 25 to 22 cents a pound. A similar reduction was shown in the price of copper wire. A copper dealer in New York gave the following explanation:

"For the last two months we have been doing practically no business in the copper market. Buyers have been unwilling to make new commitments on the old basis, and so we finally decided to make a radical reduction in price, reducing it from 25 to 22 cents a pound. We have held off from making this reduction for a long time, in order to enable consumers who bought the metal at 25 cents to use up their supplies. A reduction to 22 cents, we believe, will represent the bottom level. It is, of course, impossible to say positively that the price will not go lower, but from all indications the outlook seems to favor an advance in the figure within the next month or two rather than a further decline."

A Chicago man in close touch with the wire business told a representative of the Western Electrician that for some time there has been a deadlock between the big producers and the principal consumers. After a period of inactivity, the producers were forced to give way and the decrease in price followed. This gentleman expressed himself as expecting perhaps still further reduction below the present figure of 22 cents, although he does not look for the decline until after the end of this year.

Railway Safety-device Investigation.

The Interstate Commerce Commission has announced the appointment of a board of experts to supervise and conduct experimental tests of block-signal systems and other safety devices as provided for by the joint resolution of Congress. The action followed a conference in Washington, D. C., on July 10th, with a committee representing the American Railway Association.

M. E. Cooley, professor of mechanical engineering in the University of Michigan, is named as chairman of the board. The other members are: Captain Ames, engineer in direct charge of signaling in the electric zone of the New York Central and Hudson River Railway; Frank G. Ewald, consulting engineer of the Railroad and Warehouse Commission of Illinois, and B. B. Adams of the Railroad Gazette. A committee of the American Railway Association has tendered the commission the use of railway tracks and other facilities for conducting the tests, and will cooperate to the fullest extent in securing the best results for safety in travel.

Galveston Bay Causeway Plans Delayed.

The delay in perfecting the plans for building a causeway across Galveston Bay to connect the mainland with Galveston Island, upon which the city of Galveston is situated, has somewhat disturbed the Stone & Webster interests. The county of Galveson voted bonds some time ago to build the causeway, but its building is conditional upon the several railroads entering Galveston joining in the enterprise. These roads have been slow about maturing their plans, and nothing definite has yet been done looking to the early construction of the causeway. The Stone & Webster people have everything in readiness to build their interurban electric railway between Houston and Galveston, but it is first desired to know what arrangements can be made for crossing the proposed causeway. If the new line cannot cross that structure, a separate bridge will have to be built for its use.

National Civic Federation and Public Ownership.

That part of the report of the Municipal Ownership Commission of the National Civic Federation which concerns the American light and water plants investigated has been made public. The report is made by a committee of four appointed by the commission, two of whom are connected with private enterprises and two being advocates of city ownership. Quite naturally two opinions are given.

Of the committee, Walton Clark, vice-president of the United Gas Improvement Company of Philadelphia, and Charles L. Edgar, president of the Edison Electric Illuminating Company of Boston, criticize the municipal plants examined, while Prof. Frank Parsons, of Boston, president of the National Public Ownership League, and Edward W. Bemis, superintendent of the Cleveland waterworks, commend in general such examples of municipal ownership as have been examined.

Messrs. Clark and Edgar agree that the inquiry of the committee, both into American and British plants, shows that where "municipal ownership has been removed from the realm of philosophic discussion and put to the test of actual experience it has failed ingloriously." They believe, too, that there would be grave danger of the building up of a municipal machine, which would surpass anything that has ever been effected in this line, if scores of men in gas, electric and street-railroad employ were to be made city employes. Prof. Parsons and Mr. Bemis, on the other hand, declare that the failures in municipal ownership are insignificant in comparison with the failures of private ownership.

Prof. Parsons expresses the belief that municipal ownership would develop a higher class of municipal administrators. On this point Messrs. Clark and Edgar say:

"There is little about municipal trading to attract men of the first class. We have not found evidence in the United States that the personnel of the city government of Chicago or Wheeling is superior to that of Atlanta or Norfolk, or that the introduction of municipal water and electric plants in Detroit has brought a higher type of citizenship into the governing body than we find in New Haven, which has neither."

Messrs. Clark and Edgar, in dealing with municipal electric-light plants, assert that in Chicago the cost is greater than if the supply were taken from a private company. The Chicago and Detroit municipal plants are declared to be of a type now obsolete, while the Allegheny plant is "poorly designed, inefficient and expensive to operate."

The expert quoted by Mr. Bemis estimates the profit to the city of Chicago on the operation of its plant up to the close of 1905 at $710,433. The "spoils system" had been kept out, although the plant was not all that could be desired. In street lighting the cost was less per arc lamp than was paid to private companies for similar service.

Messrs. Clark and Edgar, in a general statement at the close of their review of all conditions, say that with one or two exceptions all municipal plants properly audited have lost money.

Union Traction Reorganization Plan.

The plan of reorganization of the Chicago Union Traction Company was made public a few days ago and is now being considered by the holders of securities in the underlying companies. On July 24th Judge Grosscup and Prof. John C. Gray, as arbitrators, will hear any objections to the plan, which, in the main, is thought to be a fair one, and one which will require only the adjustment of minor details.

If accepted the reorganization plan will wipe out the old companies, with their debts, and substitute a new company with sufficient money to go ahead and carry out the rehabilitation of street-car equipment and service required by the settlement ordinance.

Two syndicates will be organized to carry out the plan. One will furnish the money for the rehabilitation of the lines, which will total in the end $24,000,000. The raising of half this is all that is contemplated at present. The other syndicate will furnish the money to satisfy the obligations of the Union Traction Company, including the reorganization. This will mean the raising of about $4,000,000.

It is expected that Isham Randolph, who has been chief engineer for the Chicago Drainage Canal for 14 years, will become consulting engineer of that work for a fixed salary. George M. Wisner, for 12 years assistant to the chief engineer, will succeed Mr. Randolph as chief engineer.

ELEMENTS OF ELECTRICAL ENGINEERING.

By Geo. R. Metcalfe.

XXV.—Central Stations.

Gas Engines.

Gas engines and oil engines represent types of prime movers quite radically different from the reciprocating and turbine types of steam engines previously considered. The broad distinction between these types is in the methods of utilizing the fuel. In the steam engine the energy is furnished by means of the slow combustion of coal under the boiler and entirely apart from the engine, and from this fact the steam engine is known as an external-combustion engine. The gas engine, as well as the oil engine, on the other hand, are known as internal-combustion engines for the reason that the energy is supplied by the explosive combustion of the fuel within the cylinders of the engine. In the internal-combustion engine the fuel used must necessarily be of gaseous or liquid form, because the use of solid fuel would imply a residue of ash or solid matter which could not readily be removed and which would cause rapid deterioration of the cylinders.

A consideration of the conditions surrounding these two types of prime movers will indicate at once that the internal-combustion type has a great advantage in efficiency, as it offers far less chances for losses of energy than the external-combustion type. In the most efficient modern steam-engine plant the efficiency as a whole is not much in excess of 12 to 14 per cent. This means that of the total potential energy of the fuel only 12 or 14 per cent. is utilized for useful work and the remaining 86 or 88 per cent. is lost.

This total loss is composed of a number of smaller losses which occur at every step in the process of converting the heat energy of the fuel to the energy of motion of the engine. The coal in the furnace burns at a temperature of 2,000 degrees F. or more, and the water in the boiler is heated to between 300 and 400 degrees at the most, and during this operation a large percentage of the heat of the furnace escapes up the chimney. The steam then loses heat constantly in its passage from the boiler to the engine in heating up the piping and engine cylinders. Considerable of the steam must also be used for operating auxiliaries, such as coal conveyors, pumps, economizers, feed-water heaters, etc., in an economical plant. In those plants which do not contain these auxiliaries the ultimate efficiency of the conversion of energy from coal is considerably under 10 per cent. Another loss which must be considered is the amount of fuel consumed under the boilers when the engine is not running. In order to be able to run without waiting to build a fire and get up steam it is necessary to keep the steam in the boilers up to a reasonable pressure at all times, and this means a constant consumption of fuel when no work is being done.

The conditions are far more favorable to efficiency with the internal-combustion engine. The fuel being gas, there are no chimney or boiler losses nor losses in transmission through pipes. The fuel is introduced into the engine cylinder and consumed there at a temperature between 2,000 and 3,000 degrees F., and a much greater proportion of this heat is utilized in useful work than is possible in a steam engine. Moreover, the gas-engine plant, having practically no auxiliary apparatus, is very simple, and can be operated with but little manual labor. The plant is much more compact and smaller than a steam plant, and the danger of boiler explosions is absent.

If the gas for such a plant has to be produced from coal a gas producer is necessary, which in a measure corresponds to the boiler of a steam plant. A good gas producer, however, is more economical than a steam boiler and will convert at least 85 per cent. of the heat energy of the coal into gas, making the loss of this conversion not over 15 per cent.

An efficient modern gas engine will convert 35 per cent. of the heat energy of the coal into useful work, so it is from two to three times as efficient as a steam-engine plant. A gas-engine plant should therefore use but one-half or less of the fuel necessary for a steam plant of the same output, and the simplicity of the plant and its small relative size should lend to still further economies in reduced operating expenses and lower first cost of station building. With these advantages the question naturally arises why the gas engine is so little used in comparison to the steam engine.

In the first place, the gas engine, in its present form, is a comparatively new machine and has only been perfected sufficiently to operate electrical machinery within the last few years, nor has it been built in large sizes until recently. Gas engines are now built in sizes equal to the largest steam engines, and their speed regulation has been perfected so that a very close uniformity of rotation during a complete revolution is obtained, making them capable of operating generators in parallel with entire success. Of the few large gas engines in use in electrical plants at present, but little has been published in regard to operating statistics, but the inherent economy of this class of engines makes it probable that they will rapidly come into more general use.

There are numerous makes of gas engines which differ considerably in mechanical details, but nearly all of them operate upon what is known as the Otto cycle, although other cycles are in limited use. It has been found that in order to operate with efficiency the mixture of gas and air in the engine cylinder must be compressed to a small volume before it is ignited, and this fact led to the adoption of the following arrangement:

On the first forward stroke of the piston the gas and air, in the proper proportions, are drawn into the cylinder through the entire stroke. Second, the mixture of gas and air is compressed during the return stroke of the piston until the explosive mixture occupies only the volume of the clearance between the piston and cylinder head. Third, the gas is ignited and the exploded charge expands throughout the next full forward stroke of the piston. Fourth, the products of combustion are exhausted during the second return stroke of the piston. This sequence of operations constitutes the Otto cycle.

On a small single-acting engine the flywheel is depended upon to carry the engine over the intervals between explosions, which occur only on alternate revolutions of the engine, but in large engines several cylinders are used, connected to cranks 90 degrees apart, so that two or four impulses or explosions per revolution are obtained, which give the engine a very uniform angular velocity. From what has been said it is apparent that the gas engine will not start itself like a steam engine does when steam is admitted to the cylinder, and when the engine is too large to start by hand some means must be provided for turning the engine over before it becomes self-acting. This is sometimes accomplished by compressed air, and more frequently by supplying the cylinders with a charge under high compression, for which special starting apparatus is provided.

As the constant explosions in the cylinder of a gas engine tend to heat the cylinder and adjacent parts to a high temperature, some means must be provided for keeping this temperature below a point which would be destructive to the engine. This is usually done by means of a jacket around the cylinder, through which a supply of cold water constantly circulates. The temperature of the cylinder can therefore be regulated by varying the temperature and amount of the water which flows about it.

In some small engines the water jacket is replaced by a succession of small ribs cast integral with the cylinder, so that the ribs present a very large radiating surface to the air, by means of which the heat is carried off. This is only practicable, however, for engines of very small capacity, as in very large engines it is often necessary to provide a water jacket for the exhaust valve.

As the gas engine is a heat engine, it is not desirable to cool the cylinder too much, but merely to keep it at a temperature which will not prove destructive to it. A little consideration will show that if the temperature is allowed to get too high, the cylinder oil would be vaporized, and the resulting friction in the cylinder would soon wear out the cylinder and piston rubbing surfaces. It will also be seen that beyond a certain temperature the engine would not operate at all, because the explosive gases would be ignited at once on entering the cylinder by coming in contact with the hot metal.

In order to have the engine operate properly, the ignition of the explosive gases must take place at just the proper time. The explosion of the gas is not instantaneous, but requires an appreciable amount of time before the maximum pressure is obtained. This time varies with the strength of the explosive mixture, and the amount of compression to which it is subjected. The proper time for the ignition is just a little before the end of the compression stroke; that is to say, just before the crank reaches dead center, so that the maximum pressure occurs a little later, just after the crank is past the center. It is very important that the explosion be properly timed. If it is too early, it will tend to reverse the engine, and if it is too late, a portion of the energy of the combustion is lost and the engine operates less efficiently.

Two methods of igniting the gases in the cylinder are employed. One is by bringing the gas into contact with a hot surface of metal, and the other is by means of an electric spark. The former method employs what is known as the hot tube, which is maintained at a red heat by a gas flame. This, however, gives rather unsatisfactory service, as the timing of the explosion is rather irregular. For this reason electric ignition is used more than any other method, because the timing can be arranged with the greatest accuracy. The electric spark may be generated by current from either a primary or storage battery, from lighting circuits, or, in the case of very large engines, small dynamos are sometimes provided especially for this purpose.

[*To be continued.*]

Note.—This series of articles, intended to survey, briefly, the whole field of applied electricity for light, power and heat, was begun in the Western Electrician of February 2, 1907.

QUESTIONS AND ANSWERS.

Loss of Polarity.

M. S. W., Linton, Ind: What is the cause of a machine losing its polarity? What is the remedy for it, if any? The machine in question is a 200-kilowatt three-phase General Electric alternator.

Answer.

A dynamo will lose its potential when the field circuit is opened. This may be either at the switch or somewhere else in the circuit. The remedy is obvious. But possibly the inquirer did not express exactly what he wished to say.

Excitation.

E. E. L., Enterprise, Ore.: In changing the direction of rotation of an exciter should any changes be made besides changing the brush holders? What size exciter would ordinarily be sent with a 200-kilowatt alternator? Suppose I were to use a 7½-kilowatt exciter with a 200-kilowatt alternator, could I not light the station from the exciter very easily if not more than 20 or 25 16-candlepower lights were needed?

Answer.

The field connections must also be reversed, or the exciter will fail to "build up." The polarity will, of course, be reversed from the original, which will require interchanging the external leads in order to maintain the original polarity on the direct-current bus-bars.

The size of the exciter will depend somewhat on the make of alternator. Ordinarily a six-kilowatt exciter should be ample for a 200-kilowatt dynamo. This would leave sufficient margin to light 25 16-candlepower station lights.

Parallel Operation with Equalizer.

A. P., Chicago: While running three or four 550-volt generators (direct current) in parallel and the voltage of one is cut down until its load is zero, will not the equalizer keep up its voltage and so prevent the other machines from backing in and running it as a motor? Or, in the case of one engine slowing down, would the generator be motorized, or would the equalizer get so hot from the current it carries to the weak machine, that it would melt? Would an answer to the above cover all the points in rotary-converter operation—that is, running from the same alternating-current source?

Answer.

If the shunt field is weakened or the speed is reduced just enough to bring the load to zero, nothing would happen. The induced voltage of this dynamo is then equal to the voltage of the others, minus the "drop" across the equalizer between this dynamo and the others. If the field strength or the speed or both are further reduced, the dynamo will be "motorized" by the others.

The equalizer bar is generally of large dimensions; therefore other parts of the circuit (fuses or circuit-breakers) would open long before the equalizer would get hot.

The above does not apply to rotary converters, as these machines run in synchronous speed, and have their potential fixed within limits by the alternating-current voltage.

Revised Standardization Rules.[1]

103. Commutator Brush Friction.—The magnitude of the commutator brush friction (which may be considered as independent of the load) is determined by measuring the difference in power required for driving the machine with brushes on and with brushes off (the field being unexcited).

104. Collector-ring Brush Friction.—Collector-ring brush friction may be determined in the same manner as commutator brush friction. It is usually negligible.

110. Armature-resistance Loss.—This loss may be expressed by $p I^2 r$, where r = resistance of one armature circuit or branch, I = the current in such armature circuit or branch, and p = the number of armature circuits or branches.

111. Commutator Brush and Brush-contact Resistance Loss.—It is desirable to point out that with carbon brushes these losses may be considerable in low-voltage machines.

112. Collector-ring and Brush-contact Resistance Loss.—This loss is usually negligible, except in machines of extremely low voltage or in unipolar machines.

113. Field Excitation Loss.—With separately excited fields the loss of power in the resistance of the field coils alone should be considered. With either shunt or series field windings, however, the loss of power in the accompanying rheostat should also be included, the said rheostat being considered as an essential part of the machine and not as separate auxiliary apparatus.

114. Load Losses.—The load losses may be considered as the difference between the total losses under load and the sum of the losses above specified.

115. a. In commutating machines of small field distortion the load losses are usually trivial and may, therefore, be neglected. When, however, the field distortion is large, as is shown, for instance, by the necessity for shifting the brushes between no load and full load, or with variations of load, these load losses may be considerable and should be taken into account. In this case the efficiency may be determined either by input and output measurements, or the load losses may be estimated by the method of section 116.

116. b. Estimation of Load Losses.—While the load losses cannot well be determined individually, they may be considerable, and therefore their joint influence should be determined by observation. This can be done by operating the machine on short-circuit and at full-load current, that is, by determining what may be called the "short-circuit core loss." With the low field intensity and great lag of current existing in this case, the load losses are usually greatly exaggerated.

117. One-third of the short-circuit core loss may, as an approximation, and in the absence of more accurate information, be assumed as the load loss.

131. Alternating or Transformer Loss.—These losses are measured by wattmeter in the field circuit. They include molecular magnetic friction and eddy currents, due to the alternation of the magnetic field, I^2r losses in cross-connections of cross-connected armatures, I^2r and other losses in armature coil and commutator leads which are short-cuited by the brushes, as far as these losses are due to the alternation of the magnetic flux.

140. Armature Resistance Loss.—This loss in the armature is $q I^2 r$, where I = direct current in armature, r = armature resistance and q, a factor which is equal to 1.47 in single-circuit single-phase, 1.15 in double-circuit single-phase, 0.59 in three-phase, 0.39 in two-phase, and 0.27 in six-phase converters.

147. The efficiency of two similar converters may be determined by operating one machine as a converter from direct to alternating, and the other as a converter from alternating to direct, connecting the alternating sides together, and measuring the difference between the direct-current input and the direct-current output. This process may be modified by returning the output of the second machine through two boosters into the first machine and measuring the losses. Another modification is to supply the losses by an alternator between the two machines, using potential regulators.

167. In rotary induction apparatus the load losses may for practical purposes be determined by measuring the total power, with the rotor short-circuited at standstill and a current in the primary circuit equal to the primary energy current at full load. The loss in the motor under these conditions may be assumed to be equal to the load losses + I^2r losses in both primary and secondary coils.

177. In rectifiers the most satisfactory method of determining the efficiency is to measure both electric input and electric output by wattmeter. The input is usually inductive, owing to phase displacement and to wave distortion. For this reason the power factor and the apparent efficiency should also be considered, since the latter may he much lower than true efficiency. The power consumed by auxiliary devices, such as the synchronous motor or cooling devices, should be included in the electric input.

178. In constant-current rectifiers, transforming from constant potential alternating to constant direct current by means of constant-current transforming devices and rectifying devices, the losses in the transforming devices are to be included in determining the efficiency and have to be measured when operating the rectifier, since in this case the losses may be greater than when feeding an alternating secondary circuit. In constant-current transforming devices the load losses may be considerable and therefore should not be neglected.

179. In open-coil arc machines the losses are essentially the same as in direct-current (closed coil) commutating machines. In this case, however, the load losses are usually greater, and the efficiency should preferably be measured by input and output test, using wattmeters for measuring the output. In alternating-current rectifiers the output should in general be measured by wattmeter and not by voltmeter and ammeter, since owing to pulsation of current and voltage a considerable discrepancy may exist between watts and volt-amperes. If, however, a direct-current and an alternating-current meter in the rectified circuit (either a voltmeter or an ammeter) give the same reading, the output may be measured by direct-current voltmeter and ammeter. The type of alternating-current instrument here referred to should indicate the effective or root-of-mean-square value and the type of direct-current instrument the arithmetical mean value, which would be zero on an alternating-current circuit.

180. The efficiency of transmission lines should be measured with non-inductive load at the receiving end, with the rated receiving voltage and frequency; also with the sinusoidal impressed wave form, except where expressly specified otherwise, and with the exclusion of transformers or other apparatus at the ends of the line.

181. In apparatus producing phase displacement, as, for example, synchronous compensators, exciters of induction generators, reactors, condensers, polarization cells, etc., the efficiency should be understood to be the ratio of the volt-amperes minus power loss to the volt-amperes.

182. The efficiency may be calculated by determining the losses, subtracting them from the volt-amperes and then dividing the difference by the volt-amperes.

183. In synchronous compensators and exciters of induction generators the determination of losses is the same as in other synchronous machines.

184. In reactors the losses are molecular magnetic friction, eddy losses and I^2r loss. They should be measured by wattmeter. The efficiency of reactors should be determined with a sine wave of impressed voltage except where expressly specified otherwise.

D. Regulation.

187. Definition.—The regulation of a machine or apparatus in regard to some characteristic quantity (such as terminal voltage current or speed) is the ratio of the deviation of that quantity from its normal value at rated load to the normal rated load value. The term "regulation," therefore, has the same meaning as the term "inherent regulation," occasionally used.

188. Constant Standard.—If the characteristic quantity is intended to remain constant (e. g., constant voltage, constant speed, etc.) between rated load and no load, the regulation is the ratio of the maximum variation from the rated load value to the no-load value.

189. Varying Standard.—If the characteristic quantity is intended to vary in a definite manner between rated load and no load, the regulation is the ratio of the maximum variation from the specified condition to the normal rated-load value.

190. (a) Note.—If the law of the variation (in voltage, current, speed, etc.) between rated load and no load is not specified, it should be assumed to be a simple linear relation, i. e., one undergoing uniform variation between rated load and no load.

191. (b) Note.—The regulation of an apparatus may, therefore, differ according to its qualification for use. Thus, the regulation of a compound-wound generator specified as a constant-potential generator will be different from that which it possesses when specified as an over-compounded generator.

192. In constant-potential machines the regulation is the ratio of the maximum difference of terminal voltage from the rated-load value (occurring within the range from rated load to open circuit) to the rated load terminal voltage.

193. In constant-current machines the regulation is the ratio of the maximum difference of current from the rated-load value (occurring within the range from rated load to short-circuit, or minimum limit of operation) to the rated-load current.

194. In constant-power apparatus the regulation is the ratio of maximum difference of power from the rated-load value (occurring within the range of operation specified) to the rated power.

195. In constant-speed direct-current motors and induction motors the regulation is the ratio of the maximum variation of speed from its rated-load value (occurring within the range from rated load to no load) to the rated-load speed.

196. The regulation of an induction motor is, therefore, not identical with the slip of the motor, which is the ratio of the drop in speed from synchronism to the synchronous speed.

197. In constant-potential transformers the regulation is the ratio of the rise of secondary terminal voltage from rated non-inductive load to no load (at constant primary impressed terminal voltage) to the secondary terminal voltage at rated load.

198. In over-compounded machines the regulation is the ratio of the maximum difference in voltage from a straight line connecting the no-load and rated-load values of terminal voltage as function of the load current to the rated-load terminal voltage.

199. In converters, dynamotors, motor-generators and frequency converters the regulation is the ratio of the maximum difference of terminal voltage at the output side from the rated-load voltage, to the rated-load voltage on the output side.

200. In transmission lines, feeders, etc., the regulation is the ratio of the maximum voltage difference at the receiving end between rated non-inductive load and no load to the rated-load voltage at the receiving end (with constant voltage impressed upon the sending end).

201. In steam engines the regulation is the ratio of the mavimum variation of speed in passing slowly from rated load to no load (with constant steam pressure at the throttle) to the rated-load speed. For variation and pulsation see sections 59-64.

202. In a hydraulic turbine or other water motor the regulation is the ratio of the maximum variation of speed in passing slowly from rated load to no load (at constant head of water, i. e., at constant difference of level between tail race and head race) to the rated-load speed. For variation and pulsation see sections 59-64.

203. In a generator unit, consisting of a generator united with a prime mover, the regulation should be determined at constant conditions of the prime mover, i. e., constant steam pressure, head, etc. It includes the inherent speed variations of the prime mover. For this reason the regulation of a generator unit is to be distinguished from the regulation of either the prime mover or of the generator contained in it when taken separately.

Conditions for and Tests of Regulation.—

204. Speed.—The regulation of generators is to be determined at constant speed and of alternating apparatus at constant impressed frequency.

205. Non-inductive Load.—In apparatus generating, transforming or transmitting alternating currents, regulation should be understood to refer to non-inductive load, that is, to a load in which the current is in phase with the electromotive force at the output side of the apparatus, except where expressly specified otherwise.

206. Wave Form.—In alternating apparatus receiving electric power, regulation should refer to a sine wave of electromotive force, except where expressly specified otherwise.

207. Excitation.—In commutating machines, rectifying machines and synchronous machines, such as direct-current generators and motors, alternating-current and polyphase generators, the regulation is to be determined under the following conditions:

(1) At constant excitation in separately excited fields.

(2) With constant resistance in shunt-field circuits, and

(3) With constant resistance shunting series-field circuits, i. e., the field adjustment should remain constant and should be so chosen as to give the required full-load voltage at full-load current.

208. Impedance Ratio.—In alternating-current apparatus, in addition to the non-inductive regulation, the impedance ratio of the apparatus should be specified, i. e., the ratio of the voltage consumed by the total internal impedance of the apparatus at full-load current to its rated full-load voltage. As far as possible a sinusoidal current should be used.

209. Computation of Regulation.—When in synchronous machines the regulation is computed from the terminal voltage and impedance voltage, the exciting ampere-turns corresponding to terminal voltage plus armature-resistance drop, and the ampere-turns at short-circuit corresponding to the armature-impedance drop should be combined vectorially to obtain the resultant ampere-turns, and the corresponding internal electromotive force should be taken from the saturation curve.

[1] This is the second installment of the extracts begun in the Western Electrician last week from the revised standardization rules of the American Institute of Electrical Engineers. The original section numbers are retained. The concluding extracts will be given next week.

Concrete Poles Prove Satisfactory.

Nearly a year ago experiments were begun at Richmond, Ind., with reinforced concrete telephone and telegraph poles. William Bailey, superintendent of the Richmond Home Telephone Company, made a series of tests, with the result that he has produced a pole 30 feet in height, octagonal in shape, tapering toward the top, with gains to be used in climbing and for the insertion of cross-arms. A number of these poles were erected on one of the main lines of the company, and a short line was constructed wholly of concrete poles.

After a year in service it has been found that the poles have given as much satisfaction as the wooden poles and have the additional quality of being almost indestructible. The pole itself could not be patented, but the manner of construction has been protected by patents. On July 8th the American Concrete Pole Company was organized in Richmond, with James A. Brailey of Toledo, Ohio, as president. Associated with Mr. Brailey are William Bailey, the inventor, and several others.

The Installation and Operation of Alternating-current Generators.

Part II.

Drying Out.

If a machine has been exposed to low temperature it should not be unpacked until it has reached the same temperature as that of the room, otherwise a film of moisture may form thereon, due to condensation. After the alternator has been set up it should be dried out by short-circuiting the armature terminals and running the machine with low-field excitation sufficient to circulate in the armature a current about 25 per cent. greater than normal full-load current. An ammeter should be inserted to indicate the current and the machine

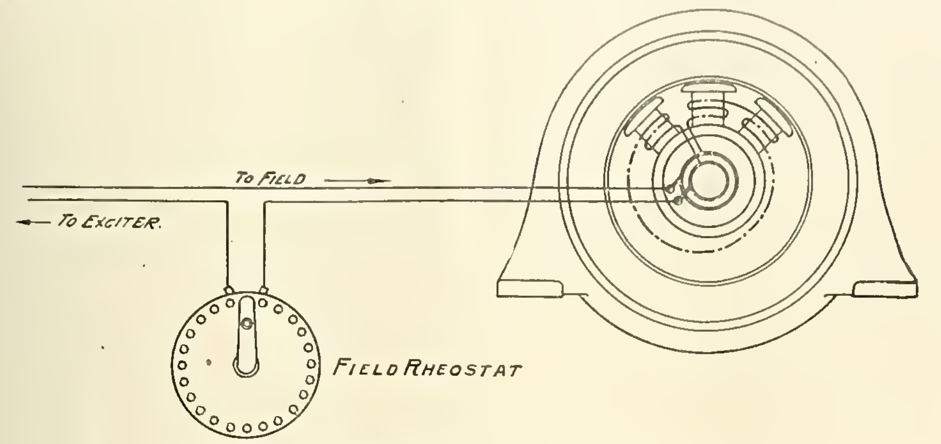


FIG 8 EXCITER CONNECTIONS WITH FIELD DISCHARGE RESISTANCE.

run until it has become thoroughly warmed up and all moisture expelled.

Starting Up.

In case the alternator does not operate in parallel with other machines the following instructions should be observed:

Bring the alternator and exciter up to speed and make sure that the oil rings are revolving freely. See that all resistance in both exciter and alternator field rheostats is cut in and that both field and main switches are open. Cut out resistance in exciter field and bring the exciter pressure up to normal. If the exciter fails to generate, follow the instructions as given in the instruction book (Allis-Chalmers) for direct-current generators. Close the field switch of the alternator and have all resistance in so that full voltage will not be generated in the windings. In case the machine is being started for the first time, allow it to run for an hour or two at low voltage and then gradually increase the voltage until it reaches normal; the load can then be thrown on.

As the load increases it will be necessary to cut out some resistance in the field circuit in order to maintain full voltage, and if the load on the alter-

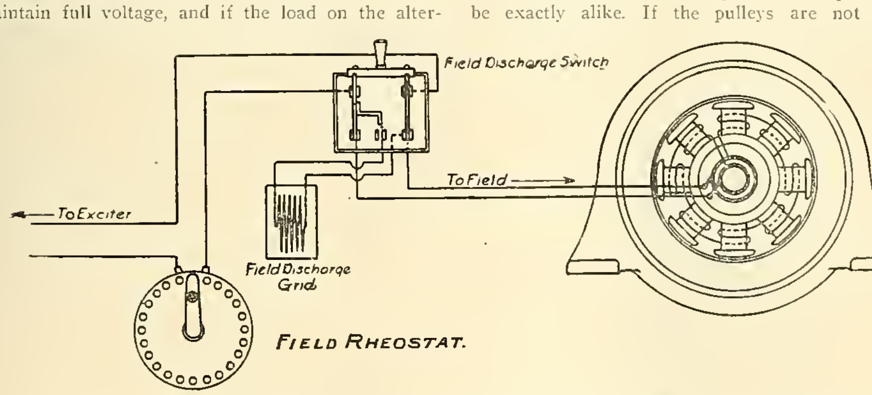


FIG. 9. EXCITER CONNECTIONS WITH FIELD DISCHARGE RESISTANCE.

nator is inductive a larger amount of resistance must be cut out than with non-inductive load. On light loads comparatively small field excitation is required, and it is advisable to run the exciter at rather low voltages and avoid wasting so much power in the field rheostat, provided the exciter voltage is not made low enough to render the operation unstable or cause sparking at the brushes, and that the exciter is not used for exciting other alternators.

Shutting Down.

Where a machine is run by itself and is to be shut down, first cut in resistance in field of alternator, thus lowering the voltage. Then open the main switch and finally the field switch of the alternator. The alternator field circuit should not be opened when full current is flowing, because the high induced electromotive force caused thereby may be sufficient to break down the field insulation. With most of the larger machines a grid resistance is connected to the field switch, so that in case the latter is opened the resistance is first connected across the field circuit, thus forming a path through which the induced current can flow and prevent any abnormal rise in electromotive force. Fig. 8 shows exciter connections for small machines and Fig. 9 for larger alternators where a grid discharge resistance is used.

Parallel Operation.

When two or more alternators are run in parallel there are certain conditions that must be met in order to secure satisfactory operation. These are:

a. The machine must be in synchronism—that is, the frequency must be the same for each, and the electromotive forces of the different machines must be in phase.

b. The electromotive forces must be approximately equal.

c. In order to secure proper division of the load under changes in load conditions the speed regulation of the prime movers must be alike.

d. To prevent periodic cross currents between machines the variations in angular velocity of the prime movers must be kept within certain limits. In waterwheel or steam-turbine-driven units the angular velocity is uniform, but with reciprocating engine units there may be trouble due to periodic variation if the engine flywheels are not heavy enough.

Belted Alternators.

With belted alternators it is very important that the pulleys be proportioned so as to make the speeds of the alternators such that they will give exactly the same frequency; if all the machines have the same number of poles their speeds must be exactly alike. If the pulleys are not of the proper size there will be excessive belt slippage or exchange of cross currents between the machines, thus causing fluctuations in voltage.

Engine-driven Alternators.

With engine-driven alternators the speed can be varied by adjusting the governor, and there will be no trouble from cross currents, provided the angular velocity of the engines does not vary too much and the engine governors act properly.

Division of Load.

When two alternators are running in parallel their output (actual power) depends on the amount of power supplied by their prime movers. For example, suppose two engine-driven machines are running in parallel on a certain load and that each is taking half of the load. When the load increases there is a tendency for the speed to drop slightly, and in order for the engine governors to act and admit more steam there must be a slight drop in speed. Now the two alternators must always run in synchronism, or at the same speed, assuming the number of poles to be alike, and if the drop in speed does not result in an equal increase in the steam admission of each engine, one alternator will be supplied with more power than the other and the load will become unequally divided.

Changing the field excitation of the slightly loaded machine will not remedy matters (as with direct-current generators, where the generators do not have to run in synchronism and have independent speeds). The only effect of changing the field excitation is to make a wattless current circulate between the two alternators, the actual amount of power supplied by each remaining the same. The only way to increase the steam admission is by adjusting the engine governor, and to secure equal division of load under all conditions the change in speed for a given change in load must be alike for each engine.

When two or more alternators are run in parallel it is advisable to have an indicating wattmeter on each machine, so that the actual load will be indicated. In case wattmeters are not provided the load on each should be adjusted so that the sum of the currents as indicated by the machine ammeters will be a minimum for a given total current supplied to the line. If the sum of the machine currents is much in excess of the line current it

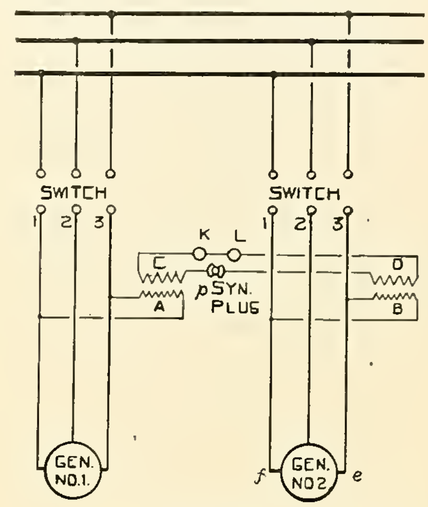


FIG 10 DIAGRAM OF CONNECTIONS FOR SYNCHRONIZING LAMPS

shows that a wattless current is circulating between the machines.

Synchronizing.

The condition of synchronism is usually indicated either by incandescent lamps or by a synchronism indicator or synchroscope, the latter now being used in most large installations. A synchroscope gives more accurate indications than lamps and has the additional advantage of showing whether the incoming machine is coming into or going out of phase and how much it is out of phase. If a synchroscope is to be installed, special instructions will be sent for connecting it up.

Fig. 10 shows diagrammatically the connections for synchronizing lamps. Two small transformers (A) and (B) have their primaries connected to the same phase of each generator. The secondaries (C) and (D) are connected in series through a plug or switch (p) and lamps (KL). Assuming that corresponding terminals of the primaries are connected to corresponding lines on each machine and that the two transformers are alike in every particular, corresponding secondary terminal will, at any given instant, have the same polarity when the two machines are in phase. When plug (p) is inserted, secondary terminals of opposite polarity are connected together; hence the two secondary electromotive forces are in series and aid each other in forcing current through lamps (KL), which are, therefore, bright at synchronism.

It may happen that the transformers are not wound exactly alike or that the connections have become confused; it is always advisable, therefore, to test the connections to make sure that the lamps are light or dark at synchronism. To test the connections in Fig. 10, disconnect (B) from generator No. 2 and transfer the connections, without changing their relative position, to lines (1) and (3) of generator No. 1; (A) and (B) will then be connected to the same lines, and if the lamps are bright they will also be bright at synchronism where (B) is connected to generator No. 2 as shown. If dark lamps are preferred, either the primary or secondary connections of one transformer must be reversed.

Another method of testing the connections is to leave the transformer connections as they are and disconnect the main leads (e) (f) on generator No. 2. Both main generator switches are then closed, thus connecting both transformers (A) and (B) to generator No. 1. In synchronizing, bright lamps are to be preferred to dark.

When a polyphase alternator is first connected up it is very important to see that all of its phases correspond with those of the bus-bars; if one phase only of a three-phase machine is correct, it does not follow that the other two are correct also. Two of the phases should be tested at the same

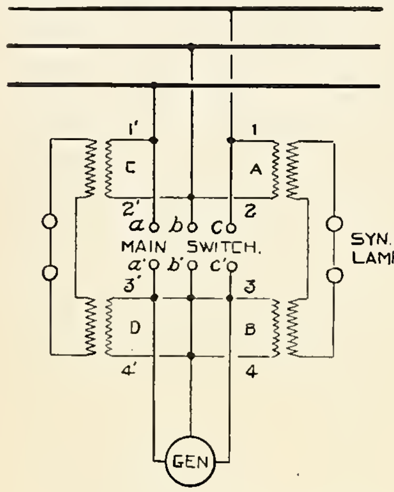


FIG. 11. DIAGRAM OF CONNECTIONS FOR SYNCHRONIZING LAMPS.

time by using a pair of auxiliary transformers in addition to the regular synchronizing transformers (A) (B), Fig. 11. Transformer (A) is connected to the bus-bars and (B) to the generator. A second pair of transformers (C) (D) is connected to one of the other phases, the connections in each case being such that the lamps are bright at synchronism.

The connections should be tested as described above to make sure that the polarity of the transformers is correct. With the main switch open and with the generator running at full voltage, both sets of synchronizing lamps should pulsate together. If they do not do so the leads from the generator are incorrectly connected to the generator terminals and should be interchanged so as to make the lamps pulsate together. After this test has been made, to insure that terminals (a) (b) (c) connected to the bus-bars correspond to (a') (b') (c') connected to the generator, the temporary transformers (C) (D) can be removed.

Belted Machines.

When a belted alternator is to be thrown in parallel with another machine, first bring the incoming generator up to speed and adjust the voltage until it is approximately the same as that of the bus-bars. Adjust the speed until the beats of the synchronizing lamps become very slow, say one beat in two or three seconds, or until the pointer of the synchroscope is moving very slowly. Close the main switch when the lamps indicate synchronism (light or dark depending on the connections), or when the pointer of the synchroscope is over the central point or slightly ahead of it. Adjust the field excitation and see that the alternator is supplied with enough power to make it carry its share of the load. In case a number of belted alternators are driven from a common line shaft, the belt of the incoming machine should be slackened, thus introducing enough slip to allow the machine to be synchronized. After the alternator is in step the belt can be tightened and the load gradually applied.

Engine-driven Machines.

With engine-driven alternators the incoming machine should be given only a small amount of steam until after it is synchronized. The load can then be taken up by admitting more steam. In large plants the engine governor is usually arranged so that it can be controlled electrically from the switchboard and the steam admission varied as desired. If the governor cannot be so controlled the steam admission can be regulated at the throttle. Waterwheel governors are also frequently provided with an electrical control device; if not, the gate opening must be controlled by hand to synchronize the machine and adjust the load.

Shutting Down.

When machines are operated in parallel and one is to be shut down, first reduce the load by throttling the engine or slackening the belt. Then open the main switch. Cut in resistance in field of alternator to reduce field current and open field switch.

General Care of Machine.

On account of not having a commutator, alternators are on the whole easier to keep in good running order than direct-current machines. At the same time they must be properly attended to. It must be remembered that they frequently generate much higher pressure than direct-current machines and there is all the more necessity for keeping them perfectly clean. No dirt, copper or carbon dust should be allowed to accumulate on or near the windings, and in plants sufficiently large to warrant the expense it is advisable to install a compressed-air system so that all dirt can be blown out of the corners not otherwise easily reached. It is also advisable to give the armature coils and connections a coat of insulating varnish occasionally.

Keep the collector rings lubricated with a small quantity of vaseline applied with a cloth and see that the brushes make good contact with the rings.

Never open the field current suddenly while current is flowing, and see that both main and field switches are open when the machine is not running.

Never throw the machines in parallel when they are out of synchronism; the excessive rush of current throws heavy strains on the engines and generators and may cause considerable damage.

Remember that the alternators are designed for the voltage indicated on the name plate. They must not be expected to give voltages considerably above normal with satisfactory performance of either exciter or alternator. This point is here mentioned because frequent attempts to raise the voltage an excessive amount have resulted in poor operation through no fault of either exciter or alternator. Furtherfore, the rated current output should not be continuously exceeded.

Check the air-gap between stator and rotor now and then, and if it is found to be uneven, realign the machine. This applies particularly to engine-type generators.

See that all bolts and nuts are kept tight. Electrical machinery should receive as much attention in this respect as steam engines.

[*The end.*]

Iwan Post-hole Auger.

The accompanying picture shows how the Iwan post-hole auger works. The device is made in 10 sizes and is useful to railway, electric-light, telephone and telegraph companies and contractors. Two crucible-steel blades, each with two scientifically formed cutting edges, and riveted to a

IWAN POST-HOLE AUGER.

strong malleable arch, form the bowl of the auger. The two blades interlock, having notched edges for this purpose, thus holding each other firmly in place. Total length of sizes is as follows: From three to 10 inch, four feet; 12 and 14 inch, six feet.

For all ordinary uses these lengths will answer the purpose, but where deeper holes are required, longer pipe can be attached. The 12 and 14-inch augers are fitted with one-inch pipe, and all the other sizes with ¾-inch. The weight is from eight to 24 pounds each. This tool is made by Iwan Brothers of Streator, Ill.

Another Electrically Equipped Paper Mill.

The Willamette Pulp and Paper Company of Oregon City, Ore., has just added to its plant a second factory, which, with the older mill, enables the company to produce 140 tons of paper a day. The new mill, being for the most part electrically driven, furnishes an excellent example of the advantages of this flexible method of power distribution.

The Willamette River at this place has a fall of about 25 feet, and the old mill of the company is located at the brink of the falls. The new mill is about 1,000 feet distant and is driven by induction motors supplied with current from a waterwheel-driven generator located in the old mill. By utilizing the electric system in this way, it has been possible to develop some 750 additional horsepower at the falls and at the same time locate the mill advantageously.

The electrical equipment was furnished by the General Electric Company, and consists of a 600-kilowatt, three-phase, 600-volt, revolving-field, alternating-current generator, direct-connected to a 1,000-horsepower waterwheel built by the Platt Iron Works. The power is transmitted directly at the generator voltage.

To insure against a shutdown in the new mill, arrangements have been made with the local company for power, should any accident happen to the paper company's generating equipment.

In the new mill, both group and individual induction motor drives have been arranged. The motors are all of the squirrel-cage type and operate at 550 volts. One group consists of a 12 by 12-inch chipper, a chip separator, a sawdust conveyor and a bucket hoist, all driven by a 200-horsepower induction motor. The motor is operated about eight hours a day and carries load easily no matter how hard the chipper is crowded. The bucket-hoist carries the chips into bins, ready for the digester.

A second group, driven by a 200-horsepower induction motor, consists of three pumps and four beaters, each handling 650 pounds of pulp. This motor runs continuously 24 hours a day. The beater load fluctuates greatly, varying with the amount of moisture in the pulp and the amount of pressure exerted by the operation. Owing to the large starting effort required for the beaters, a friction clutch is inserted in the line shaft, so that the motor can come up to speed without load and then take the load gradually by means of the clutch.

A third induction motor, having a capacity of 100 horsepower, drives two chest agitators and three pumps. The paper is reduced to the proper consistency for the paper machines in a Jordan engine, which is driven by a 100-horsepower motor. A 10-horsepower motor is belted to the elevator. This motor runs continuously, taking full load only when the elevator is in use. The four wet machines and three Decker machines are also driven from a countershaft belted to a 50-horsepower induction motor.

Steam power is used for the operation of the 152-inch Fourdrinier paper-making machine. A 650-horsepower non-condensing engine is used for this purpose, the exhaust steam being piped to the drying cylinders on which the paper is rolled before being calendered and reeled.

Data on Illumination.

Bulletin No. 7 of the Engineering Department of the National Electric Lamp Association, entitled "Data on Illumination," gives a clear explanation of the best methods for calculating illumination, and several problems are fully worked out showing the exact procedure. The tables not only give such general information as required illumination for various classes of service, effect of absorption, etc., but also materially lessen the actual calculation in figuring both illumination and wiring, and make the bulletin of practical value to both the illuminating engineer and those who have to work out only occasional problems in illumination.

An outline of the matter contained is as follows: "General Considerations," "Methods of Illumination," "Measurement of Light," "Illumination," "Wiring" and "Cost Analysis." The clear and concise manner in which the subjects are presented, together with the special tables carefully designed to minimize the labor of figuring illumination, make the bulletin useful to the novice, who can follow the calculations step by step, and also to the illuminating engineer, who will find in the tables a means of rapidly solving any problem in illumination or wiring. The tables are especially valuable to architects, building contractors, electrical engineers, and any person interested in the use of electric incandescent lamps.

The fact that these bulletins are being compiled along somewhat different lines than ordinary commercial bulletins, makes them of special interest. Copies of the bulletins will be mailed to anyone sending to the Engineering Department, 4411 Hough Avenue, Cleveland, Ohio, U. S. A.

Ohio Telephone Notes.

James S. Brailey, president of the Cuyahoga and United States Telephone companies, denied the rumor last week that he was working on a deal for leasing the companies to a stronger holding company. He says that he is perfectly satisfied with present conditions.

The Columbus Citizens' Telephone Company has installed an automatic telephone at Canal Winchester and at Worthington, and calls can be made from these points direct to the instruments of Columbus subscribers without passing through the local long-distance board. The installation of these instruments means a great saving in time, and the experiment, if successful, will result in the installation of similar instruments at other country points.

Circulars have been sent out by the Home Telephone Company of Dayton giving terms of subscriptions to the new issue of $150,000 of preferred and $150,000 of common stock, which will soon be made by the company. The stockholders may subscribe on about 15 per cent. of their present holdings at par, for which they will receive an equal amount of common with the preferred. The new issue is made to provide funds for the betterment of the plant, the extension of its cable lines and to provide facilities to take care of its rapidly increasing business. The company now has on hand almost 300 contracts which cannot be taken care of because of inadequate facilities, and there are applications for hundreds of additional telephones. S.

Indiana Telephone Items.

The Southern Indiana Electrical Company has incorporated for the purpose of establishing a plant for the manufacture of telephones and electric supplies. The headquarters will be in New Albany, with Charles D. Knoefel president.

The Stringtown Telephone Company has incorporated to construct and operate a telephone system in Jackson and Center Township, Hancock County, with postoffice address in Greenfield. This company will soon ask for bids for the furnishing of material and instruments. Roy Crider, James Parish and Frank Carter are directors.

The Park County Telephone Company, with principal exchange in Rockville, has sold the controlling interest to the Central Union Telephone Company. The old stockholders are still a part of the new organization.

A. T. Mahin has resigned as local manager for the Bell Telephone Company at Connersville, and it is understood will be succeeded by Charles Meunnier of the same city.

The Central Union Telephone Club, an organization composed of the Central Union's employes in Indianapolis, has elected officers as follows: President, E. T. Busselle; vice-president, F. A. Newberg; secretary, J. L. Bacon; sergeant-at-arms, E. Welding. The club is both a social and relief association. S.

GENERAL TELEPHONE NEWS.

The Solon (I. T.) Telephone Company will establish rural routes. A. C. Borthick is president. It is said that supplies are needed.

The Central Texas Telephone Company has been incorporated with a capital of $50,000 and succeeds the Huntsville Telephone Company of Huntsville, the Madison Telephone Company of Madisonville and the Triangle Telephone Company.

The Home Telephone Company of Alameda County, Cal., has commenced business in Oakland, Cal., where it has many miles of underground conduits in place. Service is given by a large automatic switchboard in the new telephone-exchange building at Seventeenth and Franklin streets. Nearly 3,000 subscribers have been signed, but all are not connected yet. Until that number of instruments is in use no charge will be made, but afterward the regular rate of $5 per month for business telephones and $2.50 for residence telephones will be charged.

In the case of the Home Telephone Company of Los Angeles, Cal., against the city of Los Angeles in injunction proceedings, Judge Olin Wellborn of the United States Circuit Court at that place holds that the city has the legal right to fix rates for gas and electric lighting, telephone service and similar services. The decision holds that the rate-fixing power may be delegated by the state to a city, in which case the city may proceed with all the authority and power of the Legislature. In the case of the telephone company, an ordinance was passed more than a year ago fixing service rates for business houses and for residences.

CORRESPONDENCE.

Continental Europe.

Paris, July 5.—One of the largest steam turbine plants in France will be the new station which is to be erected at Toulouse for the supply of the city. It is under the control of a company known as the Toulouse Electric Company. The order for the electric outfit of the new station has already been given to the Paris branch of the Thomson-Houston Company and the machines will be built in the Paris shops of that firm. Curtis steam turbines are to be used in this case. As regards the station, it is well situated on a canal leading from the Garonne River and is laid out for a total capacity of 9,000 kilowatts. At the start there will be installed three units of 1,000 kilowatts each, producing three-phase current at 14,000 volts. A steam engine and exciter group will be used for the starting, after which the exciting current will be furnished by a motor-generator set, using a three-phase motor mounted betwen two 60-kilowatt generators. The boiler house will have six multi-tubular boilers with automatic stokers, giving 8,000 pounds of steam per hour. Coal is brought by barges upon the canal, and is taken from the yard to the boilers by a motor-driven conveyor.

It is stated that a project is on foot for an electric railroad which is to run betwen Vienna and Budapest, covering a distance of 170 miles. The distance will be covered by through trains in two hours, and the slower trains will stop at different stations along the route. A double-track road is to be used. At different points along the line current will be supplied to industrial establishments. It appears also that the same company is making projects for other long-distance railroads between leading cities of Europe.

A new company has been formed at Valencia, Spain, for the purpose of building an electric-tramway line in that city, and the line is to run thence to the suburban locality of Moncada.

The French government has recently authorized the construction of a telegraph line between Timbuctoo, Niamey and Zinder. It will be about 1,100 miles in length and is to cost $400,000. The Postal and Telegraph Department is taking measures to establish a radio-telegraphic system between France and Algeria. The project relates to a station which will be erected on the south coast of France in the region of Marseilles. It will be the largest of the kind yet installed in France, and it is expected to have it in working order so as to communicate with the Algerian posts about the end of the year.

The Societa Elettrochimica has lately obtained the concession for the use of hydraulic power from the River Pescara, Italy, to the extent of a 300-foot head of water. Two different turbine plants will be erected, so as to divide this fall into two portions. One of the plants will be laid out for 8,500 horsepower, and the second is to give 22,000 horsepower. The first of these plants is to have four turbo-alternator sets.

At Florence has been formed a company for the erection of hydraulic plants, and it is expected to have it capitalized at $1,000,000 in the near future. A new company is also formed at Milan for utilizing the hydraulic power of the Camonica Valley, above the city of Brescia. The falls will have an output of 100,000 horsepower, and it is expected to use 30,000 horsepower at the beginning of operations. The Italian Edison Company and the Conti firm are interested in the matter. The capital is fixed at $2,000,000 at the start, but may be increased to double this figure. A. de C.

Great Britain.

London, July 5.—The supporters of the London County Council electric power scheme received a bad shock last week, when the Hybrid committee of the House of Commons, which is considering the bill, announced, without calling upon any of the opponents to proceed with their evidence, that they could not pass the measure. The London County Council has expressed itself somewhat forcibly toward the House of Commons as a result of the scant manner in which it has been treated in connection with its bill. Undoubtedly the method of working the proposed undertaking was not calculated in the best interests of London, but in the circumstances one looked for some expression of opinion from the committee, especially in view of the fact that it was not an ordinary committee of the House, but what is termed a hybrid committeee, partly appointed by the House itself, and thus given a greater political flavor than is usual. The committee simply reported, when half way through with the bill, that it was not satisfied with the allegations of the promoters, and rejected the measure. In the present exceptional circumstances, some recommendation would have been welcomed from the committee, but as matters now stand it is stated that the County Council does not intend to promote another bill itself. Therefore it seems probable that private promoters will be once again let in, and we shall therefore in all likelihood have the spectacle next year of the London County Council not promoting, and all bills deposited by private promoters "blocked" or rejected by the House of Commons.

All the governors of the new Imperial Technical College, which is to be instituted in London, have now been nominated. The president of the Institution of Electrical Engineers, Dr. R. T. Glazebrook, represents that body upon the Board of Control.

From a list just published it appears that no less than 110 insurance companies and electric-supply authorities have agreed to adopt the wiring rules issued by the Institution of Electrical Engineers, of which a new and revised edition has been published.

There has been a loss of over $50,000 for last year upon the Brighton electricity undertaking, to which Arthur Wright, of maximum-demand fame, is consulting engineer. Although there is naturally a big outcry in the local press, the loss is well accounted for by the officials, and is specially due to the past year being the first twelvemonths' working of the new high-tension power station, from which all the load is now dealt with.

Several waterlogged tin mines in Cornwall are now undergoing the process of being "unwatered," electrical means being employed for this, and it is also the intention to adopt electricity on a large scale when the mines have been recovered.

It is stated that a factory for the manufacture of metallic-filament lamps is about to be set up near London.

The Liverpool Corporation is going to spend $1,000,000 upon extensions to its electrical undertakings. Another large municipal electrical undertaking is that at Edinburgh, whose finances are probably in a more sound condition than any other similar system.

The government has just voted $30,000,000 for carrying on the telephone service until it is acquired from the National Telephone Company in 1911. It is probable that in 1911 the telephone system will be operated quite distinctly from the telegraph service, and under separate engineering management. At present both are worked as one, and even the accounts are not separated. The postmaster-general has already promised to remedy the latter defect, however.

A good many persons, on this side at any rate, have been looking forward to the time when patent litigation concerning wireless telegraphy will rather clear up the present unsatisfactory position in the matter of the strength of the patent position of the various companies. It has been known for some time that the Lodge-Muirhead syndicate had entered an action against the Marconi company, but this now appears to have been withdrawn. G.

New York.

New York City, July 13.—The remarkable activity which is being shown by the Utilities Board is expected to give some of the much-needed relief from the overcrowding of cars and at the bridge entrances. A special committee has been appointed and has gone over the grounds very thoroughly and recommendations are expected at any moment. A special committee has also been appointed to investigate the legality of the Fourth Avenue Tunnel in Brooklyn. Within a short time the new Riverside subway question, which calls for the elimination of the grade tracks of the New York Central along Eleventh Avenue and the substitution of a subway instead will come up before the commission. In addition to the present freight service passengers will also be carried.

As a result of the decision of Judge Holt of the United States Circuit Court overruling a demurrer interposed by the Interborough-Metropolitan Company in the suit brought by one of the stockholders to prevent the transfer of stock of one company to that of another, the Utilities Commission has asked for a copy of this decision and expects to look into the case on its own account, power to do which has been granted under the new law. In his opinion Judge Holt holds that the combining of these two companies is clearly a monopoly, as defined under section 7 of the stock corporations act. On or before July 22d all the surface, elevated and subway railways in the city must submit to the commission copies of their financial accounts, and by the same date they must also submit a report of the number of cars or trains in operation and copies of their schedules. No selection of the $10,000-a-year counsel for the commission has as yet been made.

An interesting feature of the street-cleaning service of Brooklyn is now being brought to the public attention. For a number of years past the Brooklyn Rapid Transit Company has had the contract for carrying and disposing of the city's ashes and street sweepings, and when the bids were again opened not a bidder came forward. The Brooklyn Rapid Transit absolutely refuses to handle the contract, as it has always been done at a loss, and also refuses the use of its cars and lines to any contractor who might care to do the work.

The New York Central's 11,000-volt cables in the upper part of the electric zone to supply current to the different sections northward from the Bronx have been declared a menace to life and property. Already millions have been spent in the aerial transmission lines, and at the time a permit was requested it was held up and has been held up ever since. Had the company awaited the results of this permit it would not have been able to have completed the electrification by the time specified by the Legislature. These cables are heavily insulated and are provided with a device to cut the main-line current off the instant any one of the wires is broken, thus preventing any danger from the falling wires.

The utilities bill which has recently been introduced in the New Jersey Legislature has met with an exceedingly warm reception, and after a debate which lasted three hours was defeated in the Assembly by a vote of 26 to 13 on the ground that it tended to create an immense political machine. The matter is expected to be again brought up for reconsideration.

The Morris County Traction Company is now constructing an interurban trolley line to connect Elizabeth with Lake Hopatcong, N. J., that will open up some of Jersey's most beautiful territory. The line will pass through Springfield, Morristown, Morris Falls, Denville, Dover and other picturesque sections. E. H. S.

Ohio.

Toledo, July 13.—Electrical construction men generally are busy with old contracts and repair work. Throughout the state there seems to be a general summer quiet, except for the work which has held over from spring and which was arranged for earlier in the season. Among the retail houses there is a general activity in electric fans and electric cooking devices. These are becoming decidedly popular.

By August 1st the electrification of the old Columbus and Lake Michigan steam road will be completed and the new Lima-Defiance branch of the Indiana, Columbus and Eastern will become a certainty in operation. It is stated that the electric line from Columbus to Lima is now assured and that work will probably be commenced upon it before winter.

By September 1st the Northern Ohio Traction and Light Company stock will be regularly listed upon the New York Stock Exchange.

A syndicate headed by Harry M. Daugherty of the Scioto Valley Traction Company has purchased a large tract of land near the power house of the company, which is to be transformed into a park and site for summer residences.

Distribution of poles and ties has already been started on the West Side belt in Lorain and the laying of track will soon be under way.

The electrical supply and construction store reported as being contemplated for Fremont some time ago was formally opened last week by John Shanahan and Edward McCarthy. The former was formerly connected with the Toledo, Bowling Green and Southern Electric Railway and still more recently with the Buckeye Electric Company of Findlay. Mr. McCarthy is a local man.

Papers of incorporation have been filed for the Defiance and Fort Wayne and the Hicksville branches of the electric railway which is ultimately to run from Toledo to St. Louis.

Estimates are about ready on the power plant at the infirmary of Lucas County. The last bids submitted were so high that they exceeded the appropriation and new estimates were ordered prepared.

William G. Phare, clerk of the village of Cleveland Heights, is asking for bids for the lighting of certain streets and roads in Euclid Heights allotment. Bids will be received until August 6th. H. L. S.

Illinois.

Peoria, July 13.—At a special meeting of the City Council of Chenoa, Ill., C. C. McDonald was given a two-year contract for lighting the city. He will furnish the city 30 arc lights for $200 per month, and he also agrees to put the plant in first-class condition.

Guy Talbot, who for several years was the general manager of the Peoria and Pekin Terminal Railway, has been made manager of the Oregon Electric Railway. For the last two years he has been general manager of the Corvallis and Eastern Railway.

The Springfield and Southeastern Traction Company, which is going to build a line between Taylorville and Springfield, began the work of grading this week.

The secretary of state has granted incorporation papers to the Charleston-Westfield, Marshall and Terre Haute Interurban Railway Company. It is proposed to construct an interurban railway from Charleston, Coles County, by way of Westfield to the Indiana state line, the principal office to be in Marshall. The incorporators are headed by James Dawson.

The Mason City Telephone and Telegraph Company has begun the task of building a new office to contain a new switchboard with a capacity of 400 telephones. Twelve country lines with 250 telephones will be connected with the board, and as the company has an agreement with the Easton and Terhune Company for free toll, this will make an additional 450 telephones that will be served by the new board. The company will also put in cables to the center of town. The officers of the company are H. F. Reason, president; W. A. Grundy, treasurer, and J. F. Culp, secretary and manager.

At a meeting of the employes of the Illinois Traction Company held at Springfield this week a committee was appointed to draft a constitution and set of by-laws to establish a hospital association for themselves. Another meeting will be held at the same place next month.

The plans for the new bridge the Illinois Traction Company proposes to build at St. Louis, Mo., have been approved by the War Department.

The power house here of the Illinois Traction Company has been generating power and transmitting it to Decatur, where the power house of the company is undergoing repairs. The transmission is at 33,000 volts over bare wires. The current is used to operate the railways and also furnishes the lighting circuits. The work of connecting the power houses of the company has been completed. This gives the company the Peoria, Riverton and Decatur power houses, so connected that in case of failure of any the others can take care of the various roads operated. V. N.

Grand Rapids, July 13.—The Escanaba Electric Power and Pulp Company, the Weber Gas Engine Company and H. P. Lucas are each seeking contracts to light the city of Escanaba for a period of 10 years, and submitted bids this week. Mr. Lucas as well as the power company has a water-power to rely on. The power company has just received plans for its power plant which is to be erected on the old Flat Rock mill site. Three turbines with a combined capacity of 300 horsepower are to be installed. The dam will be raised to eight feet and 1,300 horsepower generated. New turbines will be added as needed. O. L. Huie is directing the work.

E. C. Bechtell, consulting engineer for the Walbridge interests, has been working on plans for the remodeling of the power plant of the Pontiac Light Company. Bids are being received for the work. A 250-horsepower Hamilton-Corliss engine will be added to drive a 150-kilowatt alternating generator. A new boiler will be installed and the big generator and transformer from the plant of the Standard Lighting Company will be moved over. The rest of the Standard plant will be disposed of.

Lansing's electric-light plant earned during the fiscal year $78,174.93. The operating expenses were $32,779.75. Despite extensive improvements the lighting and waterworks plants are rapidly paying off their indebtedness. L. W. B.

Pacific Slope.

San Francisco, July 10.—The telegraph strike is now attracting the greatest attention in this city, all attempts at direct negotiations looking toward a settlement of the differences between the telegraph companies and the union operators having thus far been failures. The local officials of the companies still refuse to meet the men except as individuals. This has prevented any considerable progress in negotiations up to the present.

The public has become accustomed to the street-car strike, which is now in its ninth week without strong indications of a speedy settlement. Perhaps 30 per cent. of the population of the city is still refusing to ride on the cars either from principle or from fear of the boycott or of violence. The cable line out Taylor Street and New Montgomery Avenue to North Beach has resumed operation. The California Street Cable Railroad Company's lines are now in operation with a limited number of cars.

There have been no new developments in the telephone strike. The service is neither better nor worse than it has been for a number of weeks past.

Following out the policy of the United States Army authorities to equip all the army transport vessels plying out of San Francisco with wireless-telegraph plants, the transport Sherman, which sailed a few days ago for the Philippines was equipped while in port, so that wireless messages could be sent and received. It was the intention of the officers of the vessel to keep in telegraphic communication with the wireless stations of the mainland until 800 miles off the coast, if possible. Meteorological data will be sent to the Weather Bureau, among the other messages which will be forwarded.

Horace B. Ferris, secretary of the Board of Public Works of Los Angeles, Cal., is receiving bids for furnishing the city with steam turbines and electric generators for delivering 1,000 kilowatts to the Los Angeles Aqueduct Cement Works, the equipment to be erected by the bidder. The same board has awarded contracts for a portion of the machinery to be used in the cement works. The Pacific Coast Manufacturing Company is to furnish two water-tube boilers for $12,625 and two for $6,025; nine 75-horsepower motors for $3,030, seven 35-horsepower motors for $2,702, two 10-horsepower motors for $406, and one two-horsepower motor for $58.

The Vallejo, Napa and Benicia Electric Railroad has just awarded contracts for the extension of the road above Napa. The board of directors expects to run a line into Sacramento, if the rights-of-way can be secured, and, should this plan materialize, the Vallejo and Northern will have a strong competitor for interurban traffic. Eighty-five new electric cars and 900 tons of steel rails are expected within a few weeks for the extension of the line. General Manager L. J. Perry states that the company will not extend a branch from Vallejo to Benicia, owing to the engineering difficulties.

Sealed bids will be received up to August 5th for an electric-railway franchise for a double-track road along certain streets of Los Angeles, Cal. The City Council of that city has granted the petition of A. N. Davidson asking that a franchise for an electric street railway along Tenth Street be offered for sale.

A 200-kilowatt generator and two air compressors will be installed at the new mill of the Pittsburg Mining Company, 18 miles from Forest Hill, Cal.

The City Council of San Diego, Cal., has authorized the granting of a franchise to the Point Loma Electric Railroad Company for a loop line from Roseville to Ocean Beach. A.

PERSONAL.

Mr. John Gavey, who quite recently retired from the position of engineer-in-chief to the General Postoffice in England, has been knighted by the king.

Peter Cooper Hewitt is reported to have invented a gliding boat which gives promise of traveling at the rate of a mile a minute on water. Mr. Hewitt is best known as the inventor of the mercury-vapor lamp.

Congressman McKinley, head of the Illinois Traction Company, was in Peoria last week on the way to Yellowstone Park for a month's vacation. He was accompanied by a party of young people who will make the trip with him.

At a meeting of the directors of the New York Telephone Company Theodore N. Vail was elected president to succeed Charles S. Cutler, who died a short time ago. Mr. Vail is already president of the American Telephone and Telegraph Company, to which position he was elected on the resignation of F. P. Fish a few months ago. The New York Telephone Company is a licensee of the American company.

Thomas Tait, chairman of the railway commission of the state of Victoria, Australia, is on a visit to his Canadian home. Mr. Tait spent some time in Europe, before arriving in Canada, his object being to study the electric-railway systems there, with a view to the electrification of some of the suburban lines about Melbourne. These lines are at present steam lines, but it was thought that better results would be obtained if they were operated by electricity.

Milton J. Budlong has resigned from the presidency of the Electric Vehicle Company of Hartford, Conn. The resignation is to take effect September 1st. It is also announced that Hiram Percy Maxim, chief engineer of the company, is to leave the concern on August 1st for the purpose of organizing a corporation to make electric pleasure cars and commercial vehicles. The Electric Vehicle Company announces that Harry W. Kyte has been made third vice-president and manager of the sales department.

Charles L. Rising, traffic manager for the Illinois Tunnel Company of Chicago, died on June 10th at his home in Evanston. Mr. Rising was born in Clayton, N. Y., July 4, 1841. He entered the railroad business in 1863, and for the next 20 years filled various positions on the Chicago and Northwestern, the Wabash and Illinois Central. He became commercial freight agent for the Chicago, Milwaukee and St. Paul, which position he held till February 1, 1904, when he resigned to take service with the Illinois Tunnel Company.

Prof. W. F. M. Goss, after 27 years' connection with Purdue University, has resigned his position there as professor of mechanical engineering and dean of the engineering schools to assume the position of dean of the College of Engineering of the University of Illinois at Champaign. This resignation is a severe loss to the Indiana school, for it is generally known that the efforts of this valued instructor have gone far to establishing the reputation of Purdue. The reluctance of the state Legislature in voting appropriations requested is given as the cause for the resignation.

Edward B. Kirk, vice-president and general manager of the Winnebago Traction Company of Oshkosh, Wis., has tendered his resignation, in order to accept the general managership of the Sterling, Dixon and Eastern Electric Railway Company and the Lee County Lighting Company, both of Dixon, Ill. Mr. Kirk went to Oshkosh as manager in December, 1904. Before that he had been electrical engineer for the Grand Rapids, Grand Haven and Muskegon Interurban Company. At Dixon he succeeds Henry C. Higgins, who goes to Gadsden, Ala., where he will be general superintendent of a gas and electric company.

C. H. Merz, who was responsible for the Administrative County of London and District Electric Power Bill in 1905, is about to apply his energies in another direction. The premier of Victoria, New South Wales, was in London recently in connection with the conversion of the Victorian railway system to electric traction. He has selected Mr. Merz as consulting engineer for the whole scheme, which includes the design of the power house. Mr. Merz was responsible for the conversion of the Northeastern Railway Company's system in the Newcastle district, and which was the first trunk-line electric railway to be put into operation in England.

William J. Wilgus, vice-president of the New York Central and Hudson River Railroad, will sever his connection with the company on October 1st. Mr. Wilgus is one of the best-known engineers of the country. He has been in direct charge of the electrification of the terminal lines of the Central in New York city. In a statement issued by the Central it was explained that although Mr. Wilgus had several times expressed his desire to be relieved of his burdens within the last two years, the work of changing from steam to electricity and the reconstruction of the terminal made it almost impossible for the road to comply with his wishes. It is not stated what Mr. Wilgus' plans for the future are.

Louis J. Magee, a well-known electrical engineer, died at his home in New York city on July 3d. He was born in Massachusetts in 1862 and was educated at Wesleyan University. He began work in the shops of the Thomson-Houston Company and rose to the position of European manager of the company at Hamburg in 1899. Three years later he organized the Union Electric Company in Berlin, which was merged with the Allgemeine Company of Germany in 1903. At the time of his death and since 1904 he was representative of the Allgemeine Company in New York. Mr. Magee was an authority on electric-railway construction and operation. He wrote numerous articles for trade and technical papers.

W. S. Chaplin, LL.D., has resigned as chancellor of Washington University, St. Louis, Mo., having held the position since 1891, when he came from Harwood to assume the chancellorship. Mr. Chaplin is famous as an educator and engineer. He has been professor of engineering in Maine State College, in the Imperial University, Tokio, Japan, in Union College, Schenectady, and he has been dean of the Lawrence Scientific School at Harvard. Professor Chaplin was born at Glenburn, Me., in 1847, and he is a graduate of the Maine State College and of the National Military Academy at West Point. For a while he was lieutenant of the Fifth Artillery Regiment, but abandoned the army to practice civil engineering.

William Darbee has resigned his position as general manager of the Albany (N. Y.) and Hudson (electric) Railroad, to become assistant general manager of the Consolidated Gas, Electric Light and Power Company of Baltimore, Md. He will be succeeded in Albany by Raymond H. Smith, who is now superintendent of the Bridgeport division of the Connecticut Railway and Lighting Company. These changes will take effect on September 1st. Before Mr. Darbee associated himself with the Albany and Hudson he was with the Connecticut company as general superintendent for 10 years. When this system was taken over by the New Haven recently Mr. Smith was one of the few officials who was retained.

Richard F. Gottschalk, president of the Columbus Street Railway and Light Company of Columbus, Ind., was killed as the result of a distressing accident on July 11th. A trolley pole of a local street car slipped and broke a span wire leading from the trolley wire. From a ladder Mr. Gottchalk tried to fasten the broken end to the pole, when the ladder slipped, and he grabbed the span wire to support himself. Current was on the wire and Mr. Gottschalk was dead when released. He had hung for seven minutes until the power was shut off. His body was badly burned. Mr. Gottschalk was a prominent and public-spirited citizen, 42 years of age, and undoubtedly was one of the best-liked men in the city. He was the moving spirit in plans for a great extension of the street-railway system and a new power plant to be constructed this year. He leaves a wife and two children.

ELECTRIC LIGHTING.

C. M. Miller has purchased the electric-light plant of H. L. West in Shelby, Neb.

The Pine Bluff (Ark.) Light and Water Company is ready to begin building its plant in Pine Bluff.

D. L. Larsh and others of Norman, Okla., have purchased the electric-light plant of the Comanche Light and Power Company in Lawton, Okla.

The municipal lighting commission appointed at Sioux City, Iowa, to determine the advisability of the city owning a municipal lighting plant has filed an adverse report.

Tecumseh, Neb., will vote on the issuance of $16,000 in bonds to install an electric-light plant.

Joseph J. Henry and associates have been granted an electric-light franchise for 50 years in Waco, Texas.

Bids will be taken soon for the sale of the municipal light plant at Valley City, N. D. A franchise is being drafted.

The Plainview (Texas) Electric Light and Power Company has been incorporated with a capital stock of $5,000 by T. W. Morrison and others.

The Brush Electric Light and Power Company is making improvements to its plant in Galveston, Texas, including the installation of one 500-kilowatt and one 1,000-kilowatt steam turbine, two 300-horsepower synchronous motor-generator sets, one 300-kilowatt rotary converter, two 600-horsepower Stirling boilers and jet condensers. Work is well along on the construction of the new building. This will be 120 by 120 feet. In addition to the work at the plant, the entire system of overhead wires is to be rebuilt. New wire will be put in everywhere, and wherever necessary new poles will be put up.

ELECTRIC RAILWAYS.

The Winnebago Traction Company of Oshkosh, Wis., has passed into the hands of a receiver. The action is taken to protect the holders of securities of the company, with especial regard to the various forms of litigation in which the company is a party, including the latest phase, a warm battle between two classes of bondholders, those owning bonds of the first $550,000 issue and those holding the bonds of a second issue of $450,000.

The Utica-Syracuse (N. Y.) electric cars are now being run in trains, not only over the West Shore Railroad, but through Genesee Street in Utica. It is possible that either the Brotherhood of Locomotive Engineers or the Brotherhood of Conductors, or both organizations, may ask that the wages paid to engineers and conductors on the steam roads be given to the motormen and conductors on the electric road.

Three new motor cars and one new trailer have been bought by the management of the Elgin-Belvidere Electric Railway for service between Elgin and Belvidere, Ill. The increased business of the company necessitated the additional rolling stock. The new cars have no end doors like the original cars to permit passengers to pass from one car to another. They have two doors at the rear end and one at the left side of the head end. The traffic on this line surpasses the expectations of the management.

Two meetings at the office of the city attorney of Milwaukee, Wis., between A. C. Frost and John I. Beggs, presidents, respectively, of the Chicago and Milwaukee Electric Railway and the Milwaukee Electric Railway and Light Company, and City-attorney John T. Kelly, promise to result in an agreement as to the use of downtown streets, by the traction companies by which the interests of the public will be protected. The tentative agreement is said to be along these lines: The Beggs company is to receive a franchise on Sycamore Street, from Sixth to Third streets, and on Second Street, from Sycamore to Grand Avenue. The Frost company will receive a franchise on Sixth Street, from Grand Avenue to Wells Street, on Wells Street, from Sixth to Second streets, and on Second Street, from West Water Street to Grand Avenue. These franchises will be non-exclusive.

After nine and a half years of service, running 20 hours a day and 80 revolutions per minute, Sundays included, a recent annual inspection of the engines installed at the power house of the South Side Elevated Railway Company of Chicago indicated that the amount of wear in the 54-inch low-pressure cylinders of the 26 and 54 by 48-inch Allis-Chalmers cross-compound machines constituting this equipment measured the thickness of one paper sideways and two papers top and bottom, using paper of from 0.010 to 0.011 of an inch thickness. The measurements were taken on the No. 2 engine, which is one of four units first installed in the power house. The cylinder was opened under the direction of Chief Engineer Hadin, for the regular annual inspection. The original bull rings and packing rings are still in use in this cylinder. It is interesting to note in this connection that current has never been off the bus-bars at this station since it was first put into operation. The station was described and illustrated in the Western Electrician of December 1, 1906.

RADIO-TELEGRAPHY.

William Marconi, accompanied by his wife, sister-in-law and two radio-telegraph experts, has arrived at Glace Bay, Nova Scotia. The station at Glace Bay is now about completed, and in a few days Mr. Marconi, with his assistants, will commence a series of long-distance tests between Glace Bay and the old country. He expects shortly to establish commercial working between the two countries.

Successful experiments are said to have been made in Cartagena in the exploding of torpedoes at long distances by means of the Hertzian wave system. The device was invented by a Spaniard named Balsera.

SOCIETIES AND SCHOOLS.

The Chicago Automobile Club is now comfortably housed in its handsome new building at 17 Plymouth Place. A number of the members own electric machines, but there has been delay in installing the electric charging apparatus in the club's private garage, and this feature of the equipment will not be ready for a month.

The fifth annual convention of the Colorado Light, Power and Railway Association will be held in Denver, Colo., on September 18th, 19th and 20th. Headquarters will be at the Savoy Hotel. Mr. George B. Tripp of Colorado Springs is president of the association and Mr. J. F. Dostal, chief engineer of the Denver Gas and Electric Company, is secretary.

The annual meeting of the Canadian Street Railway Association was held at Windsor, Ont., on June 14th and 15th. It was attended by representatives from Canada and several of the northern cities of the United States. W. H. Moore of Toronto is president. Papers were read by C. B. King, R. J. Clark and P. Dubee. The subjects discussed during the session included legislation affecting electric railways, standardization of equipment and traction developments in Ontario and Quebec.

The Chicago Engineers' Club had a house-warming banquet a few nights ago in its new rooms in the Chicago Automobile Club Building, 17 Plymouth Court. The toastmaster was Pliny B. Smith, and congratulatory addresses were made by Isham Randolph, Ferdinand W. Peck, Oscar J. West, F. J. Llewellyn and W. R. Stowell. Mr. G. W. Snow addressed the members and urged that the club contribute to a fund to be used each year for the education of a young man in engineering. The suggestion was received with favor by the club.

The fifty-second annual catalogue of the College of Arts and Engineering of the Polytechnic Institute of Brooklyn contains information regarding the courses offered in chemistry, chemical engineering, civil engineering, mechanical engineering and electrical engineering. There are afternoon and evening classes in chemistry and engineering, which are attended largely by students living in Brooklyn. The Institute enjoys the advantage of having all the great engineering undertakings of New York city close at hand. Dr. F. W. Atkinson is the president of the school, and Charles A. Green, A. M., is registrar.

From the material already in the hands of the various committees, the programme for the first annual convention of the Illuminating Engineering Society promises to be of educational value to every member. The convention will be held in Boston July 30th and 31st and the business headquarters will be at room 728 Old South Building. While it is planned to have a business convention, special arrangements are being made for the entertainment of members, their ladies and guests. Aside from this the festivities of Old Home Week will afford opportunities for amusement. Detailed information will be forwarded to members later. Further advance information may be obtained from local secretaries or from the chairman of the convention committee, John Campbell, 729 Old South Building, Boston.

POWER TRANSMISSION.

The Harqua Hala Development Company, which was recently incorporated in Arizona, purposes developing electric power in connection with the Harqua Hala Water Company, which is controlled by the same interests. The company's plans include the building of a submerged dam 500 feet wide at Point of Rocks. Thence water will be conducted through three miles of concrete tubing to a point where steel tubing will begin.

The Great Northern steam railroad has made a start in the enterprise of generating electricity for use in hauling trains through the Cascade Tunnel. Two dams will be placed in the Wenatchee River near Leavenworth, Wash, thus impounding the waters of this rapid river in two places. The heavy fall of the river will give an immense power at both places, opening many possibilities, not only for the utilization of the electricity in the present proposition, but will doubtless open the way for feeders to the railroad in the establishment of factories.

PUBLICATIONS.

After a lapse of some months, the bulletin of the W. K. Palmer Company, engineers, Kansas City, Mo., appears with a change in title to the

"Palmer Monthly." The July issue gives accounts of a number of the company's engineering contracts.

Several forms of electric-light wire connectors are illustrated in a little pamphlet issued by the Yonkers Specialty Company, Yonkers, N. Y. The articles are useful for making taps and connections reliably and quickly without the use of solder and are made in a variety of styles and sizes.

Isolated-plant switchboard panels with fuses, as manufactured by the General Electric Company, are the subject of bulletin No. 4517 from the lighting department of the company. The standard boards described in the bulletin have been designed to meet the requirements of all small continuous-current installations where for any reason circuit-breakers are not necessary or desired.

A four-page folder illustrates the new Hubbell fixture clusters which are equipped with pull switches. Each lamp may be turned on separately or one pull lights all. The socket shells are made part of the cluster body. An adaptation of the Hubbell push-plug principle is the "wireless" cluster, in which the connections to the cluster are made by rigid connectors, which may be separated to remove shade. The manufacturer is Harvey Hubbell, Inc., Bridgeport, Conn.

The Chase-Shawmut Company, Newburyport, Mass., has just issued to the trade a very attractive 58-page booklet, pocket size, covering its complete line of fuses, bases and fittings. In addition to the company's regular line, this catalogue presents a number of specialties which have recently been placed upon the market. Containing over 100 illustrations and considerable valuable data, this catalogue will be eagerly sought by all interested in this class of material.

The new 1907 supply catalogue of the General Electric Company, Schenectady, N. Y., is a book as handsome from a typographical viewpoint as it is complete in information concerning the varied line of articles the company manufactures. Illustrations and descriptions are given of arc lamps, transformers, meters, switches, circuit-breakers, motors, resistance devices and wiring supplies. This catalogue supersedes the supply catalogue for 1904. It consists of 430 pages and contains an index and code list. In almost every instance the price is quoted along with the article catalogued.

A new high-speed magnetic-control end-cell switch for storage-battery installations is described in Bulletin No. 102 of the Electric Storage Battery Company, Philadelphia. The switch is designed to carry heavy loads, and will travel over the entire number of contacts in 20 seconds. Shunt-wound motors are used, and the magnetic control, which may be handled from any number of points, requires only five wires to the end-cell switch. After one control switch has been operated, no manipulation of any others will prevent the traveling brush of the end-cell switch from reaching and stopping on the next contact.

"Plant Economy" is the subject of an interesting little essay by H. P. Dennis, M. E., which is published as a bulletin by the Bristol Company, Waterbury, Conn., manufacturer of recording instruments. The author believes that the most potent factor in the ultimate economy of a power plant is boiler-room efficiency. Prime movers and generators have been brought to a high degree, yet with mechanical stokers, economizers and other modern devices, the highest thermal efficiency yet obtained at the bus-bars is not over 10.3 per cent. Long-time and elaborate tests by experts, he continues, have failed to show losses which were detected by the aid of automatic recording instruments, making permanent records of conditions all the twenty-four hours. The writer asserts that even the smallest plants may be operated in a scientific and economic manner without expensive experts by using recording instruments located near the seat of control. Several sample records are appended.

TRADE NEWS.

It is not generally known that Pittsburg is one of the largest manufacturers of electric illuminants, a distinction which is due to the increasing business of the Nernst Lamp Company.

The Western Chemical Manufacturing Company has been organized to exploit the process of producing nitric acid from the atmosphere by electrical means, of which an illustrated account is given elsewhere in this issue. The downtown offices of the company are at 814 Monadnock Building, and the laboratories at 269 South Marshfield Avenue, Chicago.

In order to take better care of its growing trade in Montana, the Minneapolis Steel and Machinery Company of Minneapolis, Minn., has opened an office at 352 Phœnix Building, Butte, Mont., under the management of Mr. J. E. Lanning. This well-known concern has made a fine reputation for itself as engineer and manufacturer of Corliss and gas engines, power gas producers, complete power plants, transmission machinery, coal-handling and ore-conveying devices, castings, etc.

The Electric Cable Company of New York has just bought the entire business of the Eastern Wire and Cable Company of Roxbury, Mass. The latter company is one of the oldest manufacturers of rubber-covered wires and cables in New England. Its entire equipment will be removed to Bridgeport, Conn., where it will be installed in the plant of the Electric Cable Company, which has in course of construction a large addition to its plant. The officers of the Electric Cable Company are: President, Edwin W. Moore; vice-president, F. H. Cowles; treasurer, J. Nelson Shreve.

Maurice Gesundheit and Henry Osgood have begun business as manufacturing engineers and business methodizers. The firm's name is Gesundheit-Osgood Company, with offices at 43 Cedar Street, New York. Mr. Osgood has had wide experience in commercial life, has been connected with several of the most prominent manufacturing companies and for some time was the right-hand man of one of the best-known methodizers in this country. Mr. Gesundheit is a civil and mechanical engineer, with broad business experience. During the last few years, as chief-of-staff of a number of mechanical engineers and manufacturing specialists, he has served industrial concerns in a supervisory and consulting capacity, with the object of developing their earning power, by improving their methods and accounting, their equipment and processes, as well as their general policies.

BUSINESS.

The Southern Pacific Company's rifled pipe line will consist of 256 miles of eight-inch rifled pipe, which is being manufactured at the Lorain plant of the National Tube Company. The machinery for 24 pumping stations, covering 46 duplicate pumps, will be manufactured by the Janesville Iron Works, Hazleton, Pa., and 72 boilers are to be furnished by the Edgemoor Iron Company, Edgemoor, Del. The inspection of the material will be carried out by Robert W. Hunt & Co., whose general offices are at 1121 Rookery Building, Chicago.

The Lindstrom-Smith Company, manufacturer of electrical signs and specialties, formerly located at 59 Dearborn Street, Chicago, has moved to more commodious quarters at 253 La Salle Street.

The General Electric Company is manufacturing a new line of two and three-wire generators especially adapted for direct connection to engines. The company's bulletin, No. 4520, gives a complete description of the machines and the details of their construction. The 125 and 250-volt types are made in sizes as low as 25 kilowatts.

The William P. Crockett Company, 269-271 South Canal Street, Chicago, has recently added to its lines of specialties the well-known flexible conduit of the Alphaduct Manufacturing Company and the rigid conduit of the American Conduit Manufacturing Company. A complete stock of each will be kept on hand. The company has recently more than doubled its floor space, with excellent shipping facilities, thereby enabling it to continue to make prompt shipments of all its lines. The following well-known products have been handled by the company for several years: Diamond H. switches, Bossert boxes, De Veau telephones and Dale fixtures.

Rapidly increasing business has decided the E. H. Freeman Electric Company of Trenton, N. J., to extend its manufacturing facilities by adding a third plant to the two already in operation. The company manufactures all kinds of fittings for electric wiring. One of the present plants is a pottery, where the porcelain parts of its fuse plugs, sockets, etc., are made. The brass and copper work is done in another plant. The new plant will be for assembling and shipping the completed articles. The Freeman company furnished fittings for the Jamestown Exposition, and has just shipped an order of 25,000 fuse plugs to Spokane, Wash. Goods are being exported to Manila, South America and other foreign places.

The variety of uses to which the electric motor has already been put is one of the wonderful features of the present day's industrial operations. Taking, for example, some of the orders which the Westinghouse people have taken since the first of June: The East Pittsburg works are now turning out 16 locomotives for coal mines in West Virginia and Kentucky, one for an iron mine in Sweden, another for a power company in the state of Washington and one for a plate-glass mill at Charleroi, Pa. They are constructing a complete electric motor equipment for a phosphate mine in Florida, for a lumber camp at Mount Pleasant, Pa.; they have in hand an order for 39 motors to drive machinery in a cash-register-manufacturing plant at Dayton, O.; they are turning out 59 motors for driving textile looms at East Hampton, Mass., and a larger number for running spindles in a worsted mill at Passaic, N. J. Fifteen motors are going to a paper mill in Canton, N. C., and 20 to a paper mill in Fulton, N. Y. Since the electric motor has become a fixture in the southern cotton mills, that industry has reached a state of prosperity never known before, and since the electric motor has been brought into the metal-mining industry, many of the copper, gold and silver mines in Mexico, Arizona, Colorado, California and other western mining regions have again begun operations after they had been abandoned, because power to run them was too expensive to obtain.

ILLUSTRATED ELECTRICAL PATENT RECORD.

Issued (United States Patent Office) July 9, 1907.

859,200. Electric Switch Handle. Charles A. Clark, Hartford, Conn., assignor to Charles G. Perkins, Hartford, Conn. Application filed May 7, 1907.

Spring fingers in the recess of the handle grasp a tapered spindle.

859,201. Telephone System. Henry P. Clausen, Chicago, Ill., assignor to the American Electric Telephone Company, Chicago, Ill. Application filed July 18, 1903.

The line circuit in the exchange comprises a line-relay and cut-off jack. A relay in the cord circuit holds the ringing key closed until the called subscriber has answered. The cord contains three relays. The impedance coil principle of battery feed is used.

859,216. Wire-covering Machine. Charles E. Hadley, Cleveland, Ohio. Application filed December 10, 1903.

The control mechanism throws off the power on the breaking of the thread, which is automatically kept taut.

859,218. Electric Glass-heating Apparatus. George H. Harvey, Glenfield, Pa., assignor to the Brownsville Glass Company, Pittsburg, Pa. Application filed November 23, 1906.

Two wires of high resistance pass in opposite directions around a glass cylinder.

859,219. Block-signal System. Laurence A. Hawkins, Schenectady, N. Y., assignor to the General Electric Company, Schenectady, N. Y. Application filed December 5, 1906.

Open-circuited transformers are connected at intervals across the rails. A moving train closes the circuit of a transformer ahead of the train, operating a track relay which actuates signals.

859,221. Telephone Support. Stephen C. Houghton, Rome, N. Y. Application filed July 10, 1906.

The base is formed of a box, containing the switches for the local circuits.

859,224. Changeable Exhibitor. Robert G. Howard, Newton, Mass. Application filed November 11, 1905. Renewed December 21, 1906.

The pawl releasing the mechanical movement is operated by an electromagnet.

859,251. Safety Schedule for Cars. Edward F. Reeves, Brooklyn, N. Y. Application filed November 13, 1903.

When a dial operated by the movement of the car fails to maintain its designed relation with the hands of a clock, an electric alarm circuit is closed.

859,255. Shunt for Electrical Measuring Instruments. Frank W. Roller, Plainfield, N. J., assignor to the General Electric Company, Schenectady, N. Y. Application filed January 13, 1905.

The shunt consists of a bar of metal of high resistivity and low temperature coefficient and is studded with metal heat radiators.

859,260. Electric Heater for Glass Cylinders. James R. Speer, Pittsburg, Pa., assignor to the Brownsville Glass Company, Pittsburg, Pa. Application filed November 23, 1906.

A resistance wire encircles the cylinder, and a weighted lever automatically takes up the expansion of the wire.

859,267. Oven Door. Daniel Vollmer and Charles D. Vollmer, St. Louis, Mo. Application filed April 17, 1907.

The act of opening the door switches on an electric light.

859,276. Telephone Switchboard. Frank W. Wood, Newport News, Va., assignor to Charles Cory and John M. Cory, New York, N. Y., a firm. Application filed July 12, 1906.

The board, which is fitted with magneto drops, is enclosed in a watertight case. The drops are easily removable, being connected by spring contacts.

859,278. Switch Clip. Gilbert Wright, Pittsfield, Mass., assignor to the Stanley-G. I. Electric Manufacturing Company. Application filed June 17, 1905.

The clip comprises two similar abutting members, each formed from a single plate and having a flanged end, and a foot piece having portions holding the flanged ends together.

859,283. Power Converting and Transmitting Mechanism. Patrick J. Collins, Scranton, Pa., assignor to the General Electric Company, Schenectady, N. Y. Application filed October 12, 1904.

An engine-driven dynamo-electric machine has an outer armature secured to the driving shaft, an inner armature connected to the mechanism which is to be driven, a stationary double field acting with each of the armatures, and a clutch for connecting the inner armature shaft to the driving shaft.

859,292. Electric Lighting. Johannes Härdén, Schenectady, N. Y., assignor to the General Electric Company, Schenectady, N. Y. Application filed December 10, 1903.

For an alternating-current flaming arc lamp one electrode is composed of carbon and the other principally of titanium carbide, but contains small quantities of carbon, ammonium chloride and magnesium phosphate.

859,316. Snap Switch. Walter S. Mayer, Philadelphia, Pa., assignor to the Machen & Mayer Electrical Manufacturing Company, Philadelphia, Pa. Application filed April 4, 1907.

Besides other new details of construction, the rotatable contact clips close into double jaws carried by the posts.

859,318. Dynamo-electric Machine. Edgar W. Mix and Paul Bunet, Paris, France, assignors to the General Electric Company, Schenectady, N. Y. Application filed November 20, 1906.

For a multipolar dynamo-electric machine having a parallel-wound drum armature and a field magnet provided with commutating poles, the magnetization of each pole at all times is maintained proportional to the current in the armature conductors beneath that pole regardless of unbalanced load in several armature circuits. (See cut.)

859,323. Vacuum Cut-off. George P. McDonnell, St. Louis, Mo., assignor to the General Electric Company, Schenectady, N. Y. Application filed April 29, 1904.

In the manufacture of incandescent lamps the exhauster is cut off from the lamp by collapse of the connecting tube.

859,333. Meter. William H. Pratt, Lynn, Mass., assignor to the General Electric Company, Schenectady, N. Y. Application filed September 25, 1905.

The meter is for use on storage-battery circuits and has two independent armatures, acted on by one field (through which the circuit is led) and arranged to drive one of two dial trains when rotating in one direction, but not actuating the dial when rotating in the opposite direction.

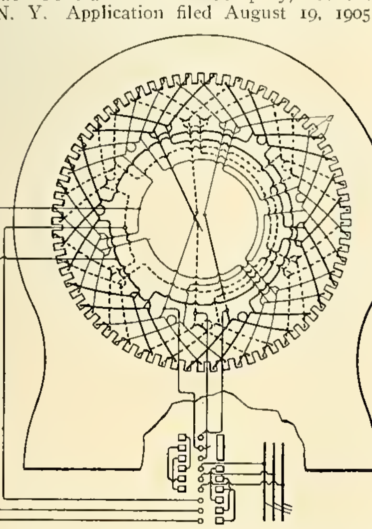
859,350. Unipolar Generator. Elihu Thomson, Swampscott, Mass., assignor to the General Electric Company, Schenectady, N. Y. Application filed September 28, 1905.

The armature is provided with a number of conductors, collector rings and collecting brushes, and the field winding is supplied through auxiliary brushes independent of those carrying the main armature current and bearing on a pair of collector rings connected at opposite ends to a single armature conductor.

859,357. Lamp Protector. Joseph E. Woods, Logan, Ohio. Application filed June 25, 1906.

The wire guard is in two parts, held together by a clamping ring at the socket and a helically coiled wire near the tip.

859,358. Alternating-current Motor. Ernst F. W. Alexanderson, Schenectady, N. Y., assignor to the General Electric Company, Schenectady, N. Y. Application filed August 19, 1905.



NO. 859,358.—ALTERNATING-CURRENT MOTOR.

There are two electrically independent windings of different pole numbers composed of interlaced coils all equal in size carried in slots, the conductors of each winding being arranged half in the top and half in the bottom of the slots. The number of one or both of the windings may be varied. (See cut.)

859,359. Frequency Changer. Ernst F. W. Alexanderson, Schenectady, N. Y., assignor to the General Electric Company, Schenectady, N. Y. Application filed August 24, 1905.

The windings and connections of a rotary frequency changer are described.

859,361. Rotor for high-speed Dynamo-electric Machines. Bernard A. Behrend, Norwood, Ohio, assignor to the Allis-Chalmers Company and the Bullock Electric Manufacturing Company. Application filed November 30, 1906.

Coils carried on the core of the rotor have end turns projecting beyond the core and surrounded by an end ring, which is held by a nut.

859,363. Sectional Gang Box for Push-button Switches. Leon W. Bossert, Utica, N. Y. Application filed February 19, 1906.

Details of construction of a gang box adapted for use for rotary or push-button switches are given.

859,367. Electrical Push Button. Frederick W. Cohn, New York, N. Y. Application filed March 5, 1907.

A small electrical push button has its shell screw-threaded on both its interior and exterior. It is similar to those used in street cars.

859,368. Dynamo-electric Machine. Patrick J. Collins, Scranton, Pa., assignor to the General Electric Company, Schenectady, N. Y. Application filed November 16, 1904.

The machine comprises an outer stationary member, an intermediate rotatable member having a tubular shaft, and an inner member journaled in the shaft.

859,473. Electric Signaling System and Selective Mechanism Therefor. Jean F. Webb, Jr., Chicago, Ill., assignor to the Electric Signagraph and Semaphore Company, Incorporated. Application filed August 25, 1906.

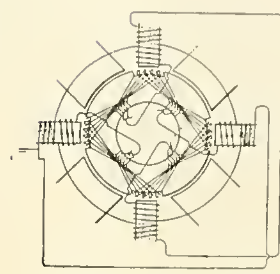
A combination of escape wheels, pawls and contacts are operated by electromagnets, giving step-by-step selection.

859,476. Tyepwriter. Neal L. Anderson, Montgomery, Ala. Application filed February 8, 1907.

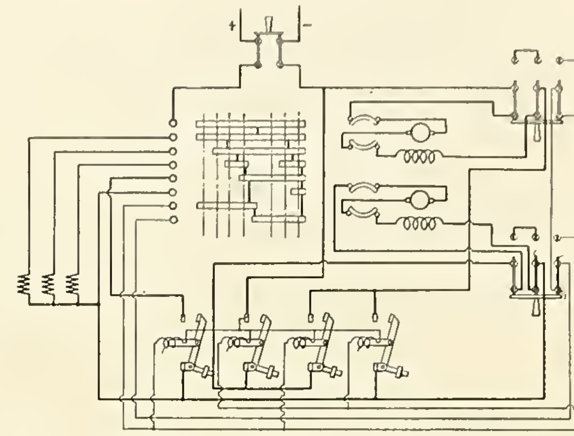
The typewriter carriage is advanced by an electric motor set into motion on depressing the keys.

859,479. Guard Attachment for Telephones. George L. Blackburn, Greensboro, N. C., assignor of one-half to John K. Callahan, Greensboro, N. C. Application filed March 7, 1907.

A guard bracket protects the lower end of the receiver when hanging on the hook.



NO. 859,318.—DYNAMO WINDING.



NO 859,551.—CUT-OUT SWITCH FOR SERIES-PARALLEL CONTROLLERS.

859,369. Dynamo-electric Machine. Patrick J. Collins, Scranton, Pa., assignor to the General Electric Company, Schenectady, N. Y. Application filed November 30, 1904.

An outer stationary member and an inner rotatable member coact with an intermediate rotatable member. There is mechanical driving connection between the rotatable members.

859,372. Signal-light Apparatus. Gustaf Dalén, Stockholm, Sweden, assignor to Aktiebolaget Gasaccumulator, Stockholm, Sweden. Application filed February 15, 1906.

For a gas-lamp signal, the valve lever is controlled by an electromagnet.

859,398. Incandescent-lamp Holder. Elmer E. Marsh, Newport, Ky., assignor to Frederick C. Kingsbury, Columbus, Ohio. Application filed April 24, 1905.

The bracket arm is extensible and is carried by a friction-ball socket. A retractile reel keeps the conductor taut.

859,416. Paper-bag Machine. Frank Tyson, Philadelphia, Pa. Application filed March 30, 1904.

A flexible armature interposed between the plies of the blank bag is attracted by a magnet carried by one of the feed rolls and serves to separate the plies of the blank.

859,430. Circuit Controller. Charles A. Carlson, New York, N. Y. Application filed March 8, 1906.

A trailer bears on contacts mounted on a ring of non-conducting material.

859,431. Apparatus for the Electrolytic Production of Chemical Compounds. Courtland F. Carrier, Jr., Elmira, N. Y., assignor to the Elmira Electro-chemical Company, Elmira, N. Y. Application filed June 9, 1906.

The anode and cathode are located in separate compartments, connected by a channel in which circulation is assured by the movement of a screw propeller.

859,435. Safety Device for Electric Motors. Frederick M. Conlee, Madison, Wis., assignor to the Northern Electrical Manufacturing Company. Application filed December 9, 1905.

A motor starting rheostat has a no-voltage magnet in the field circuit, an electromagnet connected across the line terminals, and a normally open switch controlled by the first magnet for closing the circuit of the second, which controls a switch closing the armature circuit.

859,437. Primary Battery. William P. Divine and Albert J. Shinn, Philadelphia, Pa., assignors to the Decker Electrical Manufacturing Company. Application filed August 1, 1906.

The electrodes are in porous tubes plunged in the electrolyte, similar poles being connected electrically.

859,449. Trolley Harp. John Hensley. Huntington, Ind. Application filed October 25, 1906.

Dish-shaped washers are arranged in pairs on each side of the wheel, having their concaved faces abutting.

859,464. Anti-buzzing Device for Telephones. August Schaffer, East Columbus, Ohio. Application filed December 24, 1906.

To prevent buzzing in telephone receivers a woven wire screen and a paper covering having a painted or shellacked central portion are secured in the ear piece of the receiver.

859,484. Advertising Device. William C. Carr, Buffalo, N. Y. Application filed December 5, 1906.

Electric means are utilized to change the cards exposed to view.

859,498. Street Annunciator for Electric Cars. Ira E. Hoover, Toledo, Ohio, assignor of one-half to Willard M. George, Toledo, Ohio. Application filed April 14, 1906.

A solenoid serves to advance, one at a time, the series of signs, which are arranged on an endless chain in the same order as the streets the car crosses.

859,510. Electric Igniter for Gas Engines. Benjamin McInnerney, Omaha, Neb., assignor to Louis Dohme, Baltimore, Md. Application filed November 21, 1899.

A make-and-break ignition system is described in which an electric motor in the generator circuit draws the electrodes apart to produce the spark.

859,515. Electric Lighting. William J. Phelps, Detroit, Mich. Application filed July 15, 1903.

This is a special receptacle for "Hylo" lamps, fitted with three terminals and designed to be switched from a distance. On the lamp the third contact is a ring between the usual center button and the threaded shell, and when inserted in the socket bears against a clip, connecting with the third receptacle terminal. (See cut on next page.)

859,523. Magnetic Clutch. Lewis D. Rowell, Milwaukee, Wis., assignor to the Cutler-Hammer Clutch Company, Milwaukee, Wis. Application filed May 1, 1905.

After gradually accelerating the driven member through the combined influence of the induction of torque-producing currents and friction there are separate means for coupling the two members of the clutch after the driven member has attained substantially full speed.

859,524. Electrical Contact Finger. Henry K. Sandell, Chicago, Ill., assignor to the Mills Novelty Company, Chicago, Ill. Application filed January 21, 1907.

An elctrical contact finger has a socket on one end in which a bunch of wires is removably inserted and held by pressure of a spring catch.

859,534. Telephone Selecting Apparatus. William D. Watkins, San Jose, Cal., assignor to the Watkins Manufacturing Company, San Jose, Cal. Application filed April 30, 1906.

The electromagnetically actuated selecting arm moves between a pair of sets of plates, the adjacent ends of which are bent laterally, and are disposed in staggered relation to form a zigzag path between them. Current flows in one direction through the electromagnet during a selecting operation, and in the reverse direction to withdraw the pin from all of the plates to permit the arm to return to the initial position of rest.

859,545. Dynamo-electric Machine. Patrick J. Collins, Scranton, Pa., assignor to the General Electric Company. Original application filed October 12, 1904. Divided and this application filed December 27, 1904.

In construction the machine consists of an outer rotatable member, an inner rotatable member within the outer and an intermediate stationary member arranged between and coacting with the outer and inner members.

859,547. Safety Fuse for Electric Circuits. Charles S. Davis, Somerville, Mass. Application filed October 27, 1905. Renewed December 7, 1906.

There is a gas-absorbing material within the casing around the fusible member. The terminals are of the knife-blade type.

859,549. Coin-collecting Appliance. William W. Dean, Chicago, Ill., assignor to the Western Electric Company, Chicago, Ill. Application filed January 14, 1902.

This toll box for telephone pay stations has an electromagnetic switch for rendering the telephone apparatus inoperative until a coin is deposited. Until the connection is completed, the passage of the coin through the apparatus is controlled from central.

859,551. Cut-out Switch for Series Parallel Controllers. Arthur C. Eastwood, Cleveland, Ohio. Application filed September 27, 1906.

A series-parallel controller for two motors or groups of motors comprises a switch, controlling means for placing the motors in series, means for placing the motors in parallel, a switch for cutting out one of the motors, alternate contacts for the cut-out switch, a connection between one contact and the means for placing the motors in series, and connections from the remaining contact to the means for placing the motors in series and to that portion of the controlling switch which controls the change of the motors from series to parallel. (See cut on preceding page.)

859,556. Method of and Apparatus for Fault Location on Electrical Conductors. Herbert M. Friendly, Portland, Ore. Application filed April 10, 1905.

A Wheatstone bridge, consisting of a pair of adjustable ratio arms, has means for adjusting the combined resistance of the arms, and other means for connecting the current source to a point dividing the joint arm resistance into two arm resistances for individual bridge arms having any desired ratio.

859,565. Apparatus for Detinning Tin Scrap. Meredith Leitch, Elizabeth, N. J., assignor to the American Can Company, Jersey City, N. J. Application filed February 17, 1906.

Besides means for continuously feeding tin scrap to the receiver, and automatically removing detinned scrap therefrom, a source of electricity is connected independently of the scrap to constitute an anode. A cathode is connected to the other terminal of the source, having on its inside an exposed metallic surface with which the scrap makes a moving electrical contact.

859,578. Electric Soldering Tool. Nicholas Perrella, New York, N. Y. Application filed February 20, 1906.

By a switch in the handle it is possible to regulate the heat by passing the current through all the windings, or only through the turns nearest the soldering head.

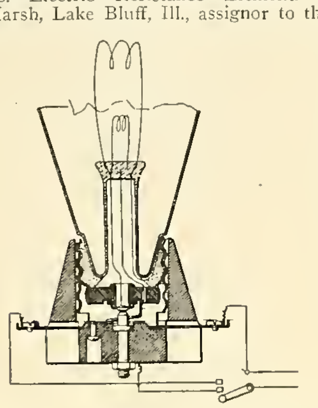
859,579. Arc-light Electrode. Robert H. Read, Schenectady, N. Y., assignor to the General Electric Company, Schenectady, N. Y. Application filed May 18, 1901. Renewed June 15, 1907.

The electrode is composed of finely divided aluminum carbide united by a carbonaceous binder.

859,598. Electric Signaling and Testing Mechanism. John Doran, Jr., Schenectady, N. Y. Application filed June 28, 1906.

By a switch mechanism a testing current can be supplied to the circuit of which the electromagnet controlling the signals forms a part.

859,608. Electric Resistance Element. Albert L. Marsh, Lake Bluff, Ill., assignor to the Hoskins



NO. 859,515.—RECEPTACLE FOR TURN DOWN LAMP.

Company, Chicago, Ill. Application filed February 18, 1907.

The resistance element is formed of a metal alloy consisting of 88 per cent. nickel, 8 per cent. chromium and 4 per cent. aluminum.

859,620. Electrical Self-playing Instrument. Henry K. Sandell, Chicago, Ill., assignor to the Mills Novelty Company. Application filed February 5, 1906.

Perforations in a sheet permit electrical contact of the rolls between which it is fed, closing the circuit of an electromagnet which causes a certain note to be struck.

859,641. Electric Furnace. Edward A. Colby, Newark, N. J., assignor to the American Electric Furnace Company. Application filed November 23, 1905.

The furnace has a crucible and an inducing coil and a rectangular frame of magnetic material surrounding the crucible and coil.

859,650. Earth Anchor. Clinton E. Frost, Cleveland, Ohio. Application filed February 14, 1907.

The anchor consists of a flat plate with parallel ribs on one side having projecting ears and a rocker to which the cable is attached, extending transversely through the ears and bearing against the plate.

859,667. Automatic Trolley Guard. Henry A. Kennedy, Natick, R. I. Application filed January 29, 1907.

The [illegible] consists of the grooved wheel proper, a revoluble [illegible] laterally [illegible]dable spring-pressed perforated guard-[illegible]nge, and a plate re[illegible]ble with it.

859,674. Massage Apparatus. Carl O. Lindstrom, Chicago, Ill. Application filed May 26, 1906.

Inside the body a small motor is mounted, driving an overbalance piece which, with the resilient connection between the handle and the housing, gives a rapid vibration to the parts.

859,676. Relay. Ray H. Manson, Elyria, Ohio, assignor to the Dean Electric Company, Elyria, Ohio. Application filed September 9, 1905.

A projecting ear on the magnet-head fits into a notch in the armature to form a fulcrum upon which it may rock, one of the arms of the armature serving as a portion of the magnetic circuit.

859,694. Automatic Safety Switch. George E. Ryan, New York, N. Y. Application filed September 27, 1906.

A system of electric signals indicates the position of the frog.

859,702. Telephone Stand. Louis Steinberger, New York, N. Y. Application filed February 8, 1905.

A flat disk, for memoranda, is arranged to be clamped around the vertical standard of a desk instrument.

859,703. Insulating Strain. Louis Steinberger, New York, N. Y. Application filed May 1, 1906.

The body portion has near its middle a disk with a number of annular petticoats, and is provided with necks, each having a step conformity and in which the strain members are imbedded.

859,725. Street Indicator. Milton S. Beaver, Bangor, Pa. Application filed September 1, 1906.

An electromagnet releases the cards bearing the street names, at proper intervals.

859,731. Electrical Condenser. Sidney A. Beyland, Elyria, Ohio, assignor to the Dean Electric Company, Elyria, Ohio. Application filed January 10, 1907.

A condenser has projecting terminals which engage the frame so as to secure mechanically the condenser while serving at the same time for its electrical connection.

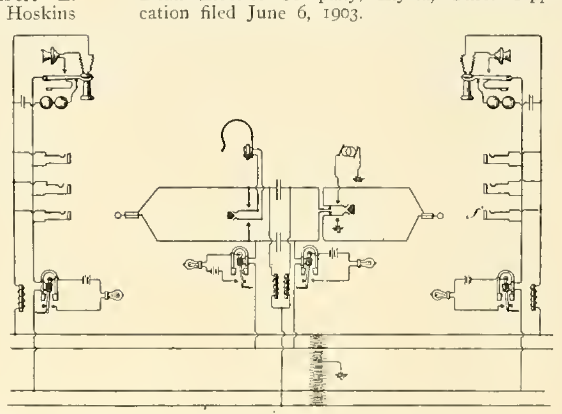
859,745. Vacuum Control Valve. Edmund L. Cridge, Passaic, N. J. Application filed April 13, 1906.

Electrical means are connected with the relief valve so that when the vacuum above the latter is relieved, air is admitted to the vacuum chamber below.

859,753. Process for the Building Up of Spongy Lead Plates for Electric Storage Batteries. Julius Diamant, Györ, Austria-Hungary. Application filed November 28, 1906.

The activity of the negative plates is prolonged by dividing them into sections and varying their order before the exposed surface shows signs of sulfating so as to bring the internal surface to the outside.

859,774. Two-wire Multiple Telephone System. Jacob W. Lattig, West Bethlehem, and Charles L. Goodrum, Philadelphia, Pa., assignors to the Dean Electric Company, Elyria, Ohio. Application filed June 6, 1903.



NO. 859,774.—TWO-WIRE MULTIPLE TELEPHONE SYSTEM.

The line and supervisory relays are all polarized, responsive to current in one direction only. The line relay is not cut off during conversation. The battery is divided into three sections of ten, thirty and ten volts, in series, to secure the directional relations of the current. The battery feed is on the impedance coil-condenser principle. (See cut.)

859,775. Telephone Toll-station Apparatus. Jacob W. Lattig, Wyncote, and Charles L. Goodrum, Philadelphia, Pa., assignors to the Dean Electric Company, Elyria, Ohio. Application filed November 3, 1903.

Inserting the coin and pressing a lever transmit a signal to central.

859,783. Trolley Finder. Frederick A. Selley, Nashville, Tenn. Application filed July 26, 1906.

Tension on the trolley ropes raises a pair of guides to direct the wheel onto the wire.

859,816. Liquid-flow Alarm. Raymond S. Kelsch, Montreal, Quebec, Canada. Application filed May 3, 1907.

The liquid is arranged to pour into a freely moving cup having a hole in its bottom. If the cup empties faster than it is filled an alarm circuit is completed.

859,820. Electric Motor Wheel. Karsten Knudsen, Grand Rapids, Mich. Application filed October 4, 1906.

The motor shaft carries a pinion connecting, by gears, with an annular rack, and an equalizer, consisting of a laterally movable bearing at the pinion end of the shaft, and a pivoted bearing at the other end.

859,821. Controller for Incandescent Electric-light Bulbs. Theodore Kopp, Philadelphia, Pa. Application filed October 13, 1906.

An attachment, designed to be screwed in the socket and to hold the lamp, contains resistance coils and contacts.

859,524. Switch-operating Mechanism. George H. Link, Cincinnati, Ohio. Application filed November 12, 1904.

Contacts closed by clockwork at the hour predetermined set a motor into action to operate the switch.

859,826. Variable-speed Motor. George Martinka, Jersey City, N. J. Application filed July 17, 1906.

Radially movable series-wound pole pieces are mounted in permanently fixed pole pieces which are shunt wound, and are arranged to be reciprocated.

859,827. Hygienic Telephone Appliance. Charles H. Molyneux, and Max Braunstein, Rochester, N. Y. Application filed September 12, 1906.

A sanitary roll sheet carried by two reels is adapted to be stretched in front of the transmitter.

859,840. Electric-light Illuminant. Robert H. Read, Schenectady, N. Y., assignor to the General Electric Company, Schenectady, N. Y. Application filed September 16, 1904.

The electrode comprises a molded pencil containing magnesium carbide.

859,867. Trolley. Charles A. Bluhm, Michigan City, Ind. Application filed February 27, 1906.

The trolley is adapted to make rolling contact with a rail.

859,868. Third Rail. Charles A. Bluhm, Michigan City, Ind. Application filed February 27, 1906.

The live rail is protected by guard rails insulated from it.

859,872. Railway Block-signal System. Winthrop M. Chapman, Newton, Mass., assignor to the Electric Railway Signal Company, Kittery, Me. Application filed February 4, 1903.

Electrically controlled signals at each end of a track section or block stand normally at danger until set at safety when a car enters the block from either direction and are released when a car leaves the block.

859,884. Telephone-service Apparatus. Uriah S. Jackson, Ossipee, N. H., assignor to the Superior Automatic Telephone Company, Boston, Mass. Application filed August 18, 1905.

A make-and-break wheel operates a step-by-step switch mechanism to secure connection with the desired line. Two wires and no ground are used.

859,889. Arc-light Electrode. Robert H. Read, Schenectady, N. Y., assignor to the General Electric Company, Schenectady, N. Y. Original application filed May 18, 1901. Divided and this application filed October 10, 1902.

An electrode formed of carbide of titanium has its pores filled with carbon.

859,890. Arc-light Electrode. Robert H. Read, Schenectady, N. Y., assignor to the General Electric Company, Schenectady, N. Y. Original application filed May 18, 1901. Divided and this application filed October 25, 1902.

The carbide electrode contains calcium carbide and carbon.

859,891. Arc-light Electrode. Robert H. Read, Schenectady, N. Y., assignor to the General Electric Company, Schenectady, N. Y. Original application filed May 18, 1901. Divided and this application filed May 29, 1905. Renewed June 15, 1907.

The electrode consists of zirconium carbide with a binding material.

PATENTS THAT HAVE EXPIRED.

Following is a list of electrical patents (issued by the United States Patent Office) that expired July 15, 1907:

432,022. Means for Generation and Conversion of Electric Energy. A. DeCastro, New York, N. Y.
430,040. Electric Stop-motion for Warping Machines. J. P. Haslam, Wilmington, Del.
432,049. Electric Railway. R. M. Hunter, Philadelphia, Pa.
432,050. Induction Coil or Transformer. C. E. Kammeyer, Eau Claire, Wis.
432,053. Electric Meter. P. H. Korst, Racine, Wis.
432,095. Electric Railway Switch. W. D. Swart, Boston, Mass.
432,098. Telegraphic Relay. J. M. Treber, Louisville, Ky.
432,136. Electrically Propelled Vehicle. R. M. Hunter, Philadelphia, Pa.
432,169. Dynamo-electric Machine. F. A. Perret, Brooklyn, N. Y.
432,202. Electrode for Secondary Batteries. J. F. McLaughlin, Philadelphia, Pa.
432,204. Means for Electric Locomotion. J. F. McLaughlin, Philadelphia, Pa.
432,205. Electric Heater. J. F. McLaughlin, Philadelphia, Pa.
432,206. Commutator Brush. J. F. McLaughlin, Philadelphia, Pa.
432,207. Electric Switch. J. F. McLaughlin, Philadelphia, Pa.
432,208. Electric-motor Car. J. F. McLaughlin, Philadelphia, Pa.
432,215. Apparatus for Detecting Short-circuits. H. Redding, Everett, Mass.
432,234. Electric Switch. A. C. Frey, Wilkinsburg, Pa.
432,237. Electrically Propelled Vehicle. J. W. Henderson, Philadelphia, Pa.
432,284. Electric Arc Lamp. E. C. Russell, Boston, Mass.
432,310. Regulation of Arc Light Circuits. D. Higham, Boston, Mass.
432,345. Multiplex Electric Locomotive. C. J. Van Depoele, Lynn, Mass.
432,387. Armature of Dynamo-electric Machine. O. A. Enholm, New York, N. Y.
432,453. Printing Telegraph. W. W. Taylor, Mansfield, Mass.
432,500. Armature. E. Wagemann, Little Rock, Ark.

WANTED, FOR SALE *and similar* **WANT COLUMN** *advertisements (50 words or less), $1.50 an insertion; additional words 3c each.* **POSITION WANTED** *advertisements (50 words or less), $1.00 an insertion; additional words 2c each.*

POSITION WANTED

By married man of 25, as engineer in electric-light plant; 6 years' experience in station work. Can do both inside and outside repairing. Technical man. Address Box 736, care Western Electrician, 507 Marquette Building, Chicago.

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Party to finance company to manufacture the only practical continuous railway crossing, patented, a crossing that does away with the interlocking towers at crossings and lasts the life of the rail, the thing for interurbans. Furnish your references; no triflers answered. Address Box 734, care Western Electrician, Chicago, Ill.

DEPARTMENT OF THE INTERIOR, OFFICE OF THE SUPERINTENDENT U. S. CAPITOL BUILDING AND GROUNDS, Washington, D. C., June 27, 1907. Sealed proposals in duplicate will be received and publicly opened at the above office on Saturday, July 20, 1907, at 12 o'clock noon, for Weatherproof and Rubber-Covered Electric Wires for House of Representatives Office Building. Material to be delivered on reels at the building. Erection of same not included. Specifications and schedule can be had upon application to the above office. Bids must be accompanied by certified check or surety bond in the sum of 2 per cent of the amount of bid. The right is reserved to reject any or all bids, or to waive any technicality or informality in any bid. Elliott Woods, Superintendent U. S. Capitol Building and Grounds. Approved, Jesse E. Wilson, Acting Secretary.

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The Obermatt-Lucerne Hydro-electric Power Station.

By Dr. Alfred Gradenwitz.

The Obermatt hydro-electric generating station, which supplies current for lighting and power purposes to the city of Lucerne, Switzerland, and surrounding communities, utilizes a head of 312 meters (constituted by the difference in level from the Engelberg plateau down to Obermatt), and a minimum of 1,000 liters of water per second, yielded by the stream known as the Erlenbach. By virtue of a convenient storing there is thus available a minimum of 6,000 horsepower in the case of a 12-hour full utilization (which limit is never reached in actual practice), while as much as 8,000 to 10,000 horsepower is generally available. As the capacity of the works can be increased by combining the waterpower of the Erlenbach with that of other streams, the plant will presumably be able to cope with the requirements of Lucerne for a number of years.

Near its source, the stream mentioned is conveyed through a channel 90 meters in length into a reservoir of about 70,000 cubic meters capacity, serving to compensate any daily fluctuations. A pit 2,567 meters in length, with a gradient of 1.2 per mile and 4.2 square meters clear cross-section, leads to the water chamber in which the locking gates and automatic slides for the pressure conduits are fitted.

The conduits lead down the slope of the mountain to the turbine house and are about 620 meters in aggregate length. They are clearly shown in Fig. 1. Two pipes about one meter inside diameter have been laid, while space is provided for additional pipes for future extension. These pipes are riveted sheet-steel tubes eight meters in length. The conduits are anchored by substantial concrete blocks at five points, and at the end have been fitted throttling valves, no-load gates and braking devices. The walled discharge channel is about 270 meters in length and discharges the water from the lower pond into the river.

The architects have admirably succeeded in adapting the building to the character of its surroundings, the gray limestone forming a most effective contrast to the lively green of the woods and meadows, while the whole building, with its simple lines, is well in harmony with the mountain valley and its forests.

The building comprises three main sections, viz., the engine house, switching plant and transformer room, in addition to which, outside of a number of accessory rooms, a room has been set apart for the storage battery.

The power house, views of which are shown in Figs. 1 and 2, is 54 meters in length, 13 meters in width and 12 meters high. It is planned for six hydro-electric units of 2,000 horsepower each, four of which have been installed. A further extension will be provided, raising the capacity of the works to eight units.

FIG. 1. THE OBERMATT HYDRO-ELECTRIC POWER STATION.

The generator hall (Fig. 3) is separated from the switching gear by five large masonry pillars, while the ground floor of the latter is separated by fluted glass walls. The hall is served by a traveling crane of 13 tons capacity.

The turbines are Pelton wheels, designed for automatic and hand regulation, being actuated by a hydraulic motor. The output of each of these turbines is 2,000 horsepower under a gross head of 312 meters and with 300 revolutions per minute. The mechanical and hydraulic part of the plant was supplied by Th. Bell & Co., Kriens. The electrical part was entrusted by the committee of experts to the Oerlikon Works of Zurich, Switzerland.

General Arrangement of the Plant.

The plant is mainly intended for supplying light and power to the city of Lucerne, 28 kilometers distant, while about 200 kilowatts is conveyed through a cable to Engelberg (4.5 kilometers), there to be used for lighting and power purposes. Another 200 kilowatts is supplied to about 15 localities of the cantons of Nidwalden and Obwalden. As reserve for the operation of the Stansstadt-Engelberg electric railway there has further been installed a special generator, intended for working in parallel with the machines of the neighboring railway central station.

Two separate systems have been provided, one serving for the supply of single-phase current for lighting the city of Lucerne and the other for three-phase current to be used for all remaining purposes. Separate single-phase operation had to be chosen for Lucerne, as the lighting requirements of that city are extremely heavy, an absolutely smooth operation being indispensable. The former central station of Thornberg is to serve as a reserve.

Four alternators of 2,000 horsepower each have been installed, which are switched at will to the lighting or power bus-bars. The railway generator is entirely separated from the remaining plant, but for its excitation is supplied by excitation bus-bars common for all machines.

The exciting current is supplied by two direct-current generators of 100 kilowatts each, operated by special turbines. As the lighting plant of the station and the circuits for operating the numerous automatic switches and signaling devices are also connected to the excitation bus-bars, a storage battery affording an efficient momentary reserve in cases of emergency was likewise provided.

The generators are provided with maximum oil switches, designed for operation at no load. The bus-bars, which are laid out in a special room, are designed as entirely closed annular circuits.

From the 6,000-volt bus-bars there is branched off, first the Engelberg cable, and next the primary circuits of the transformers, which raise the tension to 27,000 volts.

Three of the 10 single-phase transformers are used for the Lucerne lighting system and seven for the Lucerne power system and remaining power distribution. Two sets of three of the latter seven transformers are combined to polyphase current sets by triangle connection, while the seventh transformer, being connected between any two phases of the two sets, constitutes a reserve. Each transformer or group of transformers is provided with maximum oil switches and time relays at the primary and secondary ends.

The 27,000-volt bus-bars likewise constitute two closed annular systems. Three lines of three wires each are branched off from these systems, one serving for the Lucerne lighting system, one for the Lucerne power system and one for the Unterwalden lighting and power systems. In a similar way the generators of these lines are switched over from lighting service to power service. By means of conveniently arranged switches any two wires of a given line can be used as lighting circuit, thus leaving one wire of the line as a reserve.

All starting lines are protected against atmospheric discharges and excess in tension by induction coils, lightning arresters of the horn type and water resistances.

Generators and Storage Battery.

The generators, wound for 6,000 volts, are of the revolving-field type and are connected with the turbines by a rigid clutch. The armature coils are imbedded in open slots (nine for each pole division), and are insulated with seamless micanite sleeves and kept in the slots by fiber wedges. The three phases are arranged in star connection. The periodicity is 50 cycles and the speed 300 revolutions per minute.

FIG. 2. REAR VIEW OF POWER STATION WITH TRANSFORMER HOUSE ADDITION.

The 600-horsepower three-phase generator, installed as reserve for the Stansstad-Engelberg electric railway, was designed to work in parallel with the neighboring railway power house. It accordingly was designed for 32½ alternations per second, and with 490 reolutions per minute and 780 volts, yielding an output of 540 kilovolt-amperes.

The exciter machines are six-pole shunt-wound dynamos. They will work without any sparking, the position of the brushes remaining constant from no load to full load.

The storage battery comprises 56 cells of an aggregate capacity of 1,000 ampere-hours, the maximum admissible discharging current being 1,000 amperes during one hour and 1,500 amperes during one-fourth of an hour. The cells are arranged in three rows. In order to protect the armored concrete beams against decay the ceiling was coated with an acid-proof gray enamel varnish.

A double-cell switch is designed for remote operation. Direct-current motors with toothed wheel gearings are provided both for the charging and discharging slides. These motors are started in the required direction by a double-pole switch. The actual position of the contact slide is watched at remote gauges fixed to the battery column.

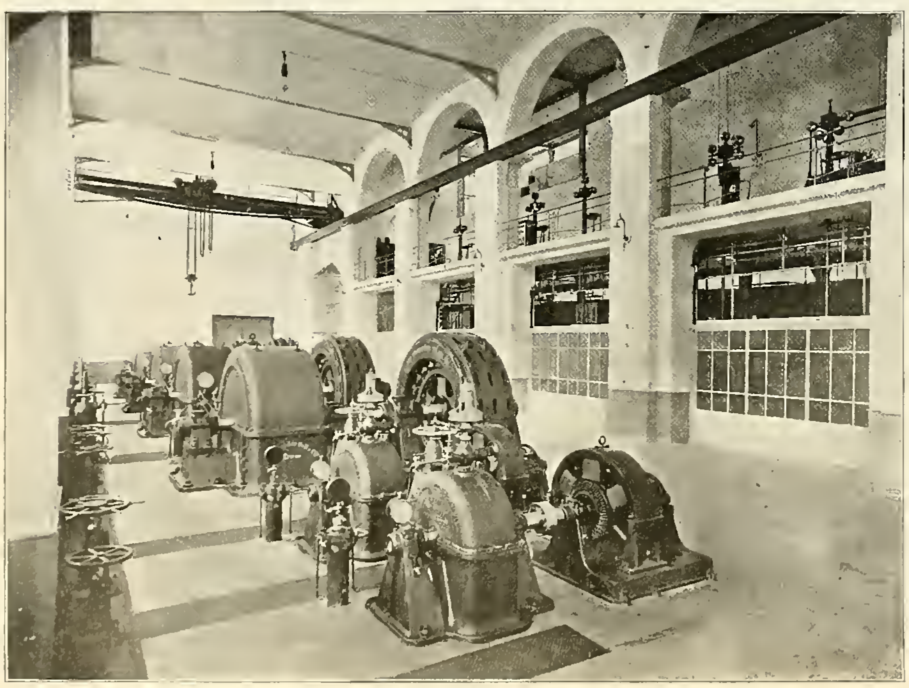

FIG 3. GENERATOR ROOM OF OBERMATT STATION, SHOWING SWITCH GALLERY.

Transformer Plant.

The transformer plant has been arranged with special care, being located in a building connected with the main power house, as shown in Fig. 2, but being entirely separated from the switching compartment by a wall. The transformers are single-phase water-cooled oil transformers, each of which is placed in a special fireproof cell locked outside by rolling iron doors, as shown in Fig. 4.

A corridor between the switching plant and transformer room has been provided in which the water-cooling pipes are mounted. Automatic signaling devices are fitted into the conduits which will actuate an alarm as soon as the normal water flow is discontinued. Through apparatus fitted at [illegible] each cell can thence be inspected. Should a transformer be ignited in spite of these precautions there would be absolutely no risk of the remaining plant being affected.

The building is designed for receiving 16 single-phase transformers, 10 of which have been at present installed, their primary voltage being 6,000 and the secondary 27,000.

Each transformer comprises two vertical iron cores of oblong rectangular cross section, being bridged on the top and underneath by iron sheet bows. The rectangular cross section increases the cooling surface while reducing the length of the bows and thus insuring a rational utilization of the iron volume. Close to the cores are fitted the low-tension coils, made up of bare copper tape, wound flat above one another in several layers which are insulated by pasteboard. This arrangement specially increases the overload capacity.

The high-tension coil surrounds the primary coil, from which it is entirely separated by an impregnated paper sheath about 10 millimeters in thickness with mica fittings. The high-tension coils are made up of flat copper tape with pasteboard insulation and are subdivided into individual coils so as to eliminate any tension higher than 900 volts in any given section.

Switching Plant.

A significant feature of the recent development of power stations is that switching plants now occupy nearly as much space as the generator room. This part of a power station formerly was somewhat neglected, all interest centering on the machines themselves. As electrical energy was transmitted to ever-increasing distances, requiring the use of higher potentials, the switching plant necessarily grew in size and importance. In connection with the Obermatt central station the guiding principle has been to increase the safety of operation by a careful design and very full dimensions.

The whole plant is designed on the enclosed system, each apparatus being fitted in a cell of its own, while avoiding as far as possible any crossings. The distances between the conductors of different polarity are as considerable as possible. All partition walls are of reinforced concrete and also the intermediary floors and ceilings.

The switching hall consists of a ground floor, first floor and maneuvering tower. The ground floor comprises any apparatus required for the generators and their excitation, in addition to the 6,000-volt bus-bars and the primary switches of the transformer. On the first floor are installed the secondary switches of the transformers, the 27,000-volt bus-bars and the main controlling platform. The tower finally contains the line switches and lightning arresters.

The ground floor and first floor are divided into three lengthwise compartments by two partition walls. The machines are connected with the switches by insulated cables, traversing an underground tunnel which passes throughout the length of the engine house. The apparatus used in connection with the generators, exciters and battery is installed in that part of the ground floor which adjoins the engine hall.

The first panel is set apart for the Engelberg railway generator and comprises an automatic oil switch, high-tension fuse and synchronizing devices for connection in parallel with the railway power station. Behind this panel are four panels serving for the 2,000-horsepower generators, each of which, as shown in Fig. 5, contains one automatic oil switch, one potential transformer, four current transformers (one for the amperemeter, one for the wattmeter and two for the disengaging coil of the maximum switch) and the switch for connecting the generator to the lighting or power bus-bars. Further cells are set apart for receiving the maximum switches for the two exciter machines and the battery, as well as the switches for charging and operation.

FIG. 4. FIRE-PROOF TRANSFORMER CELLS IN OBERMATT POWER STATION.

In an intermediary story have been located the shunt regulators of the exciters and the rheostats for the generator exciter circuits.

The central longitudinal section of the ground floor contains the 6,000-volt bus-bars. From the latter are branched off on one hand the primary conductors for the transformers and on the other the Engelberg cable. Both bus-bar systems were installed from the beginning in the length corresponding to the full equipment of the station. Between each two generators as well as between the two transformer feeders there have been fitted oil switches for the power bus-bars. In front and behind the oil switches there are arranged some additional switches for cutting out the tension from the corresponding section of the bus-bars in addition to the switch. In normal operation the Lucerne power system and the Unterwalden lighting and power system are entirely separated from one another.

The transformer primary switch is actuated from the part of the ground floor turned toward the transformer plant. Immediately above this the first floor contains the secondary transformer switches (Fig. 6), so that the transformers can be switched out both from the ground floor and first floor, the two handles being connected together by cords. The primary and secondary switches are provided with time relays and are equipped with optical and acoustic signaling devices. The ammeters, signaling lamps and time relays corresponding to each transformer or group of transformers are combined in a small switchboard arranged immediately beside the switching lever.

The compartment on the first floor corresponding to the 6,000-volt bus-bar compartment contains the 27,000-volt bus-bars. The switches for separating these bus-bars are designed on the tubular system with spring contacts and are separated from one another by reinforced concrete walls.

Transmission Line.

The starting conductors are led through the ceiling into the tower containing the line switches and lightning arresters. The long-distance transmission line comprises nine wires, two of which are used in normal operation for the Lucerne lighting system, three for the Lucerne power system and three for the Unterwalden lighting and power system. All of these three circuits can be switched both to the lighting and power bus-bars in the same way as the generators by means of switches of similar construction but greater dimensions. Conveniently arranged knife switches further allow any two wires of a three-phase line to be used as lighting circuit. Each line contains a maximum oil switch with current converters three ammeters and the signaling devices referred to. The ammeters and signaling devices are combined on a line switchboard on the first floor, whence the line switches are likewise actuated.

Owing to the frequent occurrence of atmospheric discharges, special care had to be bestowed on the lightning arresters. Those installed at the power station are removable Siemens horn arresters, with fine adjustment of the gap in addition to series-connected adjustable water resistances and inductive resistance coils. Each coil is further permanently connected to the ground through what is called a water-jet apparatus, in order to protect against any sudden rise in voltage.

Fig. 7 shows the connection between the lightning arresters and long-distance conductors. By the aid of the knife switches all lightning arresters can be cut out of the circuits so as to always allow of a safe operation and revision of the water-jet cells. The water required for the latter is derived from a neighboring spring and is subsequently used as cooling water for the transformers.

General Features of the Service.

In spite of the seeming complication of the switching plant the service has been well centralized. The front part of the first floor contains switching columns on which the apparatus required for the operation of a given machine are combined (Fig. 8). The proper order of the various manipulations is warranted by a special mechanical arrangement preventing any mistake on the part of the attendant. The voltmeter and wattmeter connections are controlled by the manipulation of the bus-bar switch, while a white or red lamp indicates that these instruments have been switched in or out of circuit.

One of the most interesting features is that the

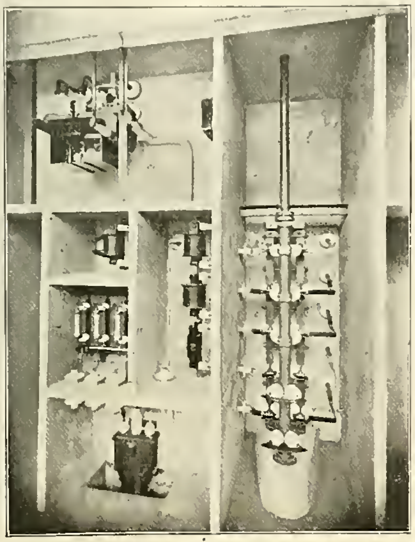

FIG. 5. ONE OF THE SWITCHING PANELS FOR THE 2,000-HORSEPOWER GENERATORS.

turbine superintendent is enabled quickly and safely to raise a turbine to the proper speed by means of a phase lamp and Westinghouse synchroscope, both of which instruments are mounted on pillars opposite the machine set in question, so as to be readily inspected by the superintendent when handling the turbine regulator.

Two general voltmeters for the light and power bus-bars, the scales of which are 1.1 meters in radius, are possibly the largest measuring instruments so far constructed.

Platinum.

A company has been incorporated in London, known as the Platinum Corporation, with a capital stock of $1,500,000, to develop concessions in the platinum-bearing districts of Russia, which for nearly a century has been the producer of nearly 90 per cent. of the platinum supply of the world. Platinum sold in 1892 for less than $10 an ounce. In two years the price had risen to $18.50, and in December of that year it was $19.50. In April, 1905, it brought $20.50. It continued to advance until in February, 1906, it sold for $25. Last September it was quoted at $34. The top-notch price of $37 and $38 was reached in March, this year, and then the price gradually declined to $25 on July 1st. Three weeks ago there was an advance of $1.

Platinum is almost indispensable in the manufacture of incandescent electric lamps and is also required for contacts in telephone switchboards.

National Civic Federation and Public Ownership.

British Lighting Plants Compared.

After declaring that gas and electric plants operated and maintained by municipalities generally give superior service at a lower cost compared

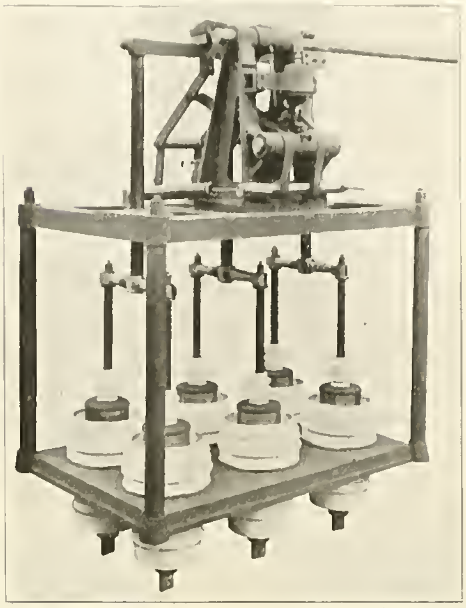

FIG. 6. SELF-DISENGAGING OIL SWITCH FOR 27,000 VOLTS.

with private companies, Milo B. Maltby, member of the Greater New York Public Service Commission and one of the National Civic Federation experts who recently spent six months of observation in Great Britain, has come forth with the statement that not actual municipal ownership and operation are necessary for the success of the idea, but the power of the city to purchase the property of the private concerns itself acts as a stimulus to better service.

Walton Clark, vice-president of the United Gas Improvement Company of Philadelphia, and Charles L. Edgar, president of the Boston Edison Electric Illuminating Company, both favor, as a result of their observations abroad, some form of regulation of private companies rather than municipal ownership of the public utilities. They see that municipal ownership has produced many and serious ills with few advantages to compensate. They direct attention to the election of public officers

FIG. 7. CONNECTIONS BETWEEN THE LIGHTNING ARRESTERS AND OUTGOING LINES.

who will protect the city against injustice on the part of individuals or corporations.

The commission investigated the public electric-lighting plants at Manchester, Liverpool, Glasgow and St. Pancras, London, and the private plants in Newcastle and London. Mr. Maltbie gives the average charge of the former to be about one cent less per kilowatt-hour than the average of the private companies. No difference in the character of service furnished by the two classes has been noted. Upon the whole, the municipal undertakings seemed to be as modern as those belonging to the companies, but not, perhaps, so well located or arranged.

"It appears," Mr. Edgar and Mr. Clark observe, "that so far as the prices charged are concerned the system of municipal ownership and operation of electric undertakings in England has given its advocates no reason for feeling ashamed or elated but that so far as extending the benefits of electric light and power and so far as progressiveness in developing the industry so as to give the best possible service are concerned, it has shown itself to be entirely outclassed by the system of private operation." In summing up the report, Messrs. Edgar and Clark conclude: "We seek, as a first principle, to insure to every man his own. In doing so, and in endeavoring to protect the public against oppression and error, we find it our duty to demonstrate the errors in the schemes of municipalizers and Socialists and to warn against the oppression that they threaten. We are resisting efforts to put burdens on the backs of the American people. We cannot and will not remain silent while the attempt is made to thrust costly and impracticable projects upon customers of public-service corporations and upon the public at large. We shall aid in hastening the day when our fellow citizens will know through discussion what the public of London have been taught by bitter experience. In that great city the municipalizers have led their fellow citizens astray, and their dupes, finding it out, have administered to their false guides an overwhelming rebuke. * * * Our nation is what she is industrially and commercially and in world politics because of the American character, developed by the most absolute individualism, and because of the American corporation,

FIG. 8. CENTRALIZED SWITCHING COLUMNS IN OBERMATT POWER STATION.

developed under a government that governed but did not trade."

Report on Street Railways.

The Federation's reports on street railways in Great Britain were submitted by William J. Clark of New York and Frank Parsons of Boston. Mr. Clark declares that the American traction systems, under private ownership, are far more progressive than those of England, Scotland and Ireland. Professor Parsons, on the other hand, expresses the opinion that municipal ownership of British tramway systems has been successful from every point of view. He sets forth that the municipalities were first in changing from horse cars and that fares have been lowered in spite of shortened hours of labor for employes. He notes, too, that on British tramways every fare secures a seat.

To combat these statements Mr. Clark points out that the entire development of street railways in the United States has been accomplished by private enterprise and that this has permitted the construction of extensive systems serving entire communities and linking them together irrespective of municipal boundary lines. "It is clearly demonstrated that the British policy has been to electrify and not greatly extend existing tramways, except through densely populated districts," says Mr. Clark. "And this means the obtaining of the greatest possible revenue without affording adequate transportation facilities, whereas in the United States private enterprise has constructed lines which will afford facilities, but which in many instances do not bring an adequate return."

Mr. Clark estimates that the British municipalities and local governments enjoy a total of possible financial benefits from tramway operations of about $8,679,176 a year, but that the American enterprises and their stockholders pay a total of $43,054,433, constituting a government revenue of more than $34,000,000 a year greater than the return to the state from similar traction systems in Great Britain.

Telephoning Without Wires.

A few years ago when wireless, space or radio-telegraphy, as it is variously termed, was first discussed, many electrical engineers were skeptical as to the possibility of its ever becoming of commercial importance, while the inventors themselves and especially the promoters of space-telegraph companies were most positive in their statements that the introduction of the new telegraphy on a commercial basis would revolutionize the telegraph business and would completely do away with the present transatlantic and submarine cables.

It is interesting to note that neither of these prophesies has been fulfilled. Today there may be found a large number of space-telegraph stations scattered throughout the world, and especially along the waterways and coasts, daily in communication with one another and with vessels at sea, few of which have not been equipped with facilities for both receiving and sending wireless messages. There is also to be observed an increase in ordinary telegraphing since space-telegraphy entered the field, since in most instances wireless messages are usually conveyed to their final destination by land telegraphy, thereby tending to increase, rather than diminish, the wire-carried business by bringing messages to them from moving craft of all kinds, which business could never have been realized had not space-telegraphy become commercialized. Of course it is possible that with increased invention, knowledge and experience space-telegraphy may make such strides as ultimately to interfere with cable or land telegraphy, but this speculation is entirely of the future.

Space-telegraphy depends for its operation upon the complete interruption of high-frequency electric currents which produce wave motions in the ether, emanating in all directions into space. The intensity of these waves can be greatly augmented by increasing the amount of current and power of the sending station. It has therefore been possible to send out waves which can be detected hundreds and even thousands of miles from the sending point in any direction.

While the telegraph transmits an electric current so interrupted as to correspond to signals, prearranged by a given code and therefore requiring an experienced operator for both transmitting and transcribing messages, the telephone produces variations in the intensity of an electric current to correspond to the sound waves given off by the sounding body. The more refined quality of the waves required for the success of telephony is, therefore, the salient reason for the present short range of wireless telephony as compared with wireless telegraphy.

Wire telephony has never yet been successfully carried to a distance of 100 miles under water, the limit being something under 60 miles, due to the distorting effect of capacity, as under the ocean

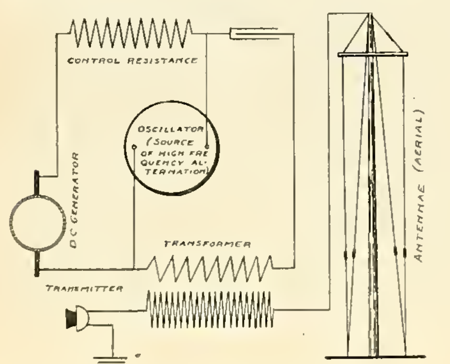

FIG. 1. TELEPHONING WITHOUT WIRES.—DIAGRAM OF TRANSMITTING CIRCUITS.

the electrically conducting wires and the surrounding medium, separated by a fraction of an inch of insulation, act as the two plates of a condenser. Wireless telephony with its present range of 10 to 15 miles therefore does not have to be extended to many times its present range to exceed that of submarine telephony.

Wire telephony on land, however, is practiced commercially up to distances of 1,500 miles and is capable of being extended by sufficient expenditure of money to 2,500 miles or even more. The greater separation of the wires in land work and the ease with which suitable loading coils may be inserted in the lines are the reasons why land telephony so greatly exceeds submarine transmission in its range of usefulness.

The question of wireless telephony is by no means new, as with the early advent of space-telegraphy it was but natural that wireless telephony should be considered. Such experimenters as Preece, Ruhmer, Arco and others in Europe, as well as Prof. Alexander Graham Bell, inventor of the telephone, Dr. Lee De Forest and several other scientists in this country have been at work on the problem for several years.

There have been many methods proposed for obtaining wireless telephonic communications, one of the earliest being that of Professor Bell's radiophone, where a selenium cell was placed in the focus of a silvered parabolic reflector and connected with a battery and telephone receiver. Selenium, as is well known, has the peculiar property of changing its resistance with changes in the amount of light which falls upon it. The effect of telephone currents superimposed upon the supply of the ordinary direct-current arc was next investigated and it was found that the arc responded very effectively to these high-frequency currents. Accordingly, Ernest Ruhmer of Berlin combined the so-called "speaking arc" in the focal center of a powerful searchlight and a selenium cell in a parabolic reflector and was able to transmit sound successfully up to seven miles, but his experiments do not seem to have come to very practical results.

Both of these methods, and in fact any method which employs light waves for the transmission of intelligence, naturally have the objection that the amount of light which is being transmitted is liable to be materially effected by the condition of the atmosphere or by intervening solids. Further, they are limited as to distance and the beam of light must be directed toward the receiving station. The apparatus is cumbersome and would seem to

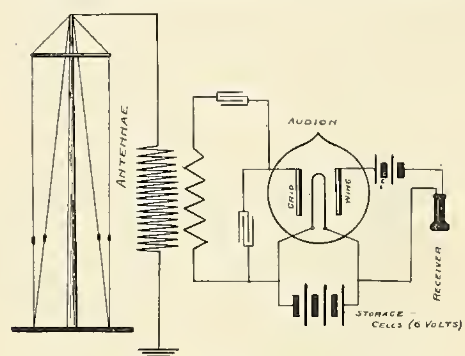

FIG. 2. TELEPHONING WITHOUT WIRES —DIAGRAM OF RECEIVING CIRCUITS

be out of the question for marine work, where it is most essential to have the apparatus in its best working order during fogs and where the exact location of the receiving station is unknown.

It would therefore appear that the best results could be expected by working along the lines of space-telegraphy or by depending upon electric waves, which are practically immune from atmospheric changes and which radiate in all directions and therefore do not have to be "aimed," so to speak, at the receiving station.

Dr. Lee De Forest, who is well known from his prominence in space-telegraphy, has been carrying on a most systematic and persistent research along these lines and has devised methods and apparatus which are apparently most successful. After almost a year of constant experimenting Dr. De Forest has reached the conclusion that wireless telephony as a commercial proposition is now being realized. A description of his receiving and transmitting apparatus will be of interest.

In his usual arrangement a condenser, transformer and non-inductive resistance, as a bank of lamps, are connected in series to a source of direct current. (See Fig. 1.) The non-inductive resistance serves only to reduce the current to about five amperes. Across the primary coil of the transformer an oscillator or source of wave motion is placed. The oscillator sets up high-frequency electric currents in the primary of the transformer which are tremendously multiplied in the secondary coils, one end of which is connected through a microphone transmitter to ground, while the other end leads directly to the antennae or aerial wires. Great care must be taken to install the microphone transmitter at the point of zero potential, otherwise the instrument might be destroyed by the excessive currents which surge in the secondary wires.

At the receiving station (see Fig. 2) another aerial is connected to one terminal of the secondary coil of a transformer similarly placed. The other side of the transformer is grounded. In

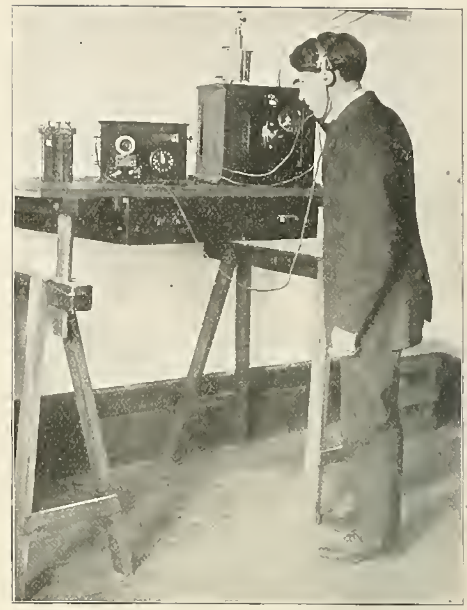

FIG. 3. TELEPHONING WITHOUT WIRES.—TRANSMITTER AND RECEIVER COMPLETE.

series with the primary coils are connected a condenser and the audion. (For description of the audion see Western Electrician of November 3, 1906.) A condenser is also placed across the terminals of the primary coil.

The receiver itself, which Dr. De Forest invented when he was at work with the wireless telegraph and which is one of the most sensitive of instruments, consists of a small incandescent lamp having a tantalum or other filament and two small plates of platinum within the bulb connected with platinum leading-in wires. The filament is raised to incandescence by a small storage battery usually of about six volts, shown beneath the audion. In the most recent instruments the two platinum plates are replaced by a grid and a wing. The interior of the bulb is highly exhausted and when the filament is heated by the passage of an electric current ionization of the rarefied gases takes place. When the electric waves reach this receiver through the grid the resistance of the interior of the bulb is changed and the telephone which is in the local circuit responds.

The oscillator may be any form of high-frequency interrupter, although in the apparatus which is here described an arc is used to supply an alternating current of a frequency so high as to be inaudible to the human ear. Upon these waves are superimposed the telephone currents of voice frequency which are carried along to the receiving station.

Although the talking currents which are sent through a submerged cable are distorted and so changed as to be wholly unintelligible when the distance between the stations exceeds the limit of 50 or 60 miles, these currents sent without wires, although possibly so weak as to be hardly discernible, are nevertheless perfectly clear, from which we may conclude that the range of communication has only to be increased by obtaining more powerful and more efficient receiving and transmitting apparatus.

The same advantages which telephony on land enjoys over telegraphy may be expected in wireless work; that it will find its greatest usefulness where it is essential to avoid experienced operators and where immediate actions are necessary.

In a recent issue of the Proceedings of the United States Naval Institute, Commander Bradley A. Fiske, U. S. N., discusses a plan for maintaining telephonic communication between vessels of a fleet. Although the plan is a primitive one, involving stringing a telephone cable between the various ships, it brings out forcibly the necessity for such communication. The writer goes on to state that space-telegraphy cannot be used, because of the fear that the enemy's ships behind the horizon may also be able to catch these waves. The wireless telephone, however, does not have this difficulty, for both telephones may be so tuned that the voices of those speaking are just distinct to each other, and it would be impossible for anyone beyond this limit to understand what was being said. The commander could then talk viva voce with anyone or all of the captains of his several ships.

The practical development of this system has so far progressed that sounds produced in Dr. De Forest's laboratory at the corner of Nineteenth Street and Fourth Avenue, New York city, have been heard not only at other laboratories several miles distant, but distinctly at Quarantine, 12 miles away aboard the steamer Bermudian. The set, including transmitter and receiver, is shown in the accompanying photograph (Fig. 3), and is so simple to handle that the most inexperienced can operate it after one or two lessons.

A key has to be used similar to those attached to telephones in London or like those formerly in use in New York. This must be pressed when speaking, because the currents used are too great for the receiver to withstand and would either effect the sensitiveness or completely destroy it.

The De Forest Radio phone Company, as Dr. De Forest's company is designated, has already contracted with the Lackawanna Railroad Company to equip several of its ferry boats with the new system, and it is expected that shortly contracts will be placed for the equipping of other ferry boats. It is quite important that the pilots and captains of the several boats should be in communication with one another, especially in case of fog and at night.

It is not unlikely, then, that there is a commercial future for wireless telephony, but consideration would indicate that its use will be supplemental to the existing wire circuits rather than in opposition to them, and that it will occupy a new field for marine work, military operations, especially during war or maneuvers, for communication between islands and mountains and in sparsely settled districts, and especially where temporary service is desired, as it can be installed at the shortest possible notice and maintained without the use of skilled operators.

Investigation of Steel-hardening Metals.

So many investigations have been carried on in connection with the manufacture of crucible steel and of high-speed tool steels that further advance in this direction would seem most improbable, but the combination of other metals with steel has now fully shown that they give it specific properties that adapt it especially to particular uses.

The known steel-hardening metals, named in the order of importance of production and use, are nickel, chromium, manganese, tungsten, molybdenum, vanadium, titanium, cobalt and uranium. The value of these metals produced in the United States in 1906 amounted to $458,327, of which $393,667 was for tungsten. The price of tungsten, which has been increasing for a number of years, was quoted at $5 to $6 per unit (one per cent. of a ton) in 1905, and at $12 per unit in the spring of 1907. Only small quantities are at present imported into the United States, as European markets utilize practically all that is produced in foreign localities, mostly in Peru and Australia. Large deposits of tungsten are found in Australia, and it is not improbable that sufficient may be obtained there to permit a certain portion of it to be shipped to the United States, but for the present this country will have to look within its own borders for sources of supply.

The increased demand for the steel-hardening metals has stimulated prospecting for the ores in the United States, and information concerning them is eagerly sought. So many inquiries have reached the United States Geological Survey that a special investigation of the subject has been planned, which has been assigned to Frank L. Hess. In the course of this work, which will extend throughout the summer and into the fall, Mr. Hess will visit South Dakota, Idaho, Colorado, Montana, Washington, Oregon, California, Nevada, Utah and Arizona. The results of Mr. Hess' work will be reported in a bulletin on the steel-hardening metal deposits other than manganese.

Chicago Engineers' Club.

The Chicago Engineers' Club, which opened its new quarters in Plymouth Court on July 10th with a dinner, is in a measure unique in that it is the only social club in the country composed entirely of engineers. In the fall of 1902 a number of engineers in the city of Chicago were invited by Mr. Ralph Modjeski to meet for the organization of an engineers' club. This meeting was attended by eighteen or twenty engineers, and resulted in the formation of a temporary organization and the election of an executive board, consisting of Ralph Modjeski, president; Charles W. Melcher, secretary; Louis E. Ritter, treasurer; Ambrose V. Powell and Onward Bates. This organization was augmented by the election of fifteen or twenty new members, and arrangements were made for a table at the Great Northern Hotel, where lunch would be served daily to the members of the club.

This club was the outgrowth of the Technical Club, and, seeking to avoid the errors which resulted so disastrously for that organization, the growth was very slow, the effort being to confine it entirely to engineers and to men who were mutually congenial. From this small start in 1902 the club has grown to 200 members, with very attractive rooms in the Chicago Automobile Club House. These rooms were obtained by an arrangement with the Automobile Club whereby the Chicago Engineers' Club paid for the building of an entire story, in which they have lounging and dining rooms, the meals being served from the Automobile Club's kitchen. Two views of the club rooms are shown on this page.

The club has been incorporated, and at the opening dinner the statement of the treasurer showed that it had not only paid out over $16,000 in the erection of the story and the furnishings of the quarters, but that there still was a very satisfactory balance in the treasurer's hands.

The membership has been fixed at 200 resident members, but is unlimited as to non-resident members. There are at present about 50 non-resident members, and since the club provides not only a dining room, but, by an arrangement with the Automobile Club, is able to provide sleeping rooms for its members, this number will undoubtedly be very much increased in the near future.

To keep the club an engineers' club, the constitution provides as a necessity to membership that the applicant must be, at the time of his application, or have previously been, "engaged in the direction or prosecution of engineering or other scientific work related to engineering."

That the club is filling an actual want is shown by the fact that luncheon is served daily to 50 or more members, and there is every indication that the Chicago Engineers' Club is to be a permanent feature in the club life of the city.

The club is governed by a board of managers, consisting of Mr. Ralph Modjeski, president; Mr. Andrew Allen, vice-president; Mr. Frank J. Llewellyn, secretary and treasurer, and Messrs. Fred K. Copeland, Charles H. Carthdge, Howard N. Elmer, James O. Heyworth, T. W. Snow and Oscar J. West, directors. Mr. West is chairman of the house committee and has been active in the advancement of the club's interests.

One End of the Lounging Room.

Dining Room.

VIEWS IN THE NEW QUARTERS OF THE CHICAGO ENGINEERS' CLUB.

To Approximate a Power Factor of Unity.

In Sheffield, England, where the electric motors connected to the mains of the municipal electrical undertaking number 831, aggregating 7,000 horsepower or 5,250 kilowatts the supply being alternating, both single and two-phase, 50 periods, 200, 400 and 2,000 volts, special efforts are being made to deal with the very low power factors which obtain in the works of large consumers. A machine is about to be installed with the object of relieving the plant and mains of the excessive amount of idle current which sometimes occupies them. It will be situated at the old generating station in the town and will serve to keep the trunk mains from the new stations, two miles away, loaded at a power factor approximately equal to unity. This machine will be of 600 kilovolt-amperes capacity, and in order to keep the starting current low it will be started by a small induction motor and switched into parallel on attaining synchronous speed, in the same manner as an ordinary generator. A power-factor meter is to be provided, so that the effect which the machine is producing may be read at intervals. The cost of the machine is $4,000, and the running expenses are estimated at $1,000 per annum. On the other hand, plant and mains to the extent of 420 kilowatts will be liberated, the estimated cost of which, without buildings, is put at $25,000 and the capital charges at $1,500 per annum. It is thus seen what an improvement it is hoped to effect by the installation of the machine.

Spontaneous Ignition of Coal.

To prevent the spontaneous ignition of large masses of coal, says the Glasgow Engineer and Iron Trades Advertiser, the most important precaution is to avoid as far as possible breakage during storing, for the exposure of fresh surfaces of coal just at the time when it is being put under conditions in which the heat generated by the action of the oxygen in the air cannot escape is one of the chief factors leading to this danger. The breaking up of the coal which has taken place at an earlier stage in its history has probably had time to complete this action, so far as the surfaces thus exposed are concerned, and the heat due to contact with the air has been gradually dissipated. In the store itself the greatest care must be exercised that no flue, drain or steam pipe that can give rise to an increase in temperature be near.

Firemen Revived by Aid of Electric Fans.

At the recent disastrous fire on the Remington Typewriter Company's premises, 325-7 Broadway, a new use for electric fans was discovered when reviving the firemen who were overcome by noxious gases generated in the cellar. Wires were run from the Elliott-Fisher offices nearby and connected to fans placed at the heads of unconscious men laid on the sidewalk. With the combined aid of restoratives and fans they were quickly brought to life and able to resume their attack on the flames.—Bulletin of New York Edison Company.

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CORRESPONDENCE relating to electricity or any of its practical applications is cordially invited, and the co-operation of all electrical thinkers and workers earnestly desired. Clear, concise, well written articles are especially welcome; and communications, views, news items, local newspaper clippings, or any information likely to interest electricians, will be thankfully received and cheerfully acknowledged.

ADVERTISING.—THE WESTERN ELECTRICIAN—**the only general electrical paper published in the West**—thoroughly covers a territory *exclusively its own*. THIS IS A CLAIM WHICH CAN BE MADE BY NO OTHER ELECTRICAL JOURNAL IN THE UNITED STATES. Electrical merchants and manufacturers *desiring western trade* will appreciate the UNEQUALED VALUE of this journal as an advertising medium in its special field. Advertising rates are moderate, and will be furnished on application.

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DEPARTMENTS.

DATES AHEAD.

Illuminating Engineering Society (first annual convention), Boston, July 30th and 31st.

Ohio Independent Telephone Association (special meeting), Southern Hotel, Columbus, Ohio, August 6th.

International Association of Municipal Electricians (twelfth annual convention), Norfolk, Va., August 7th to 9th.

Ohio Electric Light Association (annual convention), New Boody Hotel, Toledo, August 20th to 22d.

Michigan Electric Association (annual convention), Battle Creek, Mich., August 20th, 21st and 22d.

Canadian Electrical Show, Power Building, Montreal, September 2d to 14th.

Colorado Light, Power and Railway Association (annual meeting), Savoy Hotel, Denver, Colo., September 18th, 19th and 20th.

Central Electric Railway Association (regular meeting), [illegible], Ohio, September 26th.

New York Electrical Show, Madison Square Garden, September [illegible] to October 9th.

American Street and Interurban Railway Association and [illegible] (annual convention), Atlantic City, N. J., [illegible] 14th to 18th.

IN THIS ISSUE we bring to a close the voluminous extracts which the Western Electrician has printed from the Revised Standardization Rules of the American Institute of Electrical Engineers. The Institute has done no more important work than the formulation of these rules, and the extracts given show how carefully they have been drawn to conform to the best modern practice in electrical engineering, so far as the committee could ascertain that practice. Professor Crocker's committee is entitled to the thanks of the electrical fraternity.

HAS WIRELESS TELEPHONY "arrived"? Perhaps; but in view of the slow progress of wireless telegraphy in all localities where the ordinary wire circuits are practicable, it will be well to be conservative in judgment. There has been so much vociferous shouting about various kinds of "wireless" that those familiar with the history of the art will await the development of wireless telephoning with friendly interest but without any extraordinary enthusiasm. Actual tests under workaday conditions rather than laboratory experiments will determine the matter. In the meantime the article which we publish this week giving an account of the De Forest method for transmitting articulate speech by Hertzian waves will be read with profit and interest.

INDICATIVE alike of the friendly relations existing between Mexico and the United States and of the world-wide solidarity of the engineering profession, the recent convention of the American Society of Civil Engineers in the City of Mexico appears to have been in every sense a profitable and pleasing affair. The American visitors were cordially received and entertained with characteristic Mexican hospitality. They were, of course, warmly welcomed by their fellow-countrymen, of whom there are a large number in Mexico. One former Chicagoan, Mr. William B. Hale, now engaged in special expert engineering work in Mexico, has kindly described the social features of the convention for the benefit of the readers of the Western Electrician, and we are sure that his account, given elsewhere in this issue, will be read with interest.

AT A RECENT MEETING of the Electrotechnical Association in Berlin, Herr Bussman, speaking of the unwieldiness of mercury-vapor lamps with long glass tubes, made some interesting statements concerning a lamp using a tube of quartz, which has been devised by Dr. Richard Küch. For use on a 110-volt circuit, the lamp need be only 3¼ inches in length, compared with the three feet necessary in the case of a glass tube. The light given off by the quartz lamp is a pleasant yellow-white instead of the familiar blue-green mercury flame color. It is asserted that the lamp can be made as efficient as one-sixth watt per candlepower. The character of the light is not yet satisfactory for lighting places where an accurate determination of color values is necessary. The preponderance of the actinic violet and ultraviolet rays suggests its application to the therapeutic treatment of skin diseases and the sterilization of liquids, and experiments are being carried out in this direction.

THE ANNUAL conventions of the National Electrical Contractors' Association have shown a decided uplift in character, prestige and numbers, as the society has increased in importance. The convention of last year in Cleveland was an excellent one, while that held last week in New York was perhaps the best which the organization has yet held. The electrical contractor has much to do with the estimation in which electricity is held by the consumer. He is represented by individuals of the most diverse characteristics and attainments, but at his best—and it is the best class of electrical contractors which is represented in the association—he is a member of the electrical fraternity entitled to honor and praise for the execution of good work and a commendable desire to know how to do better work. Of course, he must look out for his profit, but the high-class electrical contractor also takes a manly pride in his work—the craftsmanship of it—and is proud of his connection with the up-to-date electrical industries. He is a good fellow. Good luck to him!

WITH the increasing scarcity of wood and the consequent high price of timber products, it is of importance to consider all processes for the preservation of wood. Some recent experiments in this direction have been carried out at Ghent, Belgium, with what is said to be a new coal-tar product, "injectol." The American consul reports that this preservative is a dark-brown liquid, very thin and of uniform density. Its viscosity changes little with compression, and it has the useful property of penetrating into certain woods without pressure. The experiments extended over two years, and for comparison similar specimens of wood were impregnated with a mixture composed of coal creosote, creosote and zinc chloride. The results showed that the time necessary for the soaking in of injectol is less than for any other antiseptic liquid, including creosote. After having been left in a steeping vat of decomposing substances for two years, it was found that the specimens treated with injectol were in good condition, while the others were almost completely destroyed. Further experiments are in progress.

GREAT BRITAIN will now ratify, probably, the Berlin radio-telegraphic convention, for the parliamentary committee which has had the subject under consideration for several months, and whose hearings have been mentioned in numerous issues of the Western Electrician, has now reported favorably. A majority of the committee considers that adhesion to the convention will be for the best interests of the country, but it is significant that the majority was slight—five votes to four. There is evidently a very large element of doubt whether Great Britain could not, to greater advantage, in a "wireless" sense, remain free of all conventions and entangling alliances. However, the question in that country is complicated by commercial considerations having to do, largely, with the "vested interests" of the Marconi company, and the testimony before the committee would indicate that that company was opposed to the ratification of the convention. Undoubtedly, however, the convention as a whole makes for the general progress of radio-telegraphy, dignifying, strengthening and standardizing the art, and it is a matter for congratulation that Great Britain has finally decided (if we may assume that the report of the committee will be adopted) to adhere to the declarations of the Berlin wireless conference. Other nations will doubtless follow suit.

LIFTING MAGNETS are put to many unexpected uses, and one of the most interesting applications of this sort is in the salvage operations now going on at Lundy Island, in Bristol Channel, off the west coast of England, where lies the wrecked British battleship Montagu. There are four divers engaged on the work, and the salvage steamer Etna is in constant attendance. As described by a Cardiff correspondent of the London Times Engineering Supplement, this vessel is fitted up with an elaborate electric plant and has on board magnets capable of lifting five tons of material from under water without the aid of a diver. The other salvage steamer Jumbo, which is at present stationed at Ilfracombe as a store ship, has on board pumps capable of discharging 3,000 tons of water an hour. The salvers hope to remove a considerable quantity of heavy metal during the summer, including the submerged torpedo tubes and condensers. They are at present engaged in stringing five steel wires, each of which is guaranteed to stand a strain of 75 tons. When completed these wires will be fixed to the foremast of the Montagu and carried over to the island, where the shore ends will be fastened to substantial moorings embedded to a considerable depth in the natural rock. The two side wires will be used as guides and handrails, and the other three as a roadway supporting a plank walk three feet wide.

There is no reason why electromagnets properly constructed should not work perfectly well under water, and the idea of their employment in salvage operations is novel and interesting.

NATIONAL ELECTRICAL CONTRACTORS' ASSOCIATION.

The seventh annual convention of the National Electrical Contractors' Association was held at New York city, July 17th to 19th, inclusive. The headquarters of the convention were maintained at the Hotel Imperial, but the business sessions were held in Assembly Room No. 1 of the Engineering Societies Building. There was a meeting of the board of directors on Tuesday, and the convention proper was called to order at 11 o'clock Wednesday morning by J. C. Hatzel, chairman of the convention committee, who presented James Hilton, president of the Electrical Contractors' Association of New York state. After a brief address of welcome to the National body, James R. Strong, president of the National association, was introduced. Mr. Strong presided over all of the subsequent meetings.

Three papers were presented at the first session which were intended to indicate the relations of the contractor to those with whom he has to come in contact while transacting his business. The first paper, "The Relations of the Municipalities and the Electrical Contractors," was by Prof. George F. Sever of Columbia University and also consulting engineer to the city of New York. Professor Sever pointed out the tremendous growth of electrical installations, and showed the relations of the contractor to the early work and to the present lines. He stated that in the early periods of electrical development the manufacturer of electrical apparatus was called upon not only to produce the electrical apparatus, but he had also to install it and assume all responsibility for its operation. This was before the birth of the electrical contractor. As the amount of electrical machinery grew greater, someone had to relieve the manufacturer, and it was at this time that the so-called electrical contractor entered the field. The manufacturer could then very advantageously dispense with this end of the business. The isolated plant also helped to bring about this result. Professor Sever then spoke of the present conditions, especially in our larger cities.

The question of the function of the municipality and the relation between the inspector representing the municipality and the contractor were then discussed, and the difficulties with which the former has to contend were exemplified, in the case of an old installation, where changes were made by someone connected with one of the tenants. The inspector could not be expected to watch all of the installations. The owner of the building, even though he might have been cognizant of the changes, failed to notify the proper authorities, and the work proved faulty. In this case, where lay the blame? Professor Sever concluded by asking for a closer co-operation between the inspection bureaus of the municipalities, the inspection bureaus of the underwriters and the electrical contractor who may be doing the work.

The second paper was presented by Arthur Williams of the New York Edison interests, and a former president of the National Electric Light Association. He spoke from the standpoint of the central station, pointing out its relations to the electrical contractor. He then gave some very interesting statistics on the amount of capital now tied up in the electrical industries, and went on to say that the growth of the lighting business especially was largely due to the earnest and progressive solicitation of the electrical contractor. He then pointed out the need for great care in the execution of the work itself, wherein the carelessness of a single workman might cause thousands of dollars financial loss and the imperiling of many lives. The practice of free rental of lamps, fans, arcs and small motors was also discussed and its bearing on the growth of electrical utilities. Mr. Williams' address was very interesting, and concluded by urging a much greater co-operation between the central station and the electrical contractor.

The third and last address of the morning was that of J. Robert Crouse of the Co-operative Electrical Development Association, who spoke on "Co-operation." The substance of this paper was the same as that which he delivered at the National Electric Light Association's convention at Washington, and which has already appeared in the Western Electrician. The morning session then adjourned at about 12:30.

In the afternoon an executive business session was opened shortly after two, at which the reports of the different committees and the report of the treasurer and secretary were presented and discussed.

On Thursday morning the second open session of the convention was called to order at about 11 o'clock, Mr. Strong presiding. The first paper to be presented was that by Hugh T. Wreaks, secretary of the Wire Inspection Bureau, on "Standardization of Wire," although Mr. Wreaks stated that he would make his remarks more applicable to "factory inspection," rather than on the actual standardization of the wire. Mr. Wreaks, in part, said: "To show the enormity of this field and the necessity for careful inspection both in material and workmanship, about three per cent. of the total number of fires in 1905 were recognized as due to electrical sources, representing about $12,000,000. Fires due to defective material is the only one we shall consider today, and although this inspection was originally started to protect buyers of rubber-covered wire, it has been extended to cover flexible cord, conduit, movable joints, and will undoubtedly be further applied to all other materials. The cost of this inspection is very moderate, considerably less than one per cent., and is therefore insignificant compared with the results which it accomplishes. From the nature of the inspection it is not possible to inspect each and every article, but coils are selected at random and tests upon these are taken as showing a fairly close approximation of how the quality of the goods will average."

In regard to the specifications, under which these tests are conducted, Mr. Wreaks believes that the National Electrical Contractors' Association should have something to say, and he welcomes practical criticisms from those who are directly interested. He goes on to state that electrical work of the future must be done more and more carefully, as the introduction of ever-increasing voltages and of a greater range of appliances, especially along the line of electric heating, calls for greater care in the execution of the work.

The next paper of the programme, presented by T. C. Martin, was entitled "Relations of the Press and Contractor." Mr. Martin said that in the early days of the electrical industry, when many of the electricians were very uncertain of the possibilities of ever being able to distribute electrical energy from a central station, the old-fashioned electrical contractor had little use for the electrical press, any more than the press had for him, but today the contractor has reached a very much higher plane, and must not only possess business ability, but must be a technical man and have had a good education and training. The earliest contractors came from the ranks of the telegraphers, who were then the only ones who had had any practical experience in insulations. The knowledge of electrical engineering, practical business methods and contracting in general is not sufficient for the new contractor; he must also interest himself in the production of materials, including copper and iron and mica, in municipal laws and legislations, in the campaign of new-business getting, and in many other ways which would not at first sight be significant. Between two and five per cent. of the gross income of some companies is used for advertising purposes in their efforts to secure new business. Of the electrical graduates of our engineering colleges and universities, nine per cent. go in to the sales departments and 4½ into superintendence, construction and contracting, or approximately two per cent. devote their time to this latter line.

The third paper of the morning was entitled "Underwriters' Relations with the Contractor," and was presented by C. M. Goddard, secretary of the Underwriters' National Electric Association. Mr. Goddard, however, changed this title to "Our Friends the Enemy," and stated the allusion to be applicable to either the contractor or the inspector, according to the point of view. Both the contractor and the inspector are after the same results, good, safe work, and it is more a question of misunderstandings than anything else which prevents greater harmony in their relations.

Mr. Goddard, as an inspector in 1892, sent out letters to the several insurance interests urging upon them the necessity of a meeting to discuss these questions of inspection, and as a result the Underwriters' National Electric Association was formed, and in less than two years these rules were mostly in vogue. The history of the evolution of the art was then discussed and the origin of the Code and set of rules were taken up, in which the watchword, "good, safe restrictions, which will not restrain the art" was foremost in their minds. The Code must be general in its restrictions, and frequently it will be found that some local ordinance or municipal regulation, which is absolute in its own little sphere, will require conformity thereto. Further, the only penalty which can be imposed in the disregard of the regulations is a change in the insurance rate on the property of the person, for whom this work is being done. As these rules are not used by all insurance companies, a raise in the rate will mean that the competing company will write the insurance, business will be lost and it will be a question whether the cause of protection will be a justifiable one.

Mr. Goddard then gave some advice as how to hasten the universal adoption of the Code: (1) Uphold the Code: (2) use your influence to improve it; (3) follow it in your work, and (4) be on friendly terms with the inspectors and be agreeable to what is required and don't let him feel that he is treating you unfairly. As to the supplement, regularly published as an appendix to the Code, make it a rule to use approved fittings in so far as it is possible and give your customers the advantage of the experience gained through the laboratory tests on these materials. As to factory inspection, which has already been treated, it is usual to select as many factories as are equipped with the proper facilities for turning out material of good quality and assign a corps of inspectors to make periodic tests and inspections to keep the material up to a satisfactory standard. The cost of this inspection is taken care of by the sale of inspection tags, and if any particular line of goods is found running below standard the stamps for this consignment are confiscated. The popularity of this service and the increased used of this system has already cut the cost of the stamps practically in two.

Charles L. Eidlitz, the first president of the National Electrical Contractors' Association, then gave the closing address, which was received with great applause. He stated that when the association was formed three resolutions were adopted: (1) To bring the men in the electrical contracting business together; (2) to establish respect one for the other, and (3) to obtain recognition of the business as a business, all of which have been brought about, and practically everything which they started out to do has been accomplished. Mr. Eidlitz then turned his attention to the trade relations now existing beween the manufacturers and supply dealers and the contractor, and made a plea to the members of the association to break up the "throat-cutting business" which is now going on. The price of labor has gone up, the price of materials has gone up, but neither the returns from, nor price of, contracted work has gone up in accordance.

It was then announced that O. T. Crosby of the Telharmonic Company extended a cordial invitation to the members to visit its station at Thirty-ninth and Broadway, and after a very short explanatory address the convention was adjourned and the inspection trip made to the plant.

On the afternoon of the 17th automobiles were provided which took the ladies to the wharf at the foot of Thirty-second Street, where the steamer Neptune was in readiness to take them around Manhattan Island. In the evening a banquet was given in the grand ball room of the Waldorf-Astoria, which was followed by an amateur entertainment and an original one-act play, "Not yet, but soon," which represented contracting in 1930. On Thursday afternoon a trip to Luna Park and Dreamland, with a shore dinner at the latter place, was provided for the ladies, who returned to the Imperial about 10 o'clock. The members and their guests attended a smoker, followed by high-class vaudeville, at Shenley's, and although the evening was an extremely warm one, nevertheless the stag proved a success. On Friday, the last day of the convention, a general "outing" was provided for all the members and guests. The steamer Glen left the foot of Thirty-second Street at about 9:30 a. m. for Witsel's Point-view Island on Long Island Sound. The programme included a baseball game between the "East" and the "West," which resulted in a tie, the score being 13 to 13. A clambake was also one of the enjoyable features of the day, and after a sail on Long Island Sound the boat returned promptly on schedule time at 6 p. m.

About 400 members and guests and about 70 ladies were in attendance at the convention.

The result of the election of officers was as follows: President, James R. Strong of New York; first vice-president, G. M. Sanborn of Indianapolis; second vice-president, Charles R. Kreider of Chicago; third vice-president, F. C. Work; secretary, John R. Galloway of Washington; treasurer, William H. Morton of Utica, N. Y.; sergeant-at-arms, J. C. Stearns of Buffalo.

[For convention notes see page 71.]

Radio-telegraph Extensions in Canada.

The Canadian Department of Marine is installing radio-telegraph stations on the shores of British Columbia. Cecil Doutre, commissioner of wireless telegraphy and superintendent of wireless stations for the Dominion government, is now in British Columbia in connection with the work, which will occupy most of the present summer. Within a month wireless stations will be in operation at Victoria and at Pachena Point, on the west cost of Vancouver Island. Then stations will be erected at Vancouver, either at Point Grey or at Stanley Park; at Estevan Point, on the west coast of Vancouver Island, and at Cape Lazo, on the east coast of the island, opposite Texada Island. Later, the system will be extended all along the coast as far as Prince Rupert. The system being installed is the Shoemaker, which has the advantage of interchangeability with the De Forest, the Stone, the Marconi and the Massie systems. A long wave is used, and it is possible to send messages to sea for at least 200 miles. It is expected that all the principal steamers which ply on the Pacific Coast waters will have one of these systems, so that there should not be a repetition of the great disasters to shipping which have occurred on the Pacific Coast within the last two years.

American Society of Civil Engineers in Mexico.

By William B. Hale.

City of Mexico, July 18.—Today will practically see the end of the thirty-ninth annual convention of the American Society of Civil Engineers, which has been holding its sessions in this city since July 8th. I shall not attempt to report the technical sessions, which will be fully covered by able representatives of the civil engineering press, but I believe a brief description of the various excursions made by the engineers will be of interest.

On the morning of the 8th the visiting engineers and their friends were treated to a ride around the valley of Mexico as the guests of the Mexico Tramways Company. Seven handsome parlor cars were assigned to the trip, and the first stop made was at the historic village of Guadalupe, where all were given an opportunity to visit the shrine of Our Lady of Guadalupe and to view her miraculous portrait and the snow-white altar surrounded by a massive solid silver railing said to contain 26 tons of that precious metal. After seeing the stone sails—erected in ancient times to commemorate the safe return to Vera Cruz of a vessel supposed to be lost at sea—and after having drunk from the sacred well which cures all bodily ills the party again boarded the cars and was carried to Tlalpam, a beautiful suburban town about 12 miles south of the city. Half an hour was spent at Tlalpam, and then the engineers proceeded to the Mexico Country Club at Churubusco, where, as guests of the club, they partook of an elaborate luncheon.

I may say in passing that the Mexico Country Club's new building, which was formally opened only a few weeks ago, is one of the finest of its kind in the world. The appointments of the gymnasium, swimming tank and other departments of the building are excellent; and in the extensive grounds one sees golf links, tennis courts, automobile courses, etc., together with an artificial lake for boating. This club is patronized by Mexicans and Americans alike, and will undoubtedly become one of the leading resorts of the capital. Unlike similar clubs in the northern part of the United States, the Mexico Country Club will keep open all the year round, the climate here permitting outdoor sports at any time.

Luncheon was served in the large ballroom of the club and nearly 300 of the visiting engineers and members of Mexican engineering bodies sat down to table. In the afternoon the party again took the special cars, and after a trip through Coyoacan, San Angel and Tacubaya, and a visit to the power house of the street-railway company, they returned to the city.

The opening session of the society was held Monday evening in the large hall of the Mineria, with Leandro Fernandez, minister of communications and public works in President Diaz' cabinet, occupying the chair as honorary presiding officer. An address of welcome by J. Ramon Ibarrola on behalf of the Engineers and Architects' Society of Mexico was ably responded to by Vice-president Onward Bates of Chicago, who ended his speech with the timely remark that the warmth of their reception by their Mexican brethren would make each one of them carry back in his heart the pleasantest of recollections and a true conception of the meaning of the Spanish word "amigo" (friend). Musical numbers were interspersed among the speeches and the proceedings were brought to a close with a short speech by Minister Fernandez, who declared the convention officially opened.

On Tuesday, July 9th, the Americans were the guests of the Waterworks Commission of the Mexican government. A special train took the party to Xochimilco, where large pumping stations are being erected to supply the city with pure water from the springs which bubble into Lake Xochimilco. Stops were made en route to enable the civil engineers to inspect the tunnel, now under construction, through which the water delivered by the electric pumps at Xochimilco will be carried to the city. Many complimentary comments were made upon the engineering skill shown in the design of the waterworks at Xochimilco. An excellent lunch was provided by the commission and after discussing it the engineers spent a pleasant half hour in boating on one of the beautiful little lakes in the vicinity, after which the return to the city was made.

Thursday the 11th was devoted to a visit to the great power plant of the Mexican Light and Power Company at Necaxa, an interesting feature of the trip being the journey over the little railroad connecting Necaxa with the Hidalgo and Northeastern Railway. This road is built almost entirely on the natural grade of the country through which it passes, and with such sharp curves that the last car of the train is sometimes nearly a train-length ahead of the locomotive, and passengers in the front car can shake hands with their friends in the rear coach.

Arriving at Necaxa in the late afternoon supper was served in the dining room of the camp, after which the tables were cleared away and an impromptu ball was held, dancing continuing until a late hour. The members "camped out" in cots provided for them, and on the morning of the 12th began their tour of inspection of the falls of Necaxa and the power plant, which is said to rank high among similar installations on this continent. In the evening the return to the city was begun.

Saturday the 13th was signalized by the reception of the party by President Diaz at the National Palace, in which he bade the engineers a hearty welcome to Mexico and expressed the hope that their visit would be full of pleasure to them and profit to his own countrymen engaged in engineering pursuits. President Diaz' address was responded to by Onward Bates, vice-president of the society. After the reception a visit was made to the Military College at Chapultepec, where the guests were entertained at a banquet in the dining hall of the college, their hosts being the military engineers of Mexico. Ignacio de la Barra, president of the college, delivered the main toast of the afternoon, which was replied to by Onward Bates in his usual felicitous style.

In the evening the civil engineers attended the annual session of the Society of the Military College at the Mineria, Mr. Bates being invited to take the chair as honorary presiding officer of the evening. Supper was served at the conclusion of the exercise, and music was furnished by the military bands in attendance.

On Monday the 15th the entire party was invited by the Mexican government to make a trip to the drainage works of the valley of Mexico. A special train carried the members along the line of the great drainage canal, which is 30 miles in length, and up to the entrance of the six-mile tunnel which conveys the drainage through the mountains. Stops were made at the controlling works near Lake Texcoco and at both ends of the tunnel; and lunch was served before the return trip was begun.

At 10 o'clock the same night the engineers boarded a special train on the Mexican Railway bound for Orizaba and Cordoba on the road to Vera Cruz. The next day (Tuesday) was spent in the semi-tropics, and the visitors enjoyed a ramble through the banana plantations and coffee groves near Fortin. Orizaba and Cordoba were visited, and at this latter point some of the members accepted the invitation of S. Pearson & Son to make a trip to the port works and railway on the Isthmus of Tehuantepec and boarded a special car bound for the isthmus.

The remainder of the party returned to Mexico City, reaching there the morning of the 17th, when their train was at once transferred to the tracks of the Mexican Central Railway and started over the mountains to Cuernavaca. This is a little city of much historic interest and great scenic beauty. Cortez' palace; the famous Borda Gardens, a favorite resort of Emperor Maximilian and his wife Carlotta during their short reign; the falls of San Antonio, and many picturesque old churches—one of them dating back to 1529—are among the points of interest at Cuernavaca, which is the favorite health and pleasure resort of the people of the City of Mexico. The visiting engineers were charmed with their day's outing—the last of many pleasant days spent in sightseeing during the convention.

I had the pleasure of meeting, among other Chicagoans who were in attendance at the convention, Onward Bates, vice-president of the society and a past-president of the Western Society of Engineers; John W. Alvord, also a prominent member of the Western Society; Professor Mead, Charles B. Ball, and Professor Baker and Instructor Abrams of the University of Illinois. Many of the members were accompanied by their wives, and I judged from what some of the ladies said that they were much impressed by the beauty and cleanliness of the city, and surprised at the coolness of the weather. Many of them had connected the idea of the tropics with intense heat, for which they had prepared by bringing with them the lightest of summer clothing, not realizing that the low latitude of this city is more than compensated for by its high altitude.

The weather here all the year round is like that of an October day in Chicago, and the heat usually experienced there in the summer months is absolutely unknown in the City of Mexico. It is for that reason an ideal summer resort, and the clothing suitable for spring and fall in Chicago and vicinity is just right for any month in the year in this city, or, in fact, in any city on the high central plateau of Mexico. The coast towns, such as Tampico and Vera Cruz, being at sea level, are extremely hot; but since most of the large cities are found at an elevation of 4,000 feet or over, a tour of Mexico in summer furnishes a cool and pleasant outing.

In bringing to a close this informal account of some of the excursions enjoyed by us during the convention of the American Society of Civil Engineers I wish to say a few words regarding this growing republic, about which comparatively little is known in the United States. The Mexico of today is vastly different from that of ten or even five years ago. Progress is visible on every hand. New railroad lines are being built and many others are under projection; industries of all kinds are springing up; the larger cities, already lighted by electricity, are installing electric street cars and up-to-date water supply and drainage systems. The government is firm, stable and progressive; the laws are good and they are enforced; property and individual rights are respected, and the foreign investor is fully protected in all legitimate undertakings. Mexico is rich in opportunities, but capital is required for their development, and those who provide the industries that the country needs are sure of reaping a rich reward.

Illuminating Engineering Convention.

The first annual convention of the Illuminating Engineering Society will be held Tuesday and Wednesday, July 30th and 31st, at the Edison Building, 39 Boylston Street, Boston, Mass. Owing to the number of papers that have been promised, the amount of business that will be necessary to transact at the convention and the time necessary for recreation, it has been decided that the convention will be opened at 9:30 sharp on Tuesday morning.

Members arriving in Boston in advance of Tuesday morning are requested to register at 728 Old South Building, 294 Washington Street, where they may secure any information or have mail sent to them. On Wednesday afternoon and evening it is planned to take the entire convention to the beach, with a shore dinner for the members, their guests and ladies.

Following is the programme of papers that have already been promised:

President's Address, Dr. C. H. Sharp; "Check on Reliability of Photometric Curves," J. S. Codman; "Electric Light as Related to Architecture," C. Howard Walker; "Acetylene," A. Cressy Morrison; "What is Street Lighting?" W. H. Blood, Jr.; "A New Comparison Photometer," Dr. Charles H. Williams; "Primary, Secondary and Working Standard of Light," Dr. Edward P. Hyde; "The Inverted Gas Light," T. J. Litle; "Lighting of the Boston Edison Building," Dr. Louis Bell, L. B. Marks and W. D'A. Ryan, committee; "Illuminating Engineering and Central Station Practice," L. H. Scherck; "New Lights and New Illuminants from the Central Stations' Point of View," R. S. Hale; "Coefficients of Diffuse Reflection," Dr. Louis Bell; "School House Illumination," B. B. Hatch; "Illumination of the Engineering Societies Building," C. E. Knox; "The Elements of Inefficiency in Diffused Lighting Systems, Illumination Photometers and Their Use," Preston S. Millar; "The Present Status of Candlepower Standard for Gas," C. H. Stone; "The Luminous Arc," W. D'A. Ryan.

Still other papers are expected which will further add to the importance of the convention from the technical standpoint.

It is suggested that it might be wise for members to plan to arrive in Boston in time to see the electrical parade and carnival on Monday evening. Boston will be decorated and illuminated profusely for Old Home Week and the programme provides "something doing every minute."

Arrangements are being made for a party of delegates to leave New York by the Providence Line from pier No. 18, North River, foot of Murray Street, New York, at 6 p. m. Monday, July 29th. The fare for the round trip from New York will be $5.65. State rooms may be reserved at prices ranging from $1 to $10 additional. Reservations may be made individually by communication with E. S. Peters, ticket agent, pier No. 10, New York city, or by communication with Mr. Preston S. Millar, secretary of the New York section, Eightieth Street and East End Avenue, New York city. Requests for reservations must in all cases be accompanied by a sufficient sum to cover the reservation.

ELEMENTS OF ELECTRICAL ENGINEERING.

By Geo. R. Metcalfe.

XXVI.—Central Stations.

Gas Engines.

There are several methods of governing gas engines, all of which may be divided into two general heads. One of these is by varying the number of explosions, this method being known as the hit-and-miss system, and the other by maintaining the number of regular explosions, but varying the magnitude of the explosion. The latter method is known as the variable-impulse system. The controlling mechanism generally consists of a fly-ball governor of similar construction to those used on numerous steam engines, although the operation performed by them on the gas engine is quite different.

In the hit-and-miss system the omission of the explosion is made to occur when the speed exceeds its fixed limitations, and this omission of the explosion is generally obtained by cutting off the supply of gas to the cylinder and allowing it to take in a charge of pure air only. On an engine of this kind of regulation the function of the governor is to close the valve which admits the gas to the cylinder when the speed of the engine is too high, and to again permit the admission of air when the speed falls to its normal value. The explosions in the single-cylinder engine using the Otto cycle occur only once every fourth stroke at full load, so that for only half load the explosions would occur on every eighth stroke. It is apparent, therefore, that the regulation of the engine is very irregular, especially at light loads.

The variable-impulse system permits of very much closer speed regulation, which is one of the chief requirements for driving electric generators. In governing by the variable-impulse system three methods are in common use. One is by varying the strength of the explosive mixture, another is by varying the amount of the explosive mixture, and a third is by varying the timing of the ignition.

There are certain maximum and minimum proportions of air that can be mixed with gas to form an explosive mixture, while there is but one certain strength of the mixture which gives the most economical results in the engine. The most economical method of regulation, therefore, is to run the engine at this most efficient strength of the explosive mixture and to vary the amount of the charge taken in at each cycle according to the speed of the engine. In the previous chapter it was pointed out that the explosion of the mixture must take place at a certain exact point of the stroke in order to utilize the full power of the explosion. It is obvious, therefore, that by varying this timing of the explosion a greater or less degree of its power will be utilized in useful work. This method of regulation is very inefficient, however, as it really consists of wasting part of the energy of the gas.

In some forms of gas engines the Otto cycle has been modified so as to be completed in two strokes. These two-cycle engines have one explosion for every revolution, so that they give very much more uniform turning moment and have also nearly double the capacity of a four-cycle engine of the same cylinder dimensions. The arrangement of the valves is also considerably more simple than that of the four-cycle machine, so that in regard to simplicity of arrangement, compactness of design and uniformity of speed throughout each revolution, the two-cycle engine has a considerable advantage over the four-cycle engine. It is, however, less efficient than the latter.

Gas Fuels.

Aside from liquid fuels, which pertain to oil engines rather than gas engines, the fuels in general use are either natural gas, coal gas, water gas or producer gas. In localities where natural gas is available it comprises a very economical fuel for gas engines. In most towns even of very small size illuminating gas is available either in the form of coal gas or water gas, and while both of these gases are excellent fuel for gas engines, they have undergone certain refinements which increase their illuminating qualities and which also increase their cost, but which do not add anything to their value as gas-engine fuels. In general, therefore, it may be considered that ordinary illuminating gas is too expensive for gas-engine fuel, except for very small engines, or for very infrequent use.

Gas Producers.

For all large engines operating regularly, producer gas is by far the most economical fuel. A gas producer is a sort of furnace containing a bed of red hot coals through which steam and air are passed, so that the oxygen in the air combines with the carbon, resulting in a gas composed of carbon monoxide, hydrogen and nitrogen. There are two general types of gas producers, one in which the air is forced through the coal under pressure, which is known as a pressure plant, and the other in which it is drawn through the coal by creating a partial vacuum above it. This latter type is known as a suction plant. The suction type of gas producer depends upon the suction of the engine each time it takes in a charge, and is therefore only practicable for use with engines which operate continuously for long periods.

The gas producer utilizes about 85 per cent. of the heat of combustion of the fuel, and is therefore considerably more efficient than the steam boiler. Whether the gas produced is rich or weak makes but little difference, as the strength of the explosive mixture is determined by the amount of air which is mixed with the gas, so if a weak gas is produced a smaller quantity of air is mixed with it to produce the explosive mixture.

Oil Engines.

Another class of prime mover closely allied to gas engines is the oil engine, in which the fuel used is either crude petroleum or one of its various constituents. When crude oil is heated various vapors are given off at different temperatures. The most volatile product is gasoline. Next comes benzene or naphtha, then kerosene, and finally some of the more dense oils. All of these products are used as fuel in oil engines, the construction of which is almost the same as that of gas engines, except for the devices which supply the oil to the cylinder. The same cycle of operations as in the gas engine also holds good for many of the oil engines on the market. Gasoline engines have been greatly perfected in the last few years, but these are made in comparatively small sizes, mostly for automobile motors, and are therefore not applicable to central-station conditions.

Another type of engine, differing in many respects from any of those previously mentioned, is adapted for using crude petroleum and operates on what is known as the Diesel cycle, which differs considerably from the Otto cycle. The Diesel cycle has a very high efficiency, and the average fuel consumption of engines of this type is less than one-tenth of a gallon per horsepower per hour. These engines have been recently built in quite large sizes, and have been introduced to some extent in central-station work. This cycle requires four strokes for its completion. On the first stroke pure air only is drawn into the cylinder. On the return stroke this air is compressed to about 500 pounds per square inch, and during the compression its temperature rises to about 1,000° F. At the beginning of the third stroke the liquid fuel is forced into the cylinder under high pressure and enters in the form of a fine spray. This spray is immediately ignited on coming into contact with the heated air in the cylinder, and it continues to burn as long as the oil is being supplied. The fuel in the cylinder burns comparatively slow, and there is no explosion as in the gas engine. After the admission valve is closed, the charge in the cylinder works by expansion to the end of the stroke, and on the fourth stroke the cylinder is exhausted.

The Diesel cycle is also adaptable for gasoline or gas, but the cheapest fuels are, of course, generally used. This engine merits special attention on account of its high efficiency, and tests have been made in which over 35 per cent. of the heat value of the fuel has been utilized in useful work. Like the gas engine, the oil engine, except those of very small size, must be water-jacketed about the cylinder and adjacent parts to prevent destructive heating.

Location of Machinery.

In locating the machinery in a central station a number of points should be carefully considered in order that the station shall be operated with a minimum of manual labor, and that renewals, repairs and additions to the plant can be conveniently made without interfering with the continuous operation of the plant. In a hydraulic plant the location of the waterwheels and generators is, of course, largely dictated by the location of the power house with reference to the water supply, and in the gas-engine plant the absence of almost all auxiliary apparatus makes the location of the machinery a very simple problem. As a very large majority of electric plants, however, are driven either by steam engines or steam turbines, both of which require a large amount of auxiliary apparatus, a careful study of the location of the different features of the equipment is necessary in order to produce a station capable of easy and economical operation.

The most logical arrangement of the apparatus in a central station is to have all the similar machinery arranged in distinct groups, so that each class of attendants in the station will have all the apparatus under its care arranged in a separate group or line, all of which can be within sight of the attendant, and will not require much running around to different parts of the station. For example, the boilers, coal-handling apparatus and pumps should be arranged in a compartment by themselves and separated by a fire wall from the rest of the station. The engines and generators should be symmetrically grouped in a room alongside of the boiler room, and the condensers are usually placed in pits adjacent to the engines, or, preferably, in a cellar below the engine room. The switchboard and all the controlling mechanism should be placed in as compact a group as possible, so as to be readily manipulated by the attendants, and the transformers, rotary converters, high-tension oil switches, lightning arresters, etc., should each constitute a separate group, each having its special location.

[*To be continued.*]

Note.—This series of articles, intended to survey, briefly, the whole field of applied electricity for light, power and heat, was begun in the Western Electrician of February 2, 1907.

QUESTIONS AND ANSWERS.

Changing Voltage of Transformers.

A. C., Vallejo, Cal.: I have two 10-kilowatt transformers, one wound for 2,300-volt primary and 115-volt secondary, the other for a 2,080-volt primary and 104-secondary, and want to use them on a 2,080-volt primary. How can I connect them together to supply current at 80 volts to 200 16-candlepower lamps?

Answer.

Both transformers are wound for the same transforming ratio (20 to 1), hence with a 2,080-volt primary each would give 104 volts on the secondary. As these voltages are approximately in proportion to the number of turns in the secondary and primary windings, the number of turns in the latter are too great in the proportion of 104 to 80. Removing a little less than one-fourth of the turns in the primary ought to give the desired reduction in voltage for each transformer, and the secondaries can then be connected in multiple.

Direct and Continuous Currents.

J. W. P., Bloomington, Ill.: What is the difference between direct current and continuous current, if any? Could a continuous-current motor be run on direct circuit? Could a continuous-current motor be run as a dynamo, the same as a direct-current motor?

Answer.

The terms "direct current" and "continuous current" have so long been used vaguely and interchangeably that the American Institute of Electrical Engineers did well to give new definitions of them (sufficiently accurate for practical distinctions) at its recent convention. These (as printed in the Western Electrician of July 13th, page 27) distinguish between the alternating current and the unidirectional currents, which, for short, are covered by the term "direct current." The latter term includes currents showing easily measured pulsations in either volts or amperes, and also currents in which these pulsations are so slight as to be negligible. The former were produced by certain early types of dynamos, but the generators now met in practice reduce the pulsations to negligible quantities, thus furnishing the "steady or non-pulsating direct current," which corresponds to the American Institute definition of a "continuous" current. The difference between the two lies merely in the extent of the pulsations, and as these are negligible with all recent types of American machinery, there is no difference between the two currents for such practical purposes as implied by the above questions.

Revised Standardization Rules.[1]

E. Insulation.

210. Insulation resistance is the ohmic resistance offered by an insulating coating, cover, material or support to an impressed voltage, tending to produce a leakage of current through the same.

211. Ohmic Resistance and Dielectric Strength.—The ohmic resistance of the insulation is of secondary importance only, as compared with the dielectric strength or resistance to rupture by high voltage. Since the ohmic resistance of the insulation can be very greatly increased by baking, but the dielectric strength is liable to be weakened thereby, it is preferable to specify a high dielectric strength rather than a high insulation resistance. The high-voltage test for dielectric strength should always be applied.

212. Recommended Value of Resistance.—The insulation resistance of complete apparatus should be such that the rated voltage of the apparatus will not send more than $\frac{1}{1,000,000}$ of the rated-load current, at the rated terminal voltage, through the insulation. Where the value found in this way exceeds one megohm, it is usually sufficient.

213. Insulation resistance tests should, if possible, be made at the pressure for which the apparatus is designed.

Dielectric Strength.—

214. Definition.—The dielectric strength of an insulating wall, coating, cover or path is measured by the voltage which must be applied to it in order to effect a disruptive discharge through the same.

215. Basis for Determining Test Voltages.—The test voltage which should be applied to determine the suitability of insulation for commercial operation is dependent upon the kind and size of the apparatus and its normal operating voltage, upon the nature of the service in which it is to be used, and the severity of the mechanical and electrical stresses to which it may be subjected. The voltages and other conditions of test which are recommended have been determined as reasonable and proper for the great majority of cases and are proposed for general adoption, except when specific reasons make a modification desirable.

216. Condition of Apparatus to Be Tested.—Commercial tests should in general be made with the completely assembled apparatus and not with individual parts. The apparatus should be in good condition, and high-voltage tests, unless otherwise specified, should be applied before the machine is put into commercial service and should not be applied when the insulation resistance is low, owing to dirt or moisture. High-voltage tests should in general be made at the temperature assumed under normal operation. High-voltage tests considerably in excess of the normal voltages to determine whether specifications are fulfilled are admissible on new machines only.

217. Points of Application of Voltage.—The test voltage should be successively applied between each electric circuit and all other electric circuits including conducting material in the apparatus.

218. The frequency of the alternating-current test voltage is in general immaterial within commercial ranges. When, however, the frequency has an appreciable effect, as in alternating-current apparatus of high voltage and considerable capacity, the rated frequency of the apparatus should be used.

219. Table of Testing Voltages.—The following voltages are recommended for testing all apparatus, lines and cables by a continued application for one minute. The test should be with alternating voltage having an effective value (or root mean square referred to a sine wave of voltage) given in the table and preferably for tests of alternating apparatus at the normal frequency of the apparatus:

Rated Terminal Voltage of Circuit. (220.)	Rated Output.	Testing Voltage.
Not exceeding 400 volts....	Under 10 kw...	1,000 volts.
Not exceeding 400 volts..........	10 kw. and over	1,500 volts.
400 and over, but less than 800 volts..	Under 10 kw ..	1,500 volts.
400 and over, but less than 800 volts..	10 kw. and over	2,000 volts.
800 and over, but less than 1,200 volts	Any..........	3,500 volts.
1,200 and over, but less than 2,500 volts	Any..........	5,000 volts.
2,500 and over.........................	Any..	Double the normal rated voltages.

221. Exception.—Transformers. Transformers having primary pressures of from 550 to 5,000 volts, the secondaries of which are directly connected to consumption circuits, should have a testing voltage of 10,000 volts, to be applied between the primary and secondary windings and also between the primary winding and the core.

222. Exception.—Field windings. The tests for field windings should be based on the rated voltage of the exciter and the rated output of the machine of which the coils are a part. Field windings of synchronous motors and converters, which are to be started by applying alternating current to the armature when the field is not excited and a high voltage is induced in the field windings, should be tested at 5,000 volts.

223. Rated Terminal Voltage.—Definition. The rated terminal voltage of circuit in the above table means the voltage between the conductors of the circuit to which the apparatus to be tested is to be connected—for instance, in three-phase circuits the delta voltage should be taken. In the following specific cases the rated terminal voltage of the circuit is to be determined as specified in ascertaining the testing voltage:

224. (a) Transformers.—The test of the insulation between the primary and secondary windings of transformers is to be the same as that between the high-voltage windings and core, and both tests should be made simultaneously by connecting the low-tension winding and core together during the test. If a voltage equal to the specified testing voltage be induced in the high-tension winding of a transformer it may be used for insulation tests instead of an independently induced voltage. These tests should be made first with one end and then with the other end of the high-tension winding connected to the low-tension winding and to the core.

241. Transformer Coils.—In high-tension transformers the low-tension coil should preferably be connected to the core and to the ground when the high-tension test is being made in order to avoid the stress from low-tension to core, which would otherwise result through condenser action. The various terminals of each winding of the high-tension transformer under test should be connected together during the test in order to prevent undue stress on the insulation between turns or sections of the winding in case the high-voltage test causes a breakdown.

F. Conductivity.

260. Copper.—The conductivity of copper in electric wires and cables should not be less than 98 per cent. of Matthiessen's standard of conductivity, as defined in the copper wire table of the American Institute of Electrical Engineers.

G. Rise of Temperature.

261. There are two methods in common use for determining the rise in temperature, viz.: (1) by thermometer and (2) by increase in resistance of an electric circuit.

262. 1. By Thermometer.—The following precautions should be observed in the use of thermometers:

263. a. Protection. The thermometers indicating the room temperature should be protected from thermal radiation emitted by heated bodies, or from draughts of air or from temporary fluctuations of temperature. Several room thermometers should be used. In using the thermometer by applying it to a heated part, care should be taken so to protect its bulb as to prevent radiation from it and at the same time not to interfere seriously with the normal radiation from the part to which it is applied.

264. b. Bulb. When a thermometer is applied to the free surface of a machine it is desirable that the bulb of the thermometer should be covered by a pad of definite area. A convenient pad may be formed of cotton waste in a shallow circular box about 1½ inches in diameter, through a slot in the side in which the thermometer bulb is inserted. An unduly large pad over the thermometer tends to interfere with the natural liberation of heat from the surface to which the thermometer is applied.

265. 2. By Increase in Resistance.—The resistance may be measured either by Wheatstone bridge or by drop-of-potential method. A temperature coefficient of 0.42 per cent. per degree C., from and at 0° C., may be assumed for copper.

The temperature coefficients from and at each degree Cent. between 0° C. and 50° C. are given in Appendix E. The temperature rise may be determined either (1) by dividing the percentage increase of initial resistance by the temperature coefficient for the initial temperature expressed in per cent.; or (2) by multiplying the increase in per cent. of the initial resistance by 238.1 plus the initial temperature in degrees C., and then dividing the product by 100.

266. 3. Comparison of Methods.—In electrical conductors the rise of temperature should be determined by their increase of resistance where practicable. Temperature elevations measured in this way are usually in excess of temperature elevations measured by thermometers. In very low resistance circuits thermometer measurements are frequently more reliable than measurements by the resistance method. Where a thermometer applied to a coil or winding indicates a higher temperature elevation than that shown by resistance measurement the thermometer indication should be accepted.

273. Limits Recommended.—It is recommended that the following maximum values of temperature elevation, referred to a standard room temperature of 25° Centigrade, at rated load under normal conditions of ventilation or cooling, should not be exceeded.

274. In commutating machines, rectifying machines, pulsating-current generators, synchronous machines, synchronous commutating machines and unipolar machines the temperature rise in the parts specified should not exceed the following:

275. Field and armature, 50° C.

276. Commutator and brushes, by thermometer, 55° C.

277. Collector rings, 65° C.

278. Bearings and other parts of machine, by thermometer, 40° C.

279. Rotary Induction Apparatus.—The temperature rise should not exceed the following:

280. Electric circuits, 50° C., by resistance.

281. Bearings and other parts of the machine, 40° C., by thermometer.

282. In squirrel-cage or short-circuited armatures, 55° C., by thermometer, may be allowed.

283. Transformers for Continuous Service.—The temperature rise should not exceed 50° C. in electric circuits, by resistance, and in other parts by thermometer.

284. Transformers for Intermittent Service.—In the case of transformers intended for intermittent service, or not operating continuously at rated load but continuously in circuit, as in the ordinary case of lighting transformers, the temperature elevation above the surrounding air temperature should not exceed 50° C. by resistance in electric circuits and by thermometer in other parts after the period corresponding to the term of rated load. In this instance the test load should not be applied until the transformer has been in circuit for a sufficient time to attain the temperature elevation due to core loss. With transformers for commercial lighting the duration of the rated-load test may be taken as three hours unless otherwise specified.

285. Reactors, induction and magneto regulators—electric circuits by resistance and other parts by thermometer, 50° C.

286. Large Apparatus.—Large generators, motors, transformers or other apparatus in which reliability and reserve overload capacity are important are frequently specified not to rise in temperature more than 40° C. under rated load and 55° C. at rated overload. It is, however, ordinarily undesirable to specify lower temperature elevation than 40° C. at rated load, measured as above.

287. In rheostats, heaters and other electrothermal apparatus no combustible or inflammable part or material, or portion liable to come in contact with such material, should rise more than 50° C. above the surrounding air under the service conditions for which it is designed.

288. Parts of Rheostats.—Parts of rheostats and similar apparatus rising in temperature, under the specified service conditions, more than 50° C., should not contain any combustible material, and should be arranged or installed in such a manner that neither they nor the hot air issuing from them can come in contact with combustible material.

H. Overload Capacities.

293. Performance with Overload.—All apparatus should be able to carry the overload hereinafter specified without serious injury by heating, sparking, mechanical weakness, etc., and with an additional temperature rise not exceeding 15° C. above those specified for rated loads, the overload being applied after the apparatus has acquired the temperature corresponding to rated-load continuous operation. Rheostats to which no temperature rise limits are attached are naturally exempt from this additional temperature rise of 15° C. under overload specified in these rules.

294. Normal Conditions.—Overload guarantees should refer to normal conditions of operation regarding speed, frequency, voltage, etc., and to non-inductive conditions in alternating apparatus, except where a phase displacement is inherent in the apparatus.

295. Overload Capacities Recommended.—The following overload capacities are recommended:

296. Generators.—Direct-current generators and alternating-current generators, 25 per cent. for two hours.

297. Motors.—Direct-current motors, induction motors and synchronous motors, not including railway and other motors intended for intermittent service, 25 per cent. for two hours and 50 per cent. for one minute.

298. Converters.—Synchronous converters, 25 per cent. for two hours, 50 per cent. for one-half hour.

299. Transformers and Rectifiers.—Constant-potential transformers and rectifiers, 25 per cent. for two hours, except in transformers connected to apparatus for which a different overload is guaranteed, in which case the same guarantees shall apply for the transformers as for the apparatus connected thereto.

300. Exciters.—Exciters of alternators and other synchronous machines, 10 per cent. more overload than is required for the excitation of the synchronous machine at its guaranteed overload and for the same period of time. All exciters of alternating-current, single-phase or polyphase generators should be able to give at rated speed sufficient voltage and current to excite the alternator at the rated speed to the full-load terminal voltage at the rated output in kilovolt-amperes and with 50 per cent. power factor.

301. A continuous-service rheostat, such as an armature or field-regulating rheostat, should be capable of carrying without injury for two hours a current 25 per cent. greater than that at which it is rated. It should also be capable of carrying for one minute a current 50 per cent. greater than its rated-load current without injury. This excess of capacity is intended for testing purposes only, and this margin of capacity should not be relied upon in the selection of the rheostat.

302. An intermittent service or motor-starting rheostat is used for starting a motor from rest and accelerating it to rated speed. Under ordinary conditions of service and unless expressly stated otherwise a motor is assumed to start in 15 seconds and with 150 per cent. of rated current strength.

1. This is the concluding installment of the extracts begun in the Western Electrician of July 2[illegible] from the revised standardization rules of the American Institute of Electrical Engineers. The original section numbers are retained.

A motor starter should be capable of starting the motor under these conditions once every four minutes for one hour.

303. This test may be carried out either by starting the motor at four-minute intervals or by placing the starter at normal temperature across the maximum voltage for which it is marked and moving the lever uniformly and gradually from the first to the last position during a period of 15 seconds, the current being maintained substantially constant at said 50 per cent. excess by introducing resistance in series or by other suitable means.

304. Other rheostats for intermittent service are employed under such special and varied conditions that no general rules are applicable to them.

VOLTAGES AND FREQUENCIES.

A. Voltages.

305. Direct-current Generators.—In direct-current, low-voltage generators the following average terminal voltages are in general use and are recommended:

125 volts. 250 volts. 550 to 600 volts.

306. Low-voltage Circuits.—In direct-current and alternating-current, low-voltage circuits, the following average terminal voltages are in general use and are recommended:

110 volts. 220 volts.

307. Primary Distribution Circuits.—In alternating-current, constant-potential, primary distribution circuits an average voltage of 2,200 volts, with step-down transformer ratios 1/10 and 1/20, is in general use and is recommended.

308. Transmission Circuits.—In alternating-current constant-potential transmission circuits the following average voltages are recommended:

6,600, 11,000, 22,000, 33,000, 44,000, 66,000, 88,000.

309. Transformer Ratio.—It is recommended that the standard transformer ratios should be such as to transform between the standard voltages above named. The ratio will therefore usually be an exact multiple of 5 or 10, e. g., 2,200 to 11,000; 2,200 to 44,000.

310. Range in Voltage.—In alternating-current generators, or generating systems, a range of terminal voltage should be provided from rated voltage at no load to 10 per cent. in excess thereof to cover drop in transmission. If a greater range than 10 per cent. is specified, the generator should be considered as special.

B. Frequencies.

311. In alternating-current circuits the following frequencies are standard:

25 cycles. 60 cycles.

312. These frequencies are already in extensive use and it is deemed advisable to adhere to them as closely as possible.

GENERAL RECOMMENDATIONS.

313. Name Plates.—All electrical apparatus should be provided with a name plate giving the manufacturer's name, the voltage and the current in amperes for which it is designed. Where practicable the kilowatt capacity, character of current, speed, frequency, type, designation and serial number should be added.

314. Diagrams of Connections.—All electrical apparatus when leaving the factory should be accompanied by a diagram showing the electrical connections and the relation of the different parts in sufficient detail to give the necessary information for proper installation.

315. Rheostat Data.—Every rheostat should be clearly and permanently marked with the voltage and amperes, or range of amperes, for which it is designed.

316. Colored Indicating Lights.—When using colored indicating lights on switchboards, red should denote danger, such as "switch closed," or "circuit alive;" green should denote safety, such as "switch open" or "circuit dead."

317. When white lights are used a light turned on should denote danger, such as "switch closed" or "circuit alive," while the light out should denote safety, such as "switch open" or "circuit dead." Low-efficiency lamps should be used.

318. The use of colored lights is recommended as safer than white lights.

319. Grounding Metal Work.—It is desirable that all metal work near high-potential circuits be grounded.

320. Circuit-opening Devices.—The following definitions are recommended:

321. A circuit-breaker is an apparatus for breaking a circuit at the highest current which it may be called upon to carry.

322. A disconnecting switch is an apparatus designed to open a circuit only when carrying little or no current.

323. An automatic circuit-breaker is an apparatus for breaking a circuit automatically under an excessive strength of current. It should be capable of breaking the circuit repeatedly at rated voltage and at the maximum current which it may be called upon to carry.

APPENDICES AND TABULAR DATA.

Appendix C. Photometry and Lamps.

341. Candlepower.—The luminous intensity of sources of light is expressed in candlepower. The unit of candlepower should be derived from the standards maintained by the National Bureau of Standards at Washington, D. C., which standard unit of candlepower equals 100/88 of the Hefner unit under Reichsanstalt standard conditions for the Hefner. In practical measurements seasoned and carefully standardized incandescent lamps are more reliable and accurate than the primary standard.

342. Candle Lumen. The total flux of light from a source is equal to its mean spherical intensity multiplied by 4π. The unit of flux is called the candle lumen. A candle lumen is the $\frac{1}{4\pi}$th part of the total flux of light emitted by a source having a mean spherical intensity of one candlepower.

343. Candle Meter.—The unit of illumination is the candle meter. This is the normal illumination produced by one unit of candlepower at a distance of one meter.

344. a. Candle-foot.—Illumination is occasionally expressed in candle-feet. A candle-foot is the normal illumination produced by one unit of candlepower at a distance of one foot.

345. 1 candle-foot = 10.764 candle meters.

The use of the candle-meter unit is preferable and is recommended.

346. The efficiency of electric lamps is properly stated in terms of mean spherical candlepower per watt at lamp terminals. This use of the term efficiency is to be considered as special and not to be confused with the generally accepted definition of efficiency in section 85.

347. a. Efficiency, Auxiliary Devices.—In illuminants requiring auxiliary power-consuming devices outside of the luminous body, such as steadying resistances in constant potential arc lamps, a distinction should be made between the net efficiency of the luminous source and the gross efficiency of the lamp. This distinction should always be stated. The gross efficiency should include the power consumed in the auxiliary resistance, etc. The net efficiency should, however, include the power consumed in the controlling mechanism of the lamp itself. Comparison between such sources of light should be made on the basis of gross efficiency, since the power consumed in the auxiliary device is essential to the operation.

348. b. A standard circuit voltage of 110 volts, or multiple thereof, may be assumed, except where expressly stated otherwise.

349. Watts per Candle.—The specific consumption of an electric lamp is its watt consumption per mean spherical candlepower. "Watts per candle" is the term used commercially in connection with incandescent lamps and denotes watts per mean horizontal candlepower.

350. Photometric tests in which the results are stated in candlepower should always be made at such a distance from the source of light that the latter may be regarded as practically a point. Where tests are made at shorter distances, as, for example, in the measurement of lamps with reflectors, the results should always be given as "apparent candlepower" at the distance employed, which distance should always be specifically stated.

351. Basis for Comparison.—Either the total flux of light in candle lumens or the mean spherical candlepower should always be used as the basis for comparing various luminous sources with each other, unless there is a clear understanding or statement to the contrary.

352. Incandescent Lamps, Rating.—It is customary to rate incandescent lamps on the basis of their mean horizontal candlepower, but in comparing incandescent lamps in which the relative distribution of luminous intensity differs the comparison should be based on their total flux of light measured in lumens, or on their mean spherical candlepower.

353. The spherical reduction factor of a lamp

$$= \frac{\text{mean spherical candlepower}}{\text{mean horizontal candlepower}}$$

354. The total flux of light in candle lumens emitted by a lamp $= 4\pi \times$ mean horizontal candlepower $\times$ spherical reduction factor.

355. The spherical reduction factor should only be used when properly determined for the particular type and characteristics of each lamp. The spherical reduction factor permits of substantially accurate comparisons being made between the mean spherical candlepowers of different types of incandescent lamps and may be used in the absence of proper facilities for direct measurement of mean spherical intensity.

356. "Reading Distance."—Where standard photometric measurements are impracticable, approximate measurements of illuminants such as street lamps may be made by comparing their "reading distances," i. e., by determining alternately the distances at which an ordinary size of reading print can just be read by the same person or persons when all other light is screened. The angle below the horizontal at which the measurement is made should be specified when it exceeds 15 degrees.

357. In comparing different luminous sources not only should their candlepower be compared but also their relative form, intrinsic brilliancy, distribution of illumination and character of light.

Peoria is exhibiting much electrical activity at present, including elaborate underground work.

Great Britain Ratifies Wireless Convention.

[From the London correspondent of the Western Electrician.]

The main points of interest about the report of the committee of the House of Commons which has been considering the desirability or otherwise of Great Britain adhering to the wireless convention signed in Berlin on November 3, 1906, are that it is presented with a majority of one; that it unconditionally recommends adherence to the convention, and its unhesitating disagreement with all the arguments put forward by the Marconi Wireless Telegraph Company. In other words, the report expresses complete satisfaction with the evidence and arguments of the official delegates, and the committee has been profoundly impressed by an instance mentioned by the representative of Lloyd's, in which the refusal of a Marconi fitted ship to intercommunicate with a ship fitted with the De Forest apparatus might have entailed serious consequences at the time to Atlantic shipping.

As I have intimated in notes from time to time, it has been a case of the Marconi Company versus all government departments, Lloyds' and one shipping company. But the committee without much demur put the interests of the nation and its commerce far above that of the Marconi Company and adopts the view of the official delegates in toto, with the reservation contained in the last paragraph of its remarks upon the position of the Marconi Company.

To quote in part from the committee's remarks: "The Marconi Company, the only opponent to the convention which has appeared before the committee, cannot be regarded as having any claim to a monopoly of wireless telegraphy; although, under present conditions, they have secured what amounts to something approaching a monopoly in respect of Great Britain, Italy and Canada. As regards Great Britain, the position is due to the fact that for various reasons, and pending a settlement of the policy to be finally adopted, the postmaster-general has hitherto refrained from issuing licenses for competing stations on the south coast of England and Ireland. Had the Marconi system been the only one in existence there would still have been necessity for regulations for the proper working of the system through inter-governmental control, but this necessity becomes accentuated by the existence of other systems with stations working throughout the world."

"The Marconi Company contends that an obligation of compulsory intercommunication between different systems, under an international convention, must result in an infringement of the patent rights, and therefore that the expression in the postoffice agreement 'without prejudice to its patent right,' continues to put the company in a superior position throughout the period of the agreement to any arrangement, international or otherwise, involving intercommunication that may, during that period, be brought into force. This contention may or may not be found sound in a court of law, and the committee feels precluded, therefore, from expressing any opinion upon it; but it appears obviously inconsistent with the intention of the parties when making the agreement."

"There appears to be little doubt, from the evidence placed before the committee, that even if Great Britain declines to ratify the convention the other powers will do so. Assuming that the Marconi Company maintained the policy of non-intercommunication, the result would be that, under articles 1, 2 and 3 of the convention, Marconi apparatus would have to be removed from all ships and stations belonging to signatory nations, thus seriously diminishing the scope and effectiveness of the Marconi organization on which the company lays so much stress. On the other hand, if Great Britain were to ratify, and if, as a consequence, the company abandoned the policy of non-intercommunication, there would be no necessity for this removal."

In reviewing the relations of the government with the Marconi Company, two points stand out especially clear in the light of subsequent events: (1) If at the time when the postoffice was giving to Mr. Marconi effective assistance the government had thought it expedient to secure a right of pre-emption of his invention and patents, an enterprise of national importance would have been prevented from passing into the hands of a private company and subsequent difficulties might have been avoided. (2) The fact that the postoffice has largely refrained from issuing licenses to other companies has given the Marconi Company something approaching a monopoly during an important period and may therefore have encouraged its dreams of a general monopoly.

From the evidence placed before them the committee sees no reason to apprehend that the obligations of the convention, if faithfully carried out by all concerned, will prove injurious to the Marconi Company. If, on the other hand, it is found by practical experience that the Marconi Company is injuriously affected, the committee recommends that it should be treated with a generous consideration quite irrespective of and without prejudice to its legal position.

In all cases of legislation in the public interest, and where damage can be shown to accrue to private interests, something in the nature of compensation is and should be granted. In this case the committee is not of the opinion that the Marconi Company can found an equitable claim upon the terms of its agreement with the postoffice. But in view of the particular circumstances of the case the committee recommends that, provided the Marconi Company loyally co-operates in carrying out the convention and the policy which it represents, and in the event of its being shown, under proper conditions of audit, that the Marconi Company during the transition period under the new conditions brought about by the convention has suffered diminution of business at its British stations it should be granted compensation for a period of three years from the day of the convention coming into operation, and that the compensation should be based upon a comparison with the average annual net traffic receipts from its British stations during the three years preceding ratification.

Lightning and Lightning Protection.

By Charles P. Steinmetz.

Part II.

II.—Lightning in Electric Circuits.

Of greatest importance to an electrical engineer are the high-potential phenomena produced in electric circuits by atmospheric lightning as well as by other causes, frequently internal to the circuit, which gives similar or the same effects to such an extent that it has become customary when dealing with electric circuits to distinguish between external or atmospheric lightning and internal lightning as caused by electric circuit disturbances or defects, such as sudden changes of load, arcing ground, etc.

While a very large amount of data on high-potential phenomena in electric circuits has accumulated, the possible variety of phenomena is so great that an intelligent understanding of the phenomena, as it is required for effective protection of the circuits, is feasible only by a theoretical investigation of the high-potential phenomena which may be expected in electric circuits and a comparison thereof with the observed effects.

In general the high-potential phenomena possible in electric circuits are the same three classes of phenomena which can occur in any medium, as a body of water, which is the seat of energy.

1. Steady electrostatic stress, that is, a gradual rise of potential of the total circuit against ground until a discharge occurs somewhere; just as in a body of water, as a river, the pressure, that is, the water level, may gradually rise until it breaks through the embankment.

2. Impulses, or traveling waves, similar to the ocean waves rolling over the surface of the water.

3. Standing waves, or oscillations or surges, similar to the oscillation of a tuning fork or a violin string.

A more extended discussion on the three forms of electric disturbances and their causes I have given in a recent paper before the American Institute of Electrical Engineers, "Lightning Phenomena in Electric Circuits." (See Western Electrician of April 6, 1907.)

Steady electrostatic stress obviously can occur only where the circuit is very well insulated from the ground, but not in a ground circuit, as low-voltage circuits usually are, and such static stresses can be eliminated by a permanent leak, that is, a high-resistance connection between the circuit and the ground.

As sources of impulses or traveling waves only two characteristic phenomena may be considered here—the lightning flash, or induction by the clouds, as external, and the arcing ground as internal cause.

Assuming a thunder cloud to pass over the line, the ground below the cloud then assumes an electrostatic charge corresponding to the opposite charge of the cloud. The transmission line, as part of the ground, so also assumes a static charge higher than that of the ground, since it projects above it. Any equalization of the potential distribution in the cloud by a lightning flash, as shown in the foregoing, requires a change in the electrostatic charge of the line corresponding to the changed potential difference between ground and cloud above the ground, and the static charge so set free on the line rushes as impulse or wave along the line. The wave shape of such impulses induced by cloud discharges is in general not a smooth sine wave, but may be very irregular. During the equalization of the cloud potential by the lightning flash the potential difference against ground of the part of the cloud above the electric circuit may vary in almost any conceivable manner, so giving rise to very different wave shapes of the impulses. So some impulses may rise very rapidly with extremely steep wave front and slowly die down. Others may rise slowly, then suddenly fall and reverse, or a series of oscillations may occur in the impulse, etc. If the lightning flash is parallel with the line simultaneous impulses of different directions may be produced, corresponding to the different directions of the potential gradient in the different parts of lightning flash, and these waves of different directions, intensity and wave length traveling over each other then produce a very complex system of phenomena. So, for instance, by the interference of two impulses of nearly equal wave length, moving in opposite directions, a high-voltage point may be produced, traveling slowly along the line and visible to the eye as luminous streak.

The frequencies of these impulses are those corresponding to the frequencies of cloud discharge, that is, of the magnitude of hundred thousands of cycles per second. With the velocity of light—188,000 miles per second—they travel along the line until they gradually fade out by the dissipation of their energy, or are reflected at an open end of the line or at the entrance to the station are broken up by partial reflection in reactances and interference between the reflected waves, the incoming waves and the waves passing over the reactances, and so give rise to systems of standing waves or oscillations similar as an ocean wave rolling onto a sloping beach breaks up into surf.

Where a traveling wave is reflected the combination of the reflected wave and the incoming wave produces a standing wave or oscillation, that is, a wave in which the voltage maxima and the zero points or nodes have fixed positions on the line.

By superposition of the wave maxima of incoming and reflected wave the standing wave rises to a maximum double that of the traveling wave. Where different oscillations or standing waves superimpose upon each other their maxima subtract at some places and add at others, and so again double the voltage, that is, a traveling wave or impulse breaking up into systems of oscillations at a station doubles and quadruples the potential, so that a traveling wave of moderate potential may cause dangerous voltages when breaking up into oscillations just as in the ocean surf the waves rise to far greater heights than in the rolling ocean wave before it reaches the beach.

If we consider that the impulses traveling along the line are not sine waves, but of very irregular shape, that is, can be considered as consisting of a fundamental of some hundred thousand cycles, and numerous higher harmonics of still greater frequency, and each of the components when breaking at the station gives rise to a set of oscillations at every interference point, that is, at every reactance, the complexity of the phenomenon can be imagined.

Since the equalization of cloud potential usually occurs by a series of successive discharges in short intervals, a small fraction of a second, and each discharge gives rise to an impulse in the line, and so a system of oscillations at the station, whatever protective device is used, must restore itself instantly after a discharge so as to receive the next following discharge. Any device depending on mechanical motion to restore itself after a discharge to operative position so fails to protect when a series of discharges follow each other in very rapid succession as discussed above.

Traveling waves very similar in character to those due to induction from the clouds, but frequently of far greater volume, sometimes occur in an electric circuit from internal causes, as arcing grounds or spark discharges.

Let, for instance, in an insulated underground cable system a spark occur between one of the conductors and the grounded cable armor, through a weak spot in the insulation, as a faulty joint or a cable bell. Normally a potential difference exists between the cable conductor and the ground, equal to the Y potential of the system, and so an electrostatic charge on the conductor corresponding thereto. A spark passing between conductor and ground connects it to ground, and the charge of the conductor so passes over the spark as arc to ground. As soon, however, as the conductor is discharged and at ground potential the arc between conductor and ground ceases, since there is no voltage left to maintain it, and so the conductor disconnects from ground. The conductor then charges itself again to its normal Y potential and during the inrush of the charge, momentarily the potential builds up to double voltage. Thereby a spark again passes between conductor and ground, discharges it again, opens after discharge, again causes a spark to pass, etc.

So a series of successive sparks occur between conductor and ground, discharging the conductor by currents, which momentarily rise to very high values, the discharge current of the capacity of the conductor against ground over a path of practically no resistance. Each spark discharge sends out an impulse or traveling wave, and so a spark discharge between conductor and cable armor, or in the same manner an arcing ground on an overhead transmission line, as, for instance, caused by a broken insulator, produces a continuous series of impulses or traveling waves which follow each other with the rapidity of charge and discharge of the cable or the line, that is, many thousands per second, and so give what has been called a recurrent surge. In a long-distance transmission line the frequency of the recurrent surge usually is somewhat lower than an underground cable system, but still thousands of impulses per second.

It is interesting to note that no lightning arrester in commercial service today protects against such a recurrent surge, but with such a recurrent surge discharging over the lightning arrester it very rapidly destroys itself, usually by conflagration, and where the lightning arrester is not destroyed by the recurrent surge it is because the discharge voltage is higher than the surge voltage, that is, the arrester does not discharge the surge but lets it pass into the station, or, in other words, does not protect the station, but is inoperative.

The frequency of oscillations occurring in electric circuit varies over an enormous range—from low frequencies very little above alternator frequency up to hundreds of millions of cycles per second—and the effect of the oscillations in the system so varies accordingly from the relatively harmless static displays, brush discharges, streamers, sparks, etc., of extremely high frequencies down to the disastrous high-power low-frequency short-circuit oscillation, in which, even in 10,000-volt systems, currents of many thousands of amperes may surge, which voltages approaching 100,000 and with which no protective device can cope which does not have unlimited discharge capacity, that is, contains no resistance whatever in the discharge path.

III. Lightning Protection of Electric Circuits.

From the preceding considerations it follows that the problem of protecting electric circuits from lightning is two-fold.

1. To guard against high-potential disturbances entering the circuit from the outside or originating in the circuit.

2. To discharge harmlessly to ground whatever high-voltage phenomena may appear in the circuit.

From atmospheric electric disturbances complete protection can be secured by putting the circuit underground, or, where this is not feasible, to put the ground over the electric circuit. This means the use of grounded overhead wires. The overhead ground wires so protect the circuit the more completely the more they realize a complete shield interposed between line and sky. While complete protection thus would require a system or network of grounded conductors above, beside and also below the transmission line, very good protection in most cases is secured by a single ground wire of good conductivity installed well above the line, and my opinion is that in no place of an electric transmission can money be more efficiently spent than in securing good overhead ground-wire protection.

To guard against the appearance of internal lightning requires constant watchfulness in the design, construction and operation of the system to avoid all conditions which may lead to the formation of oscillating arcs. Thus poor contacts, loose joints, masses of insulated metal near high-potential conductors, etc., should be carefully avoided.

The disturbances which have to be taken care of by the lightning arresters proper are steady accumulation of static pressure, impulses or traveling waves, and oscillations or surges, occurring singly or in groups, and of frequencies varying between many millions of cycles and ordinary machine frequencies, and recurrent surges, that is, impulses and oscillations, usually of high frequency, following each other in very rapid succession, usually thousands per second.

It is necessary that the discharge over the lightning arrester should occur with the least possible disturbance to the system, that is, the discharge current should be as small as permissible without causing a voltage rise due to the resistance of the discharge path. At the same time the protective devices must be able to discharge practically unlimited currents, that is, currents of the magnitude of the momentary short-circuit current of the system. This obviously requires that the protective devices should have no appreciable resistance in the discharge path. Any lightning arrester containing series resistance obviously fails to protect as soon as the discharge current is so large that the ohmic drop across the resistance becomes serious, and the maximum discharge current, which may occur, is the short-circuit current of the system, that is, extremely large.

Three types of protective devices are at present available.

A. The circuit is connected to ground by a single spark-gap set for a voltage exceeding the normal operating voltage by a safe margin; this is the so-called horn-gap, or goat-horn lightning arrester. As soon as the voltage rises beyond the value of which the spark-gap is set it discharges and the system is short-circuited to ground until the arc rises and gradually blows itself out. As this requires an appreciable time, motors and converters have usually dropped out of step and the generators broken synchronism, that is, the system is shut down and has to be started up again.

This type of protection therefore is not particularly favored in systems which require reasonable continuity of service, but if used is considered rather as emergency device in addition to other arresters and then adjusted for much higher discharge voltage.

A reduction of the current over the horn gap by series resistance is not permissible, since it correspondingly reduces the protective value, as explained above, and the arrester ceases to protect against a high-power surge. While such surges are relatively infrequent, their destructiveness is such that protection against them is especially needed. Fuses in series with the horn-gap, if they open slowly, would still shut down the system, and if coming very rapidly the shock of the explosive opening of the fuse on the short-circuit current of the system may be disastrous. Obviously the use of series fuses requires a multiplicity of spark-gaps to give continuity of protection.

B. The type of lightning arrester now almost universally used is the multi-gap arrester, which short-circuits the system for one half wave only. It consists of a large number of spark gaps in series with each other between metal cylinders. As now designed different sections of the gap are shunted with different resistances for the purpose of affording equal protection against all frequencies and adjusting automatically the resistance of the discharge path to the volume of the discharge, as, for instance, discharge slow accumulations of potential over a very high resistance, short-circuit surges over a path of zero resistance, and so pass a discharge with the minimum shock on the system. The operation of the multi-gap, which, by the way, is suitable only for alternating-current systems, depends on the non-arcing character of certain metals. Metals of low-boiling point, as mercury or zinc, cannot maintain an alternating-current arc, but the arc goes out when at the end of the half wave, the current falls to zero, and a very much higher voltage is required to again start an arc for the next half wave. (See paper in Institute Transactions for 1906, "Light and Illumination.")

A short-circuit on the system for a fraction of a half wave does not interfere with the operation of synchronous apparatus, that is, the operation of the system is not affected by a discharge over the multi-gap arrester.

In a large system the short-circuit current is very considerable, its power, and so the heating effect produced by it, enormous. The energy, and so the heat produced by the short-circuit current during the fraction of the half wave while the discharge over the multi-gap arrester lasts, is moderate, due to its very short duration, and can easily be absorbed and radiated by the arrester, so that even if lightning discharges rapidly follow each other for some time they can be taken care of by the arrester with moderate temperature rise, as during a vicious thunderstorm in which lightning flashes succeed each other practically continuously, several per second. Each discharge causes a short-circuit over the lightning arrester, varying in duration from nearly a half wave, if the discharge occurs at the beginning of a half wave, to practically nothing if the discharge takes place near the end of a half wave; that is, in average, for one-half of one half wave, or 1/240 second in a 60-cycle system. Therefore two to three lightning discharges per second would short-circuit the system over the multi-gap arrester only for one per cent. of the total time, and the heating effect caused by a short-circuit during one per cent. of the time can be taken care of by the arrester for a considerable period.

Let us see, however, what happens to the multi-gap lightning arrester in case of the appearance of a recurrent surge as an arcing ground, that is, discharges following each other in rapid succession, as thousands per second. The first discharge passing over the lightning arrester short-circuits the system for the rest of the half wave and at the end of the half wave the arrester functions properly, that is, opens the circuit. At the next moment, however, at the beginning of the next half wave the next oscillation of the recurrent surge again discharges over the arrester and so again short-circuits. That is, with a recurrent surge the multi-gap arrester at the end of every half wave opens the circuit: at the beginning of the next half wave the next oscillation of the recurrent surge short-circuits again.

As far as the effect on the operation of the system and the heating of the arrester is concerned, a recurrent surge so causes a permanent short-circuit on the system, except that at the beginning of every half wave for a short period the circuit is opened and free for the appearance of disruptive voltages elsewhere, and so apparently, simultaneous with the short-circuit, destructive high potentials may appear in the system. The heating effect of the short-circuit current, which occurs at every half wave, rapidly destroys the arrester. In such cases to save the arrester it is customary to insert a series of auxiliary gaps, which are thrown in by the blowing of a fuse shunting them and raise the discharge voltage of the arrester so that the recurrent surge does not pass over it. It is obvious that in this case the arrester ceases to protect the system against the recurrent surge, but if left in circuit the destruction of the arrester would put it out of operation anyway.

It is obvious now that no lightning arrester which functions by short-circuiting the system for the rest of the half wave during which a discharge occurs can take care of and protect against a recurrent surge, since the proper functioning of the arrester, with a recurrent surge, represents a permanent short-circuit on the system over the arrester, and so a destruction of the arrester, no matter whose make it may have been, and a shutdown of the system.

C. To take care of a recurrent surge a protective device would thus be required which does not short-circuit the system even for one half wave, but which never allows the normal voltage of the system to pass a current over the arrester but acts as a short-circuit for any excess voltage above the normal voltage. The possibility of such a device we can understand by considering the effect, which, in a direct-current circuit, a storage battery would have when shunted between the circuit and the ground. Assume, for instance, in a 500-volt trolley circuit a 500-volt storage battery of very low capacity, that is, negligible internal resistance permanently connected between line and ground. With the normal line potential of 500 volts, no current will pass over the battery to ground, except the very small current required to maintain the battery charged. No rise of voltage could occur, however, in the system of lightning or any other cause, since any voltage above 500 volts, the counter electromotive force of the battery, would be short circuited to ground through the battery, and such a battery so would give perfect protection against any high-voltage disturbances in the system. In the case of a recurrent surge the current discharging over the battery would be the short-circuit current of the excess voltage, that is, the surge potential, and the heating effect of this current is negligible, since high-potential high-frequency phenomena are of limited power and especially of limited current as condenser discharges.

A storage battery obviously is not suitable for alternating current and would not be practical in any case, as it requires a cell for every two volts. The same effect, however, is produced at a much higher voltage in an alternating-current circuit by the aluminum cell. If such a cell, consisting of two aluminum plates in certain electrolytes, is exposed to an alternating voltage a film forms on the aluminum plates which holds back the impressed voltage, that is, acts like a counter electromotive force, so that practically no current passes the cell, or only the small current required to maintain the film, of a magnitude of about 0.01 ampere per square inch plate surface, while for any sudden rise of voltage the cell acts as a short-circuit for the excess voltage. Over the storage battery the aluminum cell has the advantage of higher voltage. A single cell can take care of 500 or even 600 volts. Also it does not have a fixed counter electromotive force but a counter electromotive force which adjusts itself to equality with the impressed voltage at any value up to about 600 volts per cell.

Assume, for instance, an aluminum cell connected across an alternating electromotive force of 300 volts. With the film formed a negligible current passes through the cell, for instance, one-quarter of an ampere, maintaining the integrity of the film. If now the voltage is suddenly raised to 330 volts, in the first moment the cell acts as a short-circuit of the excess voltage, in this case 30 volts, and for an instant a very large current, possibly hundreds of amperes, if the supply source is capable of giving such current, rushes through the cell. This current very rapidly decreases by the film of the aluminum plates forming for higher voltage, so that in a few seconds the current is already small, and in a few minutes again the normal current of one-quarter ampere passes, but now at 330 volts impressed, and the film has formed to a counter electromotive force equal to this higher voltage, probably has thickened.

If now we again lower the voltage suddenly to 300, in the first moment the current in the cell practically disappears and then gradually rises again, and after a few minutes is again normal at one-quarter ampere, that is, the film has built down again to 300 volts. In this manner the aluminum cell adjusts its counter electromotive force to changes of impressed voltage by the film building up or building down.

This adjustment, for moderate voltage variation, as may be expected when varying the generator voltage of the system, is quite rapid, most of the change occurring within less than a second, but still is extremely slow compared with the rapidity of lightning phenomena, and for lightning phenomena the aluminum cell so acts as a short-circuit of the excess voltage above the normal machine voltage. Thus the recurrent surge, with a system of aluminum cells in series with one another connected directly across the circuit, cannot produce any rise of voltage but the excess voltage over the normal, or the surge potential, is short-circuited through the aluminum cell, so causing a small increase of the current in the cells by the superposition of the high-frequency surge current over the normal leakage current of the cell, but no rise of voltage.

Since the recurrent oscillations are intermittent, obviously the film of the aluminum cells cannot build up to their voltage, but remain corresponding to the machine voltage, that is, the aluminum cell can permanently discharge a recurrent surge without any short-circuit of the main voltage or any disturbance on the system.

Very great difficulties had to be overcome in the development of the aluminum arrester, and great credit is due to Professor Creighton for this work. For instance, while very many electrolytes are available for an aluminum cell intended for temporary service, it was difficult to find an electrolyte where permanence of the aluminum cell during continuous operation for a long time is required. When connected permanently in circuit, that is, without spark-gap, as necessary to give effective protection, a small leading current continuously passes through the cell, and the heat produced by this current must be dissipated, so requiring an entirely different construction from an aluminum cell for intermittent service. By not connecting the aluminum cells continuously into circuit but connecting them through a single spark gap, or multi-gap, the arrester can be made very much smaller and so cheaper, since it carries current only during the discharge. In this case, however, the film, following its characteristic of adjusting itself to the impressed voltage, which in the case of series spark gaps is zero, gradually dissolves, and the first discharge then finds the aluminum cell practically without film, that is, the discharge is a half wave short-circuit, just as in the multi-gap, so that the arrester is usually destroyed by a recurrent surge, hence offers no particular superiority over the standard multi-gap arrester.

It is interesting to observe that in an electrical system the aluminum cell exerts a similar effect on the voltage as in a mechanical system the flywheel exerts on the speed. The aluminum cell neither lowers nor raises the voltage, but adjusts itself to any voltage given by the generator, but it does not permit any rapid change or sudden pulsation of the voltage, but evens out all fluctuations just as a flywheel does not allow any sudden change or rapid pulsation in speed, but gradually follows whatever speed the prime mover tends to give.

Since the aluminum cells exert on the voltage of a system a similar action as the flywheel on the speed of a mechanical system, just as the flywheel is located at the prime mover, the aluminum cell finds its proper place at the bus-bars, low potential as well as high potential of the generating station, and in very long transmission lines also the receiving station, and further at such places of the system where sudden voltage rises are especially dangerous, as at cables interposed between overhead lines, etc., while the multi-gap lightning arrester should be used for general protection throughout the system.

Summary.

To conclude, then, of the three types of lightning arresters:

The single-gap arrester protects by short-circuiting the system for a considerable time and thereby shutting it down.

The multi-gap arrester short-circuits for one-half wave, and if without series resistance protects without shutting down the system, for all disturbances and high-potential phenomena, except recurrent surges as arcing ground.

The aluminum arrester short-circuits only the excess voltage, but not the normal-system voltage, and so protects against recurrent surges, but continuously consumes a small amount of power and finds its proper place at the station bus-bars in addition to the multi-gap arresters on the system.

[*The end.*]

Contractors' Convention Notes.

Alphaduct Company, Jersey City, was represented by Russell Dart, Jr.

McLeod, Ward & Co., New York, were represented by W. E. Ward.

Troy Electrical Company, Troy, N. Y., was represented by E. G. Bernard.

Mr. E. S. Keefer, as usual, did the honors for the Western Electric Company.

John A. Roebling's Sons Company was represented by Frank W. Harrington.

Bossert Electric Construction Company was represented by R. B. Corey, Utica, N. Y.

Holophane Company of New York was represented by its secretary, W. F. Minor.

India Rubber and Gutta Percha Insulating Company was represented by James B. Olsen.

Safety Insulated Wire and Cable Company, Bayonne, N. J., was represented by E. T. Eckert.

E-J Electric Installation Company of New York had Mr. James J. Ehrenreich to represent it.

Hart & Hegeman Manufacturing Company, Hartford, Conn., had Shiras Morris to represent them.

National Carbon Company, Cleveland, manufacturer of "Columbia" carbons, was represented by A. C. Henry.

Mr. J. Robert Crouse of the Co-operative Electrical Development Association was in attendance during the week.

Sears B. Condit, Jr., represented the Condit Electrical Manufacturing Company of Boston, Mass., at the convention.

The interests of the Crouse-Hinds Company were looked after by H. B. Crouse, A. F. Hills and F. C. Hawkins.

Hagstrom Brothers Manufacturing Company, Lindsborg, Kan., distributed circulars of a new porcelain tube and carbon cutter.

D. & W. Fuse Company, Providence, R. I., was represented by W. S. Sisson, secretary, who looked after the interests of the company.

General Electric Company had the following-named gentlemen at the convention: A. D. Babson, manager of supply department, New York office; W. M. Deming, Philadelphia; M. H. Sargent, and J. C. Dallon.

Dossert & Co., New York, manufacturers of solderless connectors and terminals, were represented by H. B. Logan, president.

American Conduit Manufacturing Company of Pittsburg was represented by the talented and versatile Thomas H. Bibber, sales manager.

Dale Company, New York, manufacturer of Dale's wireless clusters, was represented by H. S. Salt, general manager, and H. F. Rainsford.

Hart Manufacturing Company, Hartford, Conn., manufacturer of the Diamond "H" switches, was represented by R. L. Jaynes and William Taylor.

W. E. G. Mitchell, manufacturer of insulating waxes, insulating paint, cements, etc., was represented by Mr. Rudolph Miehling in his usual very cheerful manner.

Charles L. Eidlitz was the indispensable man—always on the spot when somebody was needed to make them "move up a little closer" or to "give them a chance."

Wirt Manufacturing Company, Burrage, Mass., manufacturer of porcelain, was looked after by a representative of the Steers Supply Company, 88 Maiden Lane, New York.

For Harvey Hubbell, Inc., Bridgeport, Conn., H. W. Bliven, general sales manager, and T. S. McLean, New York representative, were in evidence during the convention week.

American Circular Loom Company, Chelsea, Mass., manufacturer of circular loom and the "electroduct," was represented by A. T. Clarke, Oscar Hoppe and Alexander Henderson.

American Conduit Company distributed a bulletin on underground conduit construction. The company was represented by W. W. Grant, manager of the New York office, and A. G. McClure.

No contractors' convention would seem to be quite complete without the hustling "Flexduct" representatives, C. E. Corrigan and Harry B. Kirkland, who were, as usual, present and very active.

Mrs. James B. Olsen was a very active and efficient member of the Ladies' entertainment committee, and was untiring and most successful in her efforts to make it pleasant for the visiting ladies.

Trumbull Electric Manufacturing Company, Plainville, Conn., had its new July bulletin of the well-known Circle T specialties for distribution. John Trumbull, Frank Trumbull and T. D. Watson were in attendance.

Waterbury Company, manufacturer of insulated wire and lead-covered cable, had its interests ably taken care of by R. G. Richmond, general manager; Thomas Gore, general superintendent of factories, and Alexander L. Sykes.

Pass & Seymour, Solvay, N. Y., distributed a very neat booklet, in colors, of their P & S standard brass sockets. The company was represented by John W. Brooks, sales manager, W. Brewster Hall, New York manager, A. M. Little and A. H. Spahn.

Telephone News from the Northwest.

There is talk of organizing a local telephone company at Wheaton, Minn.

The Corn Belt Telephone Company has sold its exchange at Dumont, Iowa, to the Ingham Township Mutual Telephone Company.

F. J. Day and C. A. Beno of Council Bluffs, Iowa, have purchased the Shelby Independent Telephone Company.

H. W. Willis and others have incorporated as the Dallas (Iowa) Mutual Telephone Company.

The People's Mutual Telephone Company has sold its exchange at Rockwell, Iowa, to the Rockwell Farmers' Telephone Company.

The North Platte Telephone Company has sold its plant at Lexington, Neb., to E. Warner.

The North Side Bell Telephone Company has been organized at Norfolk, Neb.

Articles of incorporation have been filed for the Red Line Mutual Telephone Company of Superior, Neb.

The North Colton (Neb.) Telephone Company has been organized with John Junker as president and William Johnson, secretary.

The extension of telephone lines through North Dakota in the last five years is very noteworthy, covering every part of the state which is at all settled.

The Central Farmers' Telephone Company of Utica, S. D., has been incorporated with $25,000 capital.

The Park Rapids and Lake George Telephone Company has been incorporated at Park Rapids, Minn., by Horace Allen of Park Rapids and others. Capital, $1,000. R.

Canadian Telephone Notes.

The Alberta Department of Telephones has 75 men at work building long-distance lines throughout the province. At present five lines are under construction, viz.: Edmonton to Lloydminster, Wetaskiwin to Daysland, Lacombe to Stettler, Balimore to Calgary, Calgary to Banff. As soon as the lines are completed to any town a local exchange will be equipped and put in operation. S. Edwards is superintendent of government telephones at Edmonton, Alb.

L. Belcourt of the Bell Telephone Company addressed a meeting of farmers from Elgin, Man., recently and endeavored to induce them to form a company to construct a rural telephone system which would be under Bell control, the company charging $8 a mile for stringing wire and $3 per year per telephone for switching connections with the Elgin exchange. It is expected, however, an Independent rural company will be formed at once for the purpose of building rural lines. Councillor Dutton of Elgin, Man., is interested in the project.

The Bell Telephone Company of Canada has two large gangs of men employed in completing the extension of its long-distance line from Nanton to McLeod, Alb. Another gang is at work completing the exchange at Lethbridge, and as soon as this is completed work will be rushed on the line from MacLeod to Lethbridge. Within a few weeks the company will have a long-distance line in operation between Edmonton and Cardston. Other important lines will be built in Alberta to compete with the lines being built by the Alberta government. Frank Patterson of Winnipeg is western superintendent. R.

Indiana Telephone Items.

The South Bend Home Telephone Company has increased the common capital stock from 2,000 shares of the par value of $100 each to 4,000 shares. President Thorward announces that the increase of capital is for the purpose of repairing, improving and enlarging the company's plant.

The work of installing the New Home automatic-telephone system in Richmond began July 15th. When ready the cut-over can be accomplished in 10 minutes. There are nine large cables, each containing 300 pairs of wires, running into the Central exchange. All wires have been connected with the 2,000 switches in the exchange building, and the tests which have been given the new switches and wiring proved them eminently satisfactory and in thorough working order. The sub-stations, as buildings, are completed, but the equipment has not yet been installed.

Telephone service is being used along the Chicago, South Bend and Northern Indiana Railway Company's line between South Bend and Goshen for the better regulation of traffic. A telephone station at every switch between the two cities will enable the dispatcher to know at all times the location of every car on the line. The telephones are of special construction, and are encased in metallic boxes, for which every conductor has a key. S.

Ohio Telephone Notes.

The work of cutting over the telephones of the Citizens' Telephone Company between Main and Broadway streets east of Miller Avenue, Columbus, Ohio, has been completed and the equipment is installed. This is said to be one of the most modern automatic plants in the country. The company has installed an automatic switchboard at the exchange at Westerville. Automatic exchanges had previously been installed at Winchester and Worthington.

The Central Union Telephone Company will erect a new fireproof building at Youngstown, Ohio, in a short time. The offices and exchange of the company will be located in the new structure, which is expected to serve the company for 20 years. New cables will be laid throughout the city and better service is promised when this work is completed.

The franchise has been granted to the Middleton Telephone Company, an Independent company, which will operate in connection with the Hamilton Home Telephone Company. The franchise is for a term of 25 years and the system is to be in operation within one year from the date of franchise. S.

GENERAL TELEPHONE NEWS

At the meeting of the executive committee of the Ohio Independent Telephone Association, held at Columbus, Ohio, on July 11th, it was decided to call a special state meeting to discuss the general telephone situation in the state, the meeting to be held at the Southern Hotel, Columbus, Ohio, on August 6th, at 10:30 a. m.

The judiciary committee of the General Assembly of Connecticut last week reported a bill providing that three or more persons may organize a telephone business under the general laws of the state. But before such a company can engage in actual operations it must go before a judge of the Supreme Court and procure a certificate that public necessity requires the additional telephone facilities.

CORRESPONDENCE.

Continental Europe.

Paris, July 12.—The project for supplying Paris with current from a distant waterpower continues to attract attention, since it can probably be carried out without too much difficulty, following the lines of the large power transmission plants which are now in operation. It is proposed to utilize the Rhone River for this purpose. Messrs. Blondel and Harlé, two well-known electricians of Paris, and the latter a member of a prominent construction firm, advocate two different methods for securing the power supply. The first of these is to erect a dam at Gresin, on the upper Rhone, by which some 130 cubic meters per second would be obtained, with a 63-meter head of water. The hydraulic plant would be run on the Thury high-voltage direct-current system, such as has been found to work very well in practice, and they propose to work the pole line at 60,000 volts. A second and more recent project is to construct the dam at the mouth of the Rhone Gorges, and in this case a higher fall, of 70 meters, would be had. The three-phase system used here would be operated at 120,000 volts, and probably 70,000 kilowatts could be delivered at Paris, allowing a 15 per cent. line loss. Consumers would have the current delivered to them at the rate of 10 cents per kilowatt, which is now the cost price of current generated in the city plants.

A new typesetting machine which is operated by an electric method has been lately invented in Germany. It follows the principle of the linotype machine as to the method of casting the type. There is a keyboard somewhat like a typewriter by which the operator makes perforations in a paper strip and at the same time forms the corresponding letter, so that the proof can be corrected. By passing the strip in the other part of the machine, an electric contact device, worked by the perforations, causes a selection of the type molds, which are placed in line, and the type is then cast from melted metal. The new system is said to work very satisfactorily.

A project is on foot in France for enlarging and improving the canal which passes from Orleans to Montargis, so as to allow of operating a hydraulic plant upon the canal. In this way it is expected to secure at least 500 kilowatts. From the station will be run an overhead line about 15 miles long. At the locks of the canal there will be a set of motor-driven pumps for raising the water level. The estimated cost of the project is about $100,000. Another project calls for a hydraulic plant upon the Rance River, and it can be carried out without any hindrance to navigation, as the necessary locks will be provided. The current in this case will be used to a great extent in electro-metallurgical plants for the production of iron, aluminum, ferro-silicon, etc., and it is thought that the profits will be large.

The first rolling mill on the Continent to use a set of reversible rolls operated by electric motors is the Hildegardehütte works of Germany. There are four pairs of rolls of 10 inches mean diameter in this case, and they are designed to handle pieces of two tons, to form rails or channel bars. The electric plant is carried out on what is known as the Ilgner system.

A bill has been recently passed in Switzerland authorizing the construction of a line of railroad, which will no doubt be operated electrically, between Schaffhouse and a point near Oberbargen. The president of the company is C. Spahn, mayor of Schaffhouse. About one million is the estimated cost of the line, allowing $160,000 for the rolling stock.

The Diatto surface-contact system is now employed in Paris upon a well-patronized railway which runs through town and passes into the suburbs. The line runs along the Seine for some distance, then crossing the river and proceeding through the northeastern part of the city, then running by trolley into the suburbs as far as Romainville.

A syndicate of considerable importance has been formed at Milan within a recent period. Its object is to erect electric plants and to operate a system of distribution lines in the north of Italy.

A. de C.

Great Britain.

London, July 12.—The Board of Trade has issued an official report upon the runaway car at Easter time upon a London suburban tramway on which several people were killed. The accident occurred upon a curve, the limit of safe speed upon which was five miles per hour having regard to the down grade. The car was of the fixed wheel base pattern, fitted with brake blocks, worked by hand from both ends of the car; in addition there is the ordinary rheostatic electric brake for use in emergency. The center of gravity of the unloaded car is put at four feet above rail level and of the loaded car at about six feet above level, the respective weights being 7¼ and 10¾ tons. Theoretically, under the conditions prevailing the Board of Trade inspector estimates that at a speed of 18 miles a car so loaded would tend to over-turn on the curve, but he has to admit that this actually happened at a considerably lower speed than this. But all the wheels were locked and were skidding, a condition accelerated by the action of the conductor, who without any communication with the driver put on the brakes from the rear end. Putting aside these technical considerations, however, the inspector lays stress upon the fact that the driver was a spare hand put on to deal with the holiday traffic and had not had sufficient experience to form any correct judgment of the speed at which he was traveling. The inspector further recommends that passengers should not be allowed on top decks beyond the seating capacity. It really comes back to the old question of eliminating the human element entirely before such accidents as these will be entirely avoided, and it is with interest that all tramway engineers here await the result of the investigation into brakes generally now being carried on by the Light Railways and Tramways Association in conjunction with the Board of Trade.

A sort of campaign is now being carried on against the Local Government Board by all municipalities owning electrical undertakings with so much determination that the issue may be looked forward to with interest. Since Mr. John Burns came into office as president of the local government a new rule has been put into force concerning loans for electrical work, viz., that the wages of permanent workmen at work upon the plant for which the loan is sanctioned shall not be paid out of the loan, i. e., capital, but out of the general revenue of the undertaking. Although there is something to be said for such a ruling, yet it creates an anomalous position, for temporary workmen's wages may be charged to capital, and a way out of the difficulty is to call all men temporary and to go through the farce of discharging them week by week and re-engaging them every Monday morning.

A commencement has been made with the reconstruction of Blackfriars Bridge for the purpose of widening it to take the double line of tramways which the London County Council has authority to lay down. The magnitude of the work may be judged from the fact that it will cost $12,500,000 and is estimated to occupy two and a half years in carrying out. When completed there will be a roadway of 73 feet, with a footpath of 16 feet on either side. The only point of electrical interest, however, about this work at present is the complete use of electrical power for working the contractor's machinery. Those acquainted with ordinary contractor's work carried on both day and night are familiar with the interference with the amenities of a district caused by the steam plant, cranes, etc. At Blackfriars Bridge, however, the air-compressing machinery for working the caisson will be electrically driven, the riveting will be largely done by pneumatic tools, and electric cranes and hoists will be employed for raising the excavating material from the working chamber in the caisson and for lowering the concrete for filling in the caisson.

There was a somewhat remarkable falling off last year in the number of applications both for electric lighting provisional orders and for electric light railway orders. The reason for the former is not far to seek, for no town of any size is now without either a supply of electricity or powers to undertake such a supply. The Light Railway Act of 1896, however, was largely framed to assist in the opening up of remote agricultural districts. The commissioners report that many such lines are urgently needed, but that difficulty in raising the capital is responsible for the present position. Financial assistance by the state is recommended.

Another of our leading electrical manufacturing firms has just announced its inability to pay any dividend upon its ordinary stock for 1906. This is the old-established Electric Construction Company of Wolverhampton.

Both in the south and in the north of London the price of gas has been somewhat considerably increased, owing to the present high prices of coal. Advantage is being taken of the opportunity by several borough councils to urge an extension of electric street lighting, and especially where mains are laid. G.

Dominion of Canada.

Ottawa, July 20.—The Dominion Railway Commission has granted the application of the Grand Valley Railway Company for sanction of certain agreements which authorize the purchase, lease or amalgamation of the two Ontario electric systems, the Brantford street railway and the Woodstock Valley and Ingersoll electric railway. This would make an electric line of 128 miles.

The Canadian General Electric Company is increasing its capital from $5,000,000 to $8,000,000. Of the new stock, two-thirds is preferred and one-third common. A shareholders' meeting will be held on August 15th to ratify the by-law. Of the present stock, $300,000 is to be retired. It pays six per cent. The new preferred stock will pay seven per cent. Only the preferred stock is to be issued at present, and the stock, not taken up by shareholders, is to be disposed of in Great Britain.

The Hydro-electric Power Commission is sending out a fourth surveying party to go over the projected branch lines of the main transmission system. The first party is surveying the line from Toronto to Hamilton; the second from Niagara Falls to Hamilton, and the third from Hamilton to London. Plans and profiles of the surveys are being prepared as the details are sent in by the surveyors in the field, so that no time is lost in pushing forward the necessary work of preparation.

The negotiations entered into some months ago by the city of Peterboro, Ont., and the Peterboro Light and Power Company, for the purchase of the electric-light business of the company have fallen through. The City Council, therefore, has decided to apply to the Ontario Hydro Electric Commission to acquire waterpower privileges and construct the necessary works to supply cheap electric power. W.

Winnipeg, Man., July 20.—The City Council of Prince Albert, Sask., is figuring on a fire-alarm system to be installed in that city. R. S. Cook may be addressed.

The Packard Electric Company will supply Winnipeg with 100 arc lights, three transformers and 12 lightning arresters for $5,510. F. E. Cambridge is city electrician.

A petition is being circulated at Moosejaw, Sask., favoring the raising of $90,000 for the extension of the electric-light and power plant. Mayor J. H. Bunnell is interested.

The Saskatchewan provincial government has secured the services of Francis Dagger, telephone expert for Manitoba, and will at once arrange for the construction of a provincial telephone system. Particulars may be obtained from F. J. Robinson, deputy minister of public works, Regina, Sask.

Commissioner Pace of Edmonton, Alberta, states the civic street-railway system will be running by September, 1908. The work is costing $340,000.

The largest water grant ever issued in the Yukon has been granted by Hon. Frank Oliver, minister of public works for Canada, to the Yukon Milling, Dredging and Power Company. The grant is for 50,000 inches of water from the Klondike River, which will be used for various purposes, including the development of power. The head office of the company is in Dawson City. R.

New England.

Boston, July 20.—A resolution amending the charter of the Stanley Works Company and permitting that company to increase its capital stock from $1,500,000 to $3,000,000 has been reported favorably to the Legislature of Connecticut. This increase in its capital stock will allow the company to transmit electric power from the town of Kent, in Litchfield County, to its plant in New Britain. The concern expects to construct a large power plant on the Housatonic River and to convey the current a distance of 40 miles to New Britain.

The consolidation of the Webster Electric Company and the Southbridge Gas and Electric Light Company has been approved by the Board of Gas and Electric Light Commissioners of Massachusetts. The board has also approved an increase of the capital stock of the Webster Electric by 650 shares for the purchase of the Southbridge company. They have also approved of an issue of 100 shares to pay the cost of constructing an electric transmission line. The market value of these shares is to be $100 per share.

The Mount Desert Transit Company of Maine recently procured the Rodick estate, which contains some of the most valuable land in Bar Harbor, Me., for a railway terminal. The company has been formed to build a first-class electric line.

The Consolidated Railway Company has begun the operation of an electric service between Middletown and Meriden, Conn., and also between Middletown and Berlin. In each case the tracks of the steam roads are equipped with an overhead trolley.

The Boston Elevated Railway Company has given the use of five acres of land near its car barns on Clarendon Hill, West Somerville, to its employes who may wish to do a little farming.

It is again rumored that the headquarters of the American Bell Telephone Company may be moved from Boston to New York city. The general counsel and minor officials are already located in New York, but up to the present time the president and executive committee have been at 125 Milk Street, Boston.

Commissioner White of the Board of Railroad Commissioners of Massachusetts has gone abroad for July and August in order to study methods of handling crowds in the underground transit lines of London and other cities and to make an investigation of other problems connected with the handling of crowds and freight.

The Electric Cable Company of Bridgeport, Conn., has purchased the machinery and business of the Eastern Wire and Cable Company of Roxbury, Mass. The equipment of the latter company will be moved to Bridgeport. The main plant of the Electric Cable Company is now being enlarged.

The Perkins Corporation of Connecticut, manufacturer of electrical supplies, has filed notice of its action in changing its name to the Arrow Electric Company.

The New England District Council of Electric Workers has been holding its semi-annual convention the past week. It was reported that the general condition among the electrical workers is one of peace and harmony, except that there is a strike of the inside men in Providence, who demand more pay.

The Maine and New Brunswick Electric Power Company of Aroostook County, Maine, has practically completed its new hydro-electric plant.

The New York, New Haven and Hartford Railroad has just completed its new repair shop at Readville, Mass. The motive power of the whole shop is electricity.

The Electric Express Company has been incorporated recently under the Massachusetts law. The purpose of the company is to take charge of the express business of the electric roads controlled by the New York, New Haven and Hartford Railroad. Its officers are practically those of the New England Investment and Securities Company, which company is the New Haven's holding company for its electric roads.

The Washburn Wire Company will move its entire plant from Auburn, R. I., to Phillipsdale on January 1, 1908. The company has awarded contracts for four of the five new buildings it is proposed to erect. The machinery of the main building will be electrically driven. B.

New York.

New York City, July 20.—With a view to end the bridge crush, the Public Utilities Commission will give a public hearing on July 23d, when all students of the bridge conditions will have a good opportunity to present their views on the matter and to offer practical suggestions.

Twenty-one persons were more or less seriously injured as the result of a collision on the Third Avenue elevated in front of the One-hundred-and-sixth Street Station. It was on the day of an Italian holiday and on a crowded car. A fight was started, during which the cab of the motorman was broken into and the motorman thrown to the floor and pinned beneath the struggling men. The train meanwhile went on under its own power and before the motorman could again get control of either the air or power levers the train crashed into the rear of the preceding one.

The Huntington Trolley Railroad Company and the South Shore Traction Company are both laying rails in Amityville, L. I., each company having obtained franchises for a certain street, and it is a fight as to which will get its tracks laid first. The company which gets its tracks laid first will be in possession of the road and the other company must use its rival's tracks and make whatever arrangements are possible.

Inviting the Public Service Commission to test its powers the New York City Railway Company has recently abandoned the Seventh Avenue and Broadway surface line, which connects the upper West Side with the Brooklyn Bridge. No intimation was given to the public, and the result was that hundreds of passengers, accustomed to take these cars, waited in vain at street corners and finally had to reach the bridge by a system of transfers. Vice-president and General Manager Root, representing the railway company, issued a statement that the line was abandoned because it was practically a duplication of sections of several other lines and because it seriously interfered with cross-town traffic, especially on Twenty-third Street, where it was a case of 10 passengers being inconvenienced for the benefit of one.

Engineers of the Rapid Transit Department of the Public Service Commission have expressed gratification at the results which have been obtained in the efforts to improve the conditions in the subway this summer in contrast with former years. Many openings were made last winter in the line of the subway between the Brooklyn Bridge and Fifty-ninth Street. Extra ventilating apparatus has been installed. The cool water cooling system as installed at the Brooklyn Bridge has proved a great success, but the cost of installation is too great for adoption throughout the subway. It will never be possible, however, to equal the temperature at the surface. Signs illuminated by electricity and reading "exit" had also been installed between stations, so that in cases of accidents or tie-ups these means of escape can be utilized.

The board of visitors to the Military Academy has made several recommendations as to the conditions at West Point, among these that "it would be well to make the course a little less technical and turn out a more educated man rather than a technician." E. H. S.

Southeastern States.

Charlotte, N. C., July 20.—The Southern Power Company continues to effect contracts with cotton mills in the Piedmont section of the Carolinas. The latest connections are the Cherryville (N. C.) mills and the Kesler mills, near Salisbury. Developments on the Catawba and Broad rivers are being pushed.

The Schenectady Trust Company has transferred to the Federal Court about $100,000 bonds of the Cape Fear Power Company in part payment for the Buckhorn Falls, sold under mortgage September last. The bonds were issued in 1903. The Schenectady Trust Company at the receiver's sale bought in the original property at $250,000, the trust company having applied for a receivership for the Cape Fear Company in September. The Cape Fear company's bonds were originally bought by the Schenectady company at 75, the trust company upon purchasing the property proposing to pay with the Cape Fear bonds in its possession. The trust company is pushing the work of development on the falls, although handicapped by scarcity of labor.

A half-million-dollar interurban line is to extend from Chattanooga to Ringgold, Ga., and Catoosa Springs, and will be 25 miles in length. The company is chartered as the Tennessee and Georgia Interurban Railway, and the stockholders are headed by J. C. Bryan of Catoosa County, Ga.

The Southern Power Company, Charlotte, N. C., is completing a sub-station in Gastonia, to control power for Cherryville, Belmont, Bessemer City, McAdensville and other towns where cotton mills are located in North Carolina.

Books of registration have been opened in Columbus, Ga., sometimes known as "The Niagara of the South," for an election on a proposition to issue $100,000 bonds for a municipal lighting plant.

It is said that the large power development of the Southern Power Company at Ninety-nine Islands, near Blacksburg, S. C., has already been entirely contracted for by the cotton mills and other manufacturing plants of Blacksburg, Spartanburg and vicinity.

A survey is in progress for a $5,000,000 electric line from Atlanta to Augusta, across the state of Georgia. The Atlanta and Carolina Construction Company is behind the scheme, which has been promoted by J. W. English, Sr.

The Passenger and Power Company of Richmond, Va., will expend $50,000 on a new lighting plant for Petersburg, Va.

The Tidewater Construction Company, Wilmington, N. C., is chartered by Thomas W. Davis and others, with $20,000 capital, to build electric and steam roads and power plants by contract.

The North Georgia Electric Company has begun furnishing power to Buford, Ga.

The Raleigh (N. C.) electric railway has offered to extend its lines several miles in return for a renewal of lighting contract and other considerations.

The chartering of the Swannanoa Valley Railway Company, with $300,000 authorized capital, means that in all probability Asheville and half a dozen resorts within a 20-mile radius will be connected electrically. The promoters are F. T. Merriweather, E. S. Caldwell, P. R. Moale and others.

President H. A. Anderson of the Savannah River Power Company, capital $8,500,000, has announced that Calhoun Falls will be developed this summer to furnish 30,000 horsepower and that work will begin soon on Cherokee Falls with 10,000 horsepower. The company will have about 58,000 horsepower when all of its holdings are fully developed. Northern capitalists are interested.

The Four C's Company which operates the street-railway system at Charlotte, N. C., will soon have recompleted the new power house recently collapsed. Gas engines will be installed. L.

Indiana.

Indianapolis, July 20.—The City Council of Richmond has refused to grant franchises to the Dayton and Western and the Terre Haute, Indianapolis and Eastern traction companies to operate cars in and through the city without inserting a clause providing for universal or reciprocal transfers between the interurbans and city lines within the city limits.

The Pennsylvania lines were restrained by an order of the court July 10th from interfering in any way with the plans of the Indianapolis, Columbus and Southern Traction Company on Madison Avenue, the new street opened by the City Council, which gives the interurban line a way out of the city across the Pennsylvania yard tracks in Columbus.

The Indianapolis, Columbus and Southern Traction Company has brought an action in the Circuit Court at Columbus to condemn a strip of land through the McEwen farm, near Columbus, to be used as a right-of-way for the traction company's Seymour extension. The company officials assert that they have made all possible efforts to buy the land of the McEwens, but have failed in each attempt, and the court is now asked to condemn the land and appoint appraisers to assess damages. This is the only piece of right-of-way not granted between Columbus and Seymour.

The people of Ripley County are anxious for an interurban line from Greensburg to Madison. One hundred of the prominent business men and farmers have called a meeting for an organization to further the enterprise and to secure the right-of-way. Charles L. Henry, president and general manager of the Indianapolis and Cincinnati Traction Company, was present and talked the matter over with the people. The Commercial clubs at Greensburg, Batesville, Vevay and Madison are lending aid to the project.

The Gary Street and Interurban Railway Company has filed articles of incorporation with a capital stock of $400,000. The object of the company is to construct street and interurban railroads in and to connect the towns of Gary, Tolleston, Hammond, East Chicago and Whiting. Frank Gavitt, John A. Gavitt, C. B. Manbeck and M. N. Castleman are directors.

The Logan Truck Company has incorporated with a capital stock of $100,000. The company proposes to establish a large manufacturing plant in Logansport for the manufacture of electric-railway trucks. C. F. Williams, C. B. Holmes and H. R. Adams are directors.

Representatives from the government mail service are in Warsaw making all the preliminary arrangements to establish regular mail service on the interurban lines operating between Warsaw and Goshen.

The Aurora Electric Company of Aurora, Ind., has incorporated to manufacture electrical apparatus and supplies and to sell and lease the same. Charles F. Mayer is president.

The contract for furnishing gas and electrical fixtures for an office building and 255 residences in the new Indiana city of Gary has been awarded to G. H. Wheelock & Co. of South Bend. It was let by the Indiana Steel Company.

The citizens of Shelbyville are discontented over the meter system. Since the meter system was installed by the Citizens' Water and Light Company the merchants and patrons say their lights are costing them from $3 to $5 more a month. Failing to get relief, many gasoline lighting plants are being installed in order to avoid the alleged excessive meter rates.

The citizens of Hagerstown will have the privilege of voting on a proposition to establish a municipal lighting plant in the city, the estimated cost of which is upward of $10,000.

After a lapse of several months, Eugene Rush and associates, who propose to dam White River at Decker, Ind., and establish a hydro-electric plant, announce that the enterprise has ben financed by the Metropolitan Trust and Savings Bank of Chicago. It is the purpose of the company to furnish electric light, heat and power for the towns and cities within a radius of 25 miles. The dam will be constructed of reinforced concrete, and the plant patterned after that at Niagara Falls. S. S.

Michigan

Grand Rapids, July 20.—Grand Rapids officials in their investigation of the proposed franchise for the Grand Rapids and Muskegon Power Company have secured some interesting comparisons of the rates for lighting and power as charged by companies in other cities. The results show that Grand Rapids will have the cheapest service in the country when the new franchise is granted. The Grand Rapids Edison Company, which has been absorbed by the power company, holds a franchise which is good for 17 years more and which permits much higher charges, but this will be canceled by the new franchise. Since the resignation of A. J. Bemis as manager of the power company, H. W. Hillman has been placed in charge of the office, with the title of commercial manager. He was formerly with the General Electric Company at Schenectady.

Representatives of Charles A. Chapin of Chicago have announced plans for the construction of three big power dams on the St. Joseph River. The new properties will give the company eight stations on the river.

Installation of the trolley wires for the electrification of the St. Clair Tunnel at Port Huron has commenced. They will be strung on arches from the mouth of the tunnel on either side and will extend a mile on either side of these points. The wire cables have all been strung.

The proposed line of the Michigan United Railways from Jackson to Lansing is still held up by the obduracy of the council of the city of Mason, which insists that the line shall pass through the main street of the city, despite the fact that it will necessitate the building of two bridges, which might be avoided. The deadlock between the company and the council has been on for nearly three years. L. W. B.

Illinois.

Peoria, July 20.—The Illinois Valley Railway Company will construct and maintain its own bridge in Peru if the City Council will grant the company a franchise and rescind all orders interfering with the through business. The city has agreed to let the company operate the cars through the city and has agreed to settle the terms of the franchise within three months.

The Pekin-Canton telephone line is now assured. The line will be built through Mapleton, Glasford and Kingston mines.

Charles Nagle of the Pontiac Light and Water Company was killed this week by coming in contact with a wire carrying 2,300 volts.

J. F. Jarvis has been made assistant superintendent on the Peoria-Bloomington line and will make his headquarters in this city. Mr. Jarvis was formerly with the Joliet, Plainfield and Aurora line as manager.

W. D. Boyce, who owns the Marseilles waterpower, is working on a plan to generate electricity and supply the manufacturers in Streator, La Salle, Ottawa and the adjoining towns with all the power they need. He now runs his big paper mill with waterpower at Marseilles.

The city of Ottawa has agreed to pay $35,000 of the cost of the bridge to be built across the Illinois River by the Illinois Traction Company at that point. The plans have been drawn by Engineer Modjeska and the total cost is estimated at $100,000. This bridge will be used for the Peoria-Ottawa line that will be built as soon as possible, and will give the traction company the long-proposed Chicago connection.

The Chicago and Southern electric railway between Chicago and Kankakee will be in complete operation by September. Ballasting has progressed to a point near Peotone and is being finished at the rate of a mile a day. The trolley wire is being put up and machinery installed at the sub-station at Bradley. Matthew Slush of Detroit is president of the road.

The Peoria Terminal Railway has presented a petition for a franchise through the city and the franchise has been referred to the street committee of the City Council.

President Finn of the Springfield and Southeastern Traction Company has issued a call for a stockholders' meeting to be held the 19th of August in Springfield for the purpose of issuing bonds to provide for the construction of the road.

The Illinois Traction Company has purchased the Kerrens-Donnewald Coal Company's properties, consisting of 2,000 acres of land at Worden, north of Edwardsville. The company's Edwardsville division runs across this property and is also near the shaft. The various plants of the traction company consume 1,000 tons daily and the company will increase the capacity of the mines and be in a position to take care of outside business also. With the completion of the bridge at St. Louis the company will be able to haul the coal right into the city of St. Louis from the mines and come into direct competition with the steam roads.

Announcement is made that the C., B. & Q. will put on a motor car and furnish hourly service between Farmington and Lewistown.

The Springfield, Clear Lake and Rochester electric road gave a large picnic and fish fry at a park on their line near Springfield this week. The directors of the road invited everyone in Springfield to come to the park and get all they could to eat free of charge. The company is now running regularly between Springfield and Rochester, giving hourly service. As the company had more fish than were needed the next day they gave five pounds away with each round trip purchased to the park. V. N.

Northwestern States.

Minneapolis, July 20.—A franchise will be granted to a firm at Duluth, Minn., for an electric-lighting system at Bovey, Minn.

The proposition to grant a 20-year franchise to the Electric Light and Power Company of North Platte, Neb., was voted down.

The local syndicate which is constructing the street railway at Mankato, Minn., has organized as the Mankato Electric Traction Company, with W. L. Hixon as president and W. D. Willard, secretary. The company will incorporate under the laws of West Virginia.

The Shimer & Chase Company has applied to the council at Omaha, Neb., for a franchise to build a suburban electric railway to Seymour Park.

The proposition to grant an electric-light franchise to Z. G. Houck of Dubuque was voted down at Pella, Iowa.

The Ottertail Power Company of Fergus Falls, Minn., has incorporated with $100,000 capital. Vernon A. Wright heads the list of stockholders.

F. M. Mills has begun work on the new street-railway system at Sioux Falls, S. D.

The Des Moines (Iowa) City Railway Company will erect a new freight depot for its interurban business.

Work has been started on the new municipal power dam at Fergus Falls, Minn.

The Burkhardt Mill and Electric Power Company has incorporated with $50,000 capital, at St. Joseph, Wis. C. Burkhardt heads the list of stockholders.

F. C. Ludden has purchased the electric-light plant at Mineral Point, Wis., and will install additional equipment for furnishing power also.

A new electric-light plant is to be constructed at Menomonee Falls, Wis.

The municipal light and power plant at Rochester, Minn., will have to be completely remodeled.

The Crookston Lumber Company is negotiating for the sale of its power plant at St. Hilaire, Minn., to that village.

The contract for the construction of a municipal electric-light plant at Mount Ayr, Iowa, has been let to A. Bartenlanger of Omaha, Neb., at $17,626.

A new municipal electric-light plant is to be built at Ashland, Wis.

The Minahan Building Company has been granted an electric-light and power franchise at Green Bay, Wis.

The Orange City (Iowa) Electric Light Company is preparing to rebuild the plant, which was destroyed by fire early in the month. It is expected that the work will be completed about October 1st. R.

Texas.

Austin, July 19.—The Texas Interurban Company has been organized and filed its charter a few days ago. Its purpose is to build a system of interurban electric railways with Austin as the center. It has a capital stock of $400,000, the incorporators being Thomas Moore of Elizabeth, N. J.; Ephraim Miller of White Plains, N. Y.; Henry M. McKay of Hempstead, Long Island, N. Y.; C. P. Scrivener and S. M. Posey of Austin. It is announced by the company's representatives that it will soon begin the construction of an interurban line to run from Austin to Lockhart, a distance of about 30 miles. The survey for the proposed road has been made and the right of way obtained for most of the distance.

The El Paso Electric Company, which is owned by the Stone & Webster interests, has had plans prepared for erecting a large electric power plant on the Rio Grande River at El Paso for the purpose of supplying the street-railway system and electric-light plant with electrical energy. The present plant of the company is too small.

The San Marcos and Luling Interurban Railway Company has revived its project of building an electric railway between San Marcos and Luling. The prospects are said to be favorable for the early construction of the line.

A proposition to build an interurban electric railway between Fort Worth and Mineral Wells is being promoted by G. R. Turner of New Orleans. Mineral Wells is the largest health and pleasure resort in Texas, and it is claimed that a big traffic would be insured the road from the very start. The distance between the two towns is about 37 miles.

It is stated by N. M. Lee, who was one of the promoters of the Sherman-Denison electric railway, which has been in successful operation for several years, that plans are on foot for building an interurban railway between Fort Worth and Denton. The distance is about 30 miles. W. D. H.

Pacific Slope.

San Francisco, July 18.—This city continues to be a storm center for strikes and other disturbances in electrical lines, and the long-suffering citizens have almost become hardened to the chronic troubles. A new mayor has just been appointed to office, making the fourth incumbent to occupy that high position within the last two weeks. There is now some hope of a return to civic decency in the city administration. The strike of the telegraph operators of San Francisco and Oakland seems to have about reached its climax. Labor Commissioner Neill, who came West at the wish of President Roosevelt, has been here for a few days conferring with the local heads of the telegraph companies, and President S. J. Small of the Telegraphers' Union in hope of restoring peace. Repeated threats have been made by the union leader to order a sympathetic strike in Chicago or elsewhere. The best that has been obtained in the way of concessions is an offer of the Western Union company to take back 75 per cent. of its striking employes and the Postal Telegraph company to find places for 80 per cent. of its strikers. The telephone operators' strike is still being fought stubbornly, with little advantage gained by either side. The management asserts that many of the old operators have returned to work, but this is denied. The telephone linemen belonging to Local Union 151 seem to have lost their sympathetic strike, as over one hundred union men promptly took their places when they decided to defy the superior officers of the International Brotherhood of Electrical Workers, with which they were affiliated. The strikers' union has called for a referendum vote of the various unions in the brotherhood in their favor.

The City Council of Alameda, Cal., has declared itself in favor of calling a bond election for the purpose of carrying out a number of public improvements, including, among others, electric-light and power-plant betterments, $50,000; public playgrounds, $115,000; and Fire Department, $10,000.

The board of directors of the Pacific Gas and Electric Company, on July 15th, voted to levy an assessment of $3,000,000 on the stock of its shareholders. The assessment on each share will be $10 on 100,000 shares of preferred stock and 200,000 shares of common. The expenses of the company for the last year and a half are roughly figured at $7,000,000. It was decided to assess the stockholders rather than borrow the amount. According to the statement of its officials, the cost of rehabilitation since the San Francisco disaster has been enormous. Several new electric power plants have been commenced in connection with the power-transmission lines of the subsidiary corporations in various portions of the state of California. A heavy expense has been the purchase of subsidiary companies and the whipping of them into shape to supply the cities of California. Not the least of the company's troubles has been the lowering of the gas rate to the consumers of San Francisco, according to an official announcement made yesterday. Fully 70 per cent of the company's shareholders were represented directly or indirectly by the various directors at the special meeting, and it is expected that the assessment will be paid without serious protest. The management estimates that $3,500,000 has been expended in San Francisco alone, and a similar amount throughout the state, and believes that the stockholders will see the necessity for the method adopted to raise funds.

An underground distributing system for the municipal electric lighting plant at Pasadena, Cal., is now proposed, and Mayor Earley has been supplied with data and estimates by Manager C. C. Glass which indicate that for an additional outlay of $72,744.15 the city can install conduits for electric light work in the fire district, which comprises the business section in general. In the near future the city will be called upon to vote a bond issue of $175,000 to improve and enlarge its present municipal lighting plant.

The City Council of Bonanza, Ore., has accepted a proposition from Charles S. and Rufus Moore to install a light and power system in that town, to be supplied by a transmission line from the station they are building at Klamath Falls, and to be in working order by January 1, 1908.

The Board of Public Works of Seattle, Wash., is preparing plans for cluster lights on First, Second and Third avenues, and bids will be called shortly for their installation. The cost of installation is estimated at $188,000. The committee on light reported to the City Council a resolution directing Superintendent L. B. Youngs to prepare plans for the installation of 600 additional arc lights.

The Seattle Electric Company is making plans for the extension of its electric-car lines to the grounds of the Alaska-Yukon-Pacific Exposition, in a northern suburb of Seattle, Wash.

Work has been commenced on buildings to house the large force of men which will be engaged in construction of the power plant where the Great Northern will generate electricity to operate trains through the Cascades Tunnel in the state of Washington. Robert Herzog, assistant engineer for the Great Northern, will be permanently located at Leavenworth, Wash., to supervise construction.

St. Maries, Idaho, is to have an electric-light plant installed under a franchise to be granted certain capitalists by the Town Board.

J. L. Bright, manager of the Citizens' Electric Company of Lewistown, Mont., is figuring on installing an electric-light plant at Harlowton, and in connection with this will bring about direct telephonic communication between Harlowton and Lewistown. A.

PERSONAL.

Haudain Hamilton, president of the Union Electric Telegraph and Telephone Company of Davenport, Iowa, died recently at Hot Springs, Ark., of pleurisy. His home was at Harrisburg, Pa.

John Crump, Jr., has been elected president of the Columbus (Ind.) Street Railway and Light Company to succeed the late Richard F. Gottschalk. Mr. Crump states that all the improvements projected by his predecessor will be carried out.

J. D. A. Cross, Iowa City, salesman for the General Electric Company, was married to Miss Nellie Holy of the Chicago office of the same company on June 26th. Mr. Cross is one of the best-known and most popular electrical salesmen in the Central West.

John Z. Murphy, chief engineer of the Chicago Union Traction Company, has been appointed to represent that company on the Board of Supervising Engineers which has in charge the reconstruction and improvement of the Chicago street-railway properties. Members of the board have been East for a week inspecting plants that are to furnish equipment for the Chicago work and looking over street-railway and tunnel projects in various cities. Bion J. Arnold, chief engineer, headed the party.

The resignation of R. H. Smith as superintendent of the Bridgeport (Conn.) division of the Consolidated Railway Company has resulted in several executive changes. Superintendent Chapman of the Middletown division will take the place of Mr. Smith. George H. Church, superintendent of the Southington division, will become superintendent at Middletown. The Southington division will be merged with the Meriden division, with Superintendent Lee in charge of the enlarged division. Mr. Smith becomes general manager of the Albany and Hudson Railway Company.

ELECTRIC LIGHTING.

Brownsville, Texas, will vote on the proposition to issue bonds for $70,000 for an electric-light plant and waterworks.

The Union Central Light and Ice Company of Hibbard City, Texas, is about to construct so as to supply the four surrounding towns. The company has issued $25,000 of six per cent. collateral bonds and would like to hear direct from construction companies, contractors, engineers and others interested.

The Consumers' Electric Company has applied for a franchise to light the streets and business houses of Hot Springs, Ark.

The Home Light and Power Company of Waco, Texas, has been incorporated with a capital of $25,000 by J. B. Earle and others.

The Carrollton Heat, Light and Power Company has closed a contract with the city of Carrollton, Ill., to do the pumping for the city waterworks. The company will be in the market for a five mile transmission line, including poles, cross arms and wire; also a 25-horsepower 60-cycle single-phase motor, geared to a pump, capacity of about 10,000 gallons per hour. F. M. Sinsabaugh is the manager of the company to whom the contract was let.

The town of Little Valley, N. Y., has recently closed the contract for a new electric-lighting equipment which will compare favorably with that of any town of its size in Western New York. There are included in the contract a 150-kilowatt 60-cycle 1,100-volt alternator, a direct-connected exciter and an 18 by 42-inch Corliss engine of 250 horsepower, heavy-duty type. The old equipment is retained, making a complete duplicate system available for service under all conditions. The new machinery is supplied by the Allis-Chalmers Company.

The G. E. tungsten lamp for street series lighting is the subject of an interesting bulletin just issued by the General Electric Company. The high efficiency of the tungsten lamp places the series system on a favorable competitive basis with any other illuminant and may enable the incandescent lamp effectually to compete for street-lighting service. The filament can be operated at the very high efficiency of 1¼ to 1½ watts per candle with a life of approximately 1,000 hours. Tungsten lamps are particularly adapted to series-lighting service, as the lamps employed are of low voltage, and this permits the use of a short, stable and durable filament.

ELECTRIC RAILWAYS.

A third-rail electric line is being projected between Battle Creek, Mich., and La Grange, Ind., by the Indianapolis Transportation and Transit Development Company, whose headquarters are in Indianapolis.

The American Light and Traction Company has issued a comparative statement of earnings for the half year ending June 30th. In 12 months ended June 30th the company paid $1,209,108 dividends, carried $681,600 to reserve, and had a balance of $422,256 surplus, making the total surplus June 30, 1907, $2,657,403.

At the request of receivers, Judge Lockwood of Monroe, Mich., has ordered the immediate sale of the Toledo, Ann Arbor and Detroit electric railway. The property represents an outlay of about $250,000 and includes about 20 miles of track laid and a power house at Petersburg, Mich. The property will be sold upon a cash basis.

The Walla Walla (Wash.) Valley Traction Company has refused to build a line to the fair grounds, claiming financial inability, and the directors of the fair association have asked the city for a franchise to build the road as a municipal undertaking, believing the enterprise will be a moneymaker during the time of the fair.

In Montreal, Canada, a number of merchants and manufacturers have presented a petition to the mayor asking that the City Council arrange with the street-railway company for carrying freight. The petitioners have encountered much difficulty in getting carters to move goods, and have turned to the street-car company for relief.

E. R. Green, son of Mrs. Hetty Green, who owns the Texas Midland Railroad, 124 miles, from Paris to Ennis, Texas, is said to have decided to convert the road from steam to electrical operation by adopting the third-rail system. A branch is to be built from Greenville to Dallas, 30 miles. The road is not to change ownership, nor become part of an interurban system, but continue as a general traffic line.

The Elyria (Ohio) and Southern Railway was incorporated last week with a capital of $100,000. The incorporators are W. E. Elliott, W. E. Moser, F. N. Carpenter, J. M. Starr and F. L. Sargeant. The new electric road will pass through Lorain, Medina, Wayne, Ashland, Richland and Knox counties, Ohio, with a terminus at Elyria and West Salem. The present headquarters of the company will be at Cleveland.

The New York, New Haven and Hartford has about completed the installation of electrical equipment, and it was expected by this time to have electrically drawn trains running out of the Grand Central Station to Stamford, Conn. But the price of power demanded by the New York Central is more than the New Haven company is willing to pay, and it is likely that the dispute will have to be submitted to an arbitration committee of experts.

On account of the extreme hot weather, the Fort Smith (Ark.) Light and Traction Company has issued an order that will be a great relief to the men at the controller. The order provides the motormen may wear shirtwaists while on duty and discard their heavy coats. The men are said to look neat and clean and almost all of them are wearing the comfortable blue shirt with white collars.

Control of the Troy and New England electric railway running from Troy, N. Y., to Averill Park, has passed to the Deleware and Hudson Railroad. The line was purchased, it is understood, for the purpose of rounding out the Delaware and Hudson's holdings of electric lines in and around Troy and Albany. It already owns the United Traction Company of Albany, and with the New York Central controls the Schenectady railway. L. F. Loree, president of the Delaware and Hudson, has been elected president of the Troy and New England Railway.

POWER TRANSMISSION.

The Tumwater (Wash.) Power and Water Company has been capitalized at $50,000. The incorporators are Leopold Schmidt, Peter G. Schmidt, Frank M. Kenney, Josey R. Speckart and Edmund Rice.

Articles of agreement for the merging of the St. Joseph and Elkhart Power Company, the Elkhart Electric Company and the South Bend Electric Company by the Indiana and Michigan Electric Company, capitalized at $1,915,500, have been filed with the recorder at Goshen, Ind. The corporation has dams at Twin Branch and Buchanan on the St. Joseph River and will build another at Bristol, Ind. Charles A. Chapen, Henry K. Chapen, Charles B. Calvert, Fred A. Bryan and others are directors. Power will be furnished in South Bend, Mishawaka, Elkhart, Goshen, Laporte, Niles, Buchanan, Bristol and other towns.

PUBLICATIONS.

A booklet attractive in form and reading matter is issued by the American Conduit Company describing its bituminized fiber conduit. Drawings and photographs give details of underground electrical construction and tables and curves aid in forming estimates of the cost of concrete for encircing the ducts.

Hagstrom Bros. Manufacturing Company, Lindsborg, Kan., has brought out a new porcelain tube and carbon cutter in which the pressure is applied to the tube equally at four points, causing it to snap off at any desired length. The tool is adjustable to the usual sizes of tubes and is convenient to carry, weighing less than a pound.

Instruction Book No. 5082 of the Westinghouse Electric and Manufacturing Company contains diagrams and instructions for the installation and operation of type R motors and generators. Matters of installation such as location, foundation, erection and pulley arrangements are treated in detail. Under the heading of operation are instructions for starting and stopping motors intelligently. The chapter on maintenance explains the care of brushes, bearings, commutator, and tells of the troubles which may arise and how repairs may be made. A complete set of wiring diagrams forms the last 10 pages of the little book.

The paper of G. W. Lee on "The Library and the Business Man," prepared for the 1907 meeting of the American Library Association, has been printed in the form of a booklet by Stone & Webster of Boston. Mr. Lee, as librarian for Stone & Webster, bases the paper on the work and needs of their library, treating the subject under nine divisions. Stone & Webster have the control, including operation, engineering and financing, of some 30 public-service corporations in various parts of the country. The library is at the service of them all. In giving publicity to its library and its working methods the company aims to show what library work can mean to business houses.

The General Electric Company's line of electric hoists is well illustrated by Bulletin No. 4518. Recent general distribution of electric power and the simplicity and compactness of motor-driven hoists have made possible the extensive use now found for these machines in the erection of buildings and general work about docks, ferries, warehouses, mines, quarries, coal yards, etc. The motors are designed for any of the usual voltages and are furnished for either alternating or direct current. The hoists are of the friction drum type, driven by a friction clutch and equipped with a mechanical brake. The same company's Bulletin 4512 describes and illustrates manhole fuse boxes, for use in manholes or cellars, on poles or wherever severe conditions are met.

SOCIETIES AND SCHOOLS.

The next annual convention of the Michigan Electric Association will be held in Battle Creek, Mich., on August 20th, 21st and 22d, Mr. A. C. Marshall of Port Huron is secretary.

The Illuminating Engineering Society, which will hold its first annual convention July 30th and 31st in Boston, has sent out as invitations post card passe-partouts containing scenes and points of interest of the Cape Cod metropolis.

International Brotherhood of Electrical Workers, District Council No. 7, will hold its annual convention at Oshkosh, Wis., August 5th. The district embraces Minnesota, North and South Dakota and Wisconsin, and each local of electricians in this territory is entitled to two delegates.

The Western Society of Engineers has published its latest directory, dated June, containing the constitution and by-laws with a list of members, and their titles and addresses. A table of geographical distribution gives the names of members and their location classified according to states and towns.

The Engineers' Club of Philadelphia has issued a neat pocket directory, containing the names of its members, with their titles and addresses. The little book includes an index of the club's reference library. Except during the summer, stated meetings for the reading of papers and the discussion of scientific subjects are held on the first and third Saturdays of each month.

The proceedings of the eleventh annual meeting of the National Fire Protection Association, held in New York last May, have been compiled. The report contains all of the papers and discussions at that meeting, besides a list of the members, and information about the organization. The membership includes a large number of prominent engineers and insurance officials.

The twelfth annual convention of the International Association of Municipal Electricians will be held in the City Hall, Norfolk, Va., August 7th, 8th and 9th. A good list of papers by competent authors has been prepared. The people of Norfolk and the exposition management are making great preparations for entertainment. Those who desire can write to Mr. R. A. Smith, city electrician, Norfolk, Va., and he will secure rooms. The Monticello Hotel has been selected as headquarters. Secretary Frank P. Foster of Corning, N. Y., will be at the City Hall in the afternoon and evening of August 6th to allow those who arrive early to register and secure their badges.

One hundred representatives of the Chicago Commercial Association were the guests of the trustees of the Sanitary District of Chicago on July 17th. The party boarded a large barge towed by a tug boat and proceeded down the Drainage Canal to the controlling works. There an inspection was made of the large hydro-electric power plant below Lockport. All the guests were pleased with the prospects of much benefit to Chicago as a result of this great project. Lunch was served on the boat and before the return the business men passed resolutions commending the Sanitary District for the work already done and pledging the support of the Commercial Association in the furtherance of intelligent effort for a deep waterway.

In the report which the insurance committee of the American Street and Interurban Railway Association will present to the 1907 convention at Atlantic City next October it is desired to include, among other features, data covering the years 1901 to 1907, inclusive, relative to the cost of fire insurance, showing the amount of insurance carried, the amount of premiums paid, the average rate per $100 of insurance, the amount of losses sustained, and the amount recovered from insurance companies. In future years this data will be collected annually, so that such information will hereafter be available at all times by applying to the office of the secretary of the association. It is also desired to prepare a standard form for the use of member companies in making contracts for insurance. In order to enable the committee to prepare such a form, members are respectfully requested to send to the secretary of the association copies of the various forms now used by them. To the end that the committee may be in a position to render a complete and valuable report, members are requested to fill out and return the data sheets which are being sent out by Bernard V. Swenson, secretary of the American Street and Interurban Railway Association, 29 West Thirty-ninth Street, New York, N. Y.

TELEGRAPH.

The telegraph strike which started in San Francisco and threatened to spread to other cities bids fair to be settled peaceably, largely as a result of the efforts of United States Labor Commissioner Neill. The striking operators in California have almost unanimously consented to return to work.

MISCELLANEOUS.

The production of aluminum in the United States in 1906 was 14,350,000 pounds. It is expected that the output of 1907 will double that of 1906, and again that 1908 will double 1907's mark.

The production of gas for illuminating and power purposes from straw and corncobs, the idea of Charles Eaton of Cleveland, Ohio, is to be the purpose of a new plant opened in Beatrice, Neb., recently. Gas is now being furnished to Beatrice at a rate of $1.19 per 1,000 feet, said to be the lowest price given to any city in Nebraska.

When the power houses of New York, now under contract, are in operation about a million electrical horsepower will be generated. These power houses could replace all the power and lighting central stations of Great Britain or Germany, or operate all the electric railways of Europe and Great Britain combined. One single station could supply all the electric railways of Germany; and a single generator could do the same for Switzerland.

The Prussian railway authorities have been making extended experiments on the line between Berlin and Stettin to find a method for insuring the efficiency of signals and thus preventing accidents. To secure a preliminary signal to give warning of a stop signal two or three horns, each with a rubber bulb, similar to those used on automobiles, are fastened to the telegraph poles at intervals of about 100 yards. These are operated electrically and are said to be effectual warnings.

In the United States Circuit Court for the Northern District of New York, Judge Ray has handed down an opinion in the case of the General Electric Company against Wilbur F. Corliss et al., upon Eickemeyer patent No. 677,308, granted June 25, 1901. This suit was brought to restrain the defendant from further infringement of the patent in the use of some induction motors. The feature of these motors which formed the basis of the suit was the relation between the number of slots in the field and the number of slots in the armature whereby all dead points or locking positions are eliminated from the motor. The court holds that the patent is valid and infringed by the defendants.

A comparative study of the character, occurrence and genesis of the lead and zinc ores of the country will be made this year by the United States Geological Survey, the work having been assigned to J. M. Boutwell, geologist. The districts to be examined include the Cœur d'Alene, Idaho; Metaline, Wash.; Park City, Alta, and Frisco, Utah; Leadville, Breckenridge, Kokomo, Rico and Silverton, Colo.; Eureka, Ely and Potosi, Nev.; southwestern Wisconsin; southeastern and southwestern Missouri; certain properties in Arizona and New Mexico; Franklin, N. J., and a number of active properties in Maine and New Hampshire. A special study will also be made of reduction plants and methods.

The flaming arc lamp, using impregnated electrodes, has always been liable to the objection that during the combustion of the electrodes noxious gases are produced which are unhealthful if liberated and interfere with the mechanism if allowed to enter the lamp-feed compartment. English patents have been granted on a method of correcting the difficulty, devised by Prof. A. Blondel of Paris, whose name is famous as a pioneer of flaming arc development. The invention relates to the purification and circulation of the gases within the lamp. In the enclosed arc lamp using mineralized electrodes the combustion products of the arc pass up through an orifice and after purification by the abstraction of nitrous fumes by means of alkaline carbonates, ferrous salts or iron shavings, the gases are arranged to be led down past the arc again, admitting a constant circulation. This is positively assured in some forms of the lamp by a fan, driven by a motor having its armature and field coils in parallel with each other and in series with the arc.

TRADE NEWS.

The Peerless Electric Company of St. Louis, Mo., has been incorporated.

J. R. Auguston of Holdrege, Neb., has sold his electrical supply business to Burge & Johnson.

The Electric Construction and Supply Company of Dallas, Texas, has been incorporated with a capital of $20,000 and will do a wholesale and retail business.

Hayden, Stone & Co. are quoted as saying: "It will not surprise us if the directors of several good copper companies vote to sell their product at the market during the next 60 or 90 days, and under those conditions we believe there will be sales of moderately good-sized amounts of copper at from 21 to 20 cents."

In the "Flamour" arc lamp, manufactured by P. H. Klein, Jr., New York, a feature of luminous arc construction has been practically to float the carbon suspension in the fields of the regulating solenoids to secure uniform regulation. A double carbon arrangement may be easily applied to the lamp, securing double the time of burning without lengthening the lamp.

Sealed proposals will be received at the office of the supervising architect, Washington, D. C., until 3 o'clock p. m., August 27th, for the construction (including heating apparatus, electric wiring and conduits) of the extension to the post-office and court house at Trenton, N. J., in accordance with the drawings and specification, copies of which may be had at the above office or at the office of the custodian at Trenton.

F. B. Badt & Co., Chicago, agents for the Excello flaming arc lamps for outdoor and indoor use, have met with very good success since taking the agency for this lamp. Among the Chicago users of Excello lamps are McVicker's Theater, Garrick Theater and five or six other theaters, the Palmer House, White City, Majestic Hotel, Riverview Park and many other prominent Chicago houses. The Excello lamp is said to be the most powerful artificial illuminant, and it is safe to say that through the energetic efforts of F. B. Badt & Co. it will soon be used by a large number of Chicago concerns.

The Columbia Incandescent Lamp Company of St. Louis, Mo., has been awarded the largest contract for incandescent lamps ever placed by the United States government. The order amounts to 270,000 lamps and embraces the requirements of the various army posts and barracks under the quartermaster's department, the various federal buildings throughout the country under the Treasury Department, the Congressional Library building and the government printing office in Washington. In addition, the Columbia Incandescent Lamp Company has just completed a contract with the Bureau of Equipment of the Navy Department for 155,000 lamps, covering the requirements of the various ships of the United States Navy. The company is justly proud of the added prestige which goes with so large an order.

BUSINESS.

The Westinghouse Electric and Manufacturing Company's circular, No. 1092, gives a detailed description of its multiple alternating-current arc lamp. In appearance the lamp is ornamental. The construction feature is the rocker arm principle, wherein the weight of one part of the mechanism is balanced by another, thus decreasing the size and power of the control magnets and securing minimum heating and chattering. The voltage and frequency adjustments are easily reached through the door in the casing. Wherever possible moulded vulcabeston has been used instead of mica or special insulating parts. The choke coil is of fireproof construction and is carried by the hanger punching, relieving the housing or the central tube of the strain of its weight. The bulletin includes a catalogue list of lamps, globes and shades.

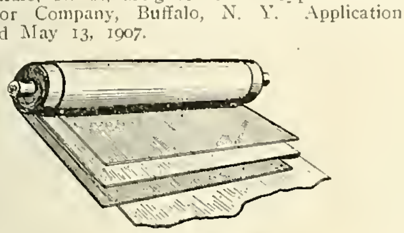
ILLUSTRATED ELECTRICAL PATENT RECORD.

Issued (United States Patent Office) July 16, 1907.

859,909. Telephone Attachment. Arne H. Berg, Clarkfield, Minn. Application filed April 23, 1907.

When the receiver is removed from the hook, the movement through mechanical connections, causes a bell to be struck inside the telephone-box.

859,923. Electrical Condenser. Clarence Z. Davis, Buffalo, N. Y., assignor to the Cyphers Incubator Company, Buffalo, N. Y. Application filed May 13, 1907.



NO. 859,923.—CONDENSER.

Two conducting sheets separated by two insulating sheets are rolled together. Projecting edges of the conducting sheets form the terminals. (See cut.)

859,944. Elevator-controlling Mechanism. William H. Hultgren, Philadelphia, Pa., assignor to the Otis Elevator Company, Jersey City, N. J. Application filed September 13, 1905.

The main line switch and reversing switches of the motor are held and actuated by cams which are controlled by a shipper sheave.

859,948. Telegraphy. Isidor Kitsee, Philadelphia, Pa. Application filed January 15, 1906.

To reproduce Morse signals in the form of dots and dashes upon chemically prepared paper, an ink is used containing a chemical which darkens when heated by the transmitted electric current.

859,949. Telegraphy. Isidor Kitsee, Philadelphia, Pa. Application filed August 23, 1906.

To translate the movement of a siphon recorder into sound, a movable siphon is adapted to discharge normally a conducting fluid to connect a series of contacts.

859,950. System for Automatic Signaling. Isidor Kitsee, Philadelphia, Pa. Application filed February 11, 1907.

An aerial conductor is provided to be carried along the line of travel, which is electrically divided into blocks. Means on the cars impress impulses (which may be localized) upon the aerial conductor. Indicators on the car advise of the proximity of other cars.

859,993. Telegraph Pole. Samuel H. Summerscales, Winnipeg, Manitoba, Canada. Application filed November 23, 1906.

A metal pole of I-section having notches in the flanges to serve as gains for the arms and braces. The arms are of Z-bars separated by blocks carrying the insulators.

859,998. Method of Electrical Separation. Henry A. Wentworth, Lynn, Mass., assignor to the Huff Electrostatic Separator Company, Boston, Mass. Application filed December 20, 1906.

This process of separating the components of mixed solid material consists in introducing the mixture to an electrostatic field characterized by brief potential accessions separated by the intervals of substantially no potential, and there subjecting the mixture to an intermittent ionized gaseous jet. A repelling charge is thus conducted to the upper stratum of the mixture, thereby overcoming the charge received from the jet. These upper layers are then removed from the mixture, leaving the lower layers locally charged by the jet. The local charge of the inferior conductors is thereafter corrected by subjecting them to the influence of a second electrostatic field.

860,001. Ship's Telegraphy. Richard D. White, Washington, D. C. Application filed August 2, 1906.

A system of communication between the various stations on board a ship includes new details of construction and operation of the indicating dial mechanisms.

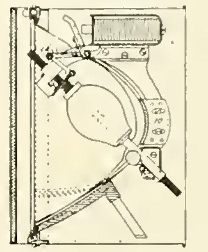
860,016. Sub-station Protector. Frank B. Cook, Chicago, Ill. Application filed May 7, 1906.

This telephone lightning arrester comprises a block of insulating material containing suitable passages which hold inclosed fuses and electro-thermal protectors connected to and mounted on the fuses.

860,025. Guard for the Mouthpieces of Telephone Transmitters. Gerhardt E. Grimm, Philadelphia, Pa. Application filed May 26, 1906.

An antiseptically treated sheet is adapted to be unrolled across the transmitter mouthpiece and torn off and discarded after being used.

860,036. Electric Arc Headlight. John Kirby, Jr., Dayton, Ohio, assignor to the United States Headlight Company, Buffalo, N. Y. Application filed November 26, 1906.



NO. 860,036.—ELECTRIC HEADLIGHT.

The line of the carbons is inclined to bring the positive crater at the focus of the parabolic reflector. Details of reflector construction are described. (See cut.)

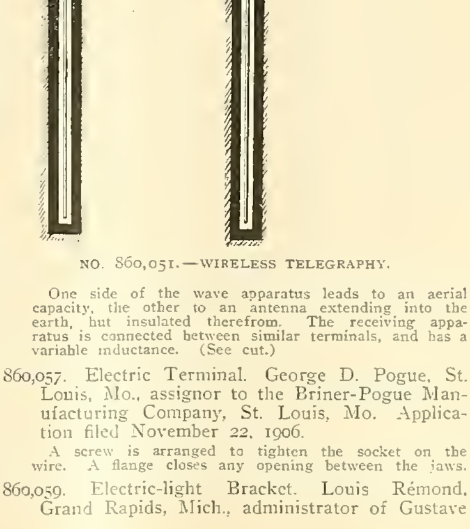
860,044. Telephone Attachment. Edward S. Maddock, Chicago, Ill. Application filed April 26, 1906.

A coin attachment for telephone pay stations is described.

860,046. Machine-operating Mechanism. Charles R. Meston, St. Louis, Mo., assignor to the Emerson Electric Manufacturing Company, St. Louis, Mo. Application filed January 9, 1907.

A shaft is driven through gearing by a motor which is mounted on a pivoted base, and by movement of a rod is adapted to vary the contact of the gears.

860,051. Constructing Antennæ of Wireless Telegraphy. Joseph Murgas, Wilkesbarre, Pa. Application filed February 17, 1906.



NO. 860,051.—WIRELESS TELEGRAPHY.

One side of the wave apparatus leads to an aerial capacity, the other to an antenna extending into the earth, but insulated therefrom. The receiving apparatus is connected between similar terminals, and has a variable inductance. (See cut.)

860,057. Electric Terminal. George D. Pogue, St. Louis, Mo., assignor to the Briner-Pogue Manufacturing Company, St. Louis, Mo. Application filed November 22, 1906.

A screw is arranged to tighten the socket on the wire. A flange closes any opening between the jaws.

860,059. Electric-light Bracket. Louis Rémond, Grand Rapids, Mich., administrator of Gustave Gautier, deceased, assignor to the Grand Rapids Show Case Company, Grand Rapids, Mich. Application filed November 28, 1906.

A pressed metal bracket is described.

860,070. Plug-seat Switch. Ernest E. Yaxley, Chicago, Ill. Application filed July 21, 1906.

Friction is reduced by providing the bell-crank arm with rollers bearing against both the plug and the contact spring.

860,072. Means for Removing Ice from Trolley Wires. Charles E. Atkinson, Richmond, Ind., assignor of one-third to John M. Lontz and one-third to Alexander Gordon, Richmond, Ind. Application filed January 8, 1906.

An ice-clearing blade is adapted to rest in a yoke held by a slot in the trolley harp.

860,099. Electric-lamp Bracket. Frederick H. Löhrs, Elizabeth, N. J. Application filed March 21, 1907.

One arm of a right angle rod telescopes into the hollow standard. The other arm carries jaws which clamp a socket.

860,104. Automatic Starter for Electric Motors. William C. O'Brien, Baltimore, Md., assignor to the Monitor Manufacturing Company, Baltimore, Md. Application filed April 19, 1905.

An arrangement of solenoids, contact pieces and dash-pot is described.

860,114. Trolley Harp. Charles E. Atkinson, Richmond, Ind., assignor of one-third to John M. Lontz and one-third to Alexander Gordon, Richmond, Ind. Application filed October 20, 1906.

The trolley harp is constructed to have a small lateral movement to follow the wire.

860,116. Motor Clutch. Herbert A. Balcome, Boston, Mass., assignor to the Holtzer Cabot Electric Company of Massachusetts. Application filed March 1, 1907.

A cam forces the friction surfaces of the shaft and pulley together and the drive is effected by the friction between them.

860,117. Base-fastening Device for Electrical Apparatus. Louis Bates, Hoboken, N. J.; Mamie Sidman Bates, administratrix of said Louis Bates, deceased. Application filed July 9, 1906.

The slab is bored partly through, and the inner end of the hole enlarged to contain a metal plug, which holds the screw.

860,124. Switch. Donald M. Bliss, Brookline, Mass., assignor to the Holtzer Cabot Electric Company. Application filed July 14, 1905.

For operating a single phase induction motor, the stationary contact of a switch is connected to one collecting ring, and the pivoted contact member, adapted to be operated by centrifugal force, is connected to the other slip ring.

860,132. Signal Drop. Henry J. Heeney, Boston, Mass., assignor to the Holtzer Cabot Electric Company. Application filed September 17, 1906.

A new combination of the shutter mechanism of a signal-drop is described.

860,153. Lamp Socket. Robert Rowley, New York, N. Y. Application filed April 13, 1906.

An electro-magnet in the socket serves to hold the contact key closed, when so placed.

860,157. Lightning-arresting Switch. Washington D. Shirk, Fairfield, Iowa. Application filed February 28, 1906.

A knife switch is combined with a carbon block arrester.

860,163. Signal for Pressure Gauges. John B. Townsend, Wellford, W. Va. Application filed January 29, 1907.

The gauge pointer, when in extreme position, closes an electric alarm bell circuit.

860,173. Flotation Bearing. Otis White, Springfield, Ill., assignor to the Sangamon Electric Company, Springfield, Ill. Application filed September 25, 1903.

A bearing for the shaft of an electric meter consists of a supplemental shaft carried in a chamber containing a liquid.

860,175. Telephone System. David H. Wilson, Chicago, Ill., assignor to George W. Kretzinger, Chicago, Ill. Application filed October 29, 1904.

A bridge circuit associated with each instrument is normally open when the talking circuit is completed, but is automatically closed during the signaling operation.

860,179. Electric Heater. Edward H. Abbot, Los Angeles, Cal. Application filed December 19, 1905.

A metal drum, lined with heat resisting material and having air openings at top and bottom contains a number of metal tubes covered with heat resisting and insulating material and wound with resistance coils connected in series.

860,189. Cord Adjuster. Horace G. Chatfield, Waterbury, Conn. Application filed May 8, 1907.

The adjuster is made in two halves, to be separated for attaching to the cord without disconnecting the lamp. A strip of felt encircles the cord and prevents wear.

860,195. Storage-battery Electrode. Thomas A. Edison, Llewellyn Park, Orange, N. J., assignor to the Edison Storage Battery Company, West Orange, N. J. Application filed April 28, 1905.

An electrode for alkaline storage batteries has a perforated tubular longitudinally corrugated metallic insoluble inclosing pocket containing active material under elastic pressure.

860,206. Alarm and Signal Mechanism. Ellsworth E. Flora and Robert J. Zorge, Chicago, Ill., assignors to the Zorge Safety Railway Equipment Company, Chicago, Ill. Application filed October 11, 1906.

An electromagnet controls the actuation of a torpedo-carrier, being provided with a circuit equipped with a circuit-changer which is controlled by electromagnets connected with different track-sections and having interlocking armatures.

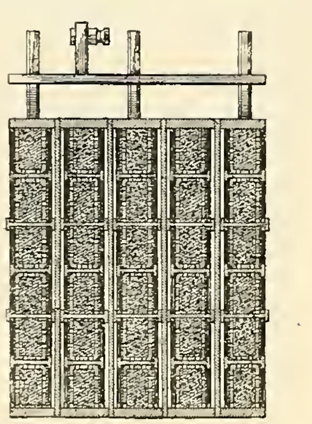
860,208. Electropneumatic Track Channeler. Arthur H. Gibson, Easton, Pa., assignor to the Ingersoll-Rand Company, New York, N. Y. Application filed January 11, 1907.

An electric motor is arranged either to drive the pressor or to propel the truck.

860,229. Trolley Stand. James H. McPherson, Haverhill, Mass. Application filed January 31, 1907.

The pole, pivoted to a base, has a stationary and a sliding abutment, which are connected by a spring. A link joins the sliding abutment and the base, the parts being so adjusted that upward movement of the pole beyond a pre-determined point will cause the spring to be stretched.

860,291. Storage Battery. William Gardiner, Chicago, Ill., assignor to C. P. Stringfield, Chicago, Ill. Application filed May 20, 1905.



NO. 860,291.—BATTERY PLATE.

The plate is the combination of a series of metallic cage-like compartments, and metallic apertured holders individual to each containing the active material. A porous diaphragm is inserted between the active material and the sides of the compartments. (See cut.)

860,305. Electric Current Regulator. David R. Knapp, Philadelphia, and Howard E. Cade, Pencoyd, Pa. Application filed November 24, 1905.

A regular system applicable to the charging of storage batteries is described.

860,325. Lamp Holder. William J. Phelps, Detroit, Mich. Application filed December 20, 1902.

This is a key socket for the control of a three-terminal "Hylo" lamp. Longitudinally shifting the key puts it in position to close either of the circuits by the usual rotation.

860,360. Plug Switch. Earl C. Eldredge, Springfield, Mass. Application filed July 27, 1906.

Contacts are successively made by pushing in a plug. This is ring-grooved, enabling the contact fingers to lock it in several contact positions.

860,383. Rotary Circuit Closer. Llewellyn Hutchinson, Boston, Mass. Application filed December 10, 1906.

This consists of a casing having a circular track in [illegible] there are one or more oblique grooves, a contact [illegible] in the track, a rotary contact piece held under yielding pressure and movable over the track to [illegible] oblique grooves, and a counterbalancing [illegible]

860,406. Fireproof Christmas Tree. Frederick L. McGahan, Los Angeles, Cal. Application filed December 28, 1906.

The trunk and branches of the tree are hollow metal tubes, which serve as conduit for wiring to electric decorations.

860,432. Electric Switch. Johan M. Andersen, Boston, Mass., assignor to Albert and J. M. Anderson Manufacturing Company, Boston, Mass., Application filed October 13, 1905.

A combination switch and fuse block is described.

860,433. Operating Mechanism for Electric Switches. Johan M. Andersen, Boston, Mass., assignor to Albert and J. M. Anderson Manufacturing Company, Boston, Mass. Application filed March 30, 1907.

An electric motor supplies energy to a spring motor to operate switches. The electric motor starts automatically when the spring motor becomes weak.

860,442. Fire Alarm. Eugene Bucci and Quirino Cicchetti, Boston, Mass., assignors of one-third to John Bucci, Providence, R. I. Application filed December 3, 1906.

Use is made of the physical fact that on exposure to heat the coefficient of elasticity of rubber is affected, and if under tension, it appears to contract. This shrinkage, when the temperature rises, is used to close an electric alarm circuit.

860,507. Electric-light Support. William A. Williams, Atlanta, Ga. Application filed November 8, 1906.

This support comprises an attaching base, with a carrying element mounted on a rotable member, a combined guide and clamp pivoted to a support on the carrying member, and a suspending bar adjustable in the clamp.

860,532. Circuit-closing Device. Roy C. Cram, Bridgeport, and Charles L. Graves, Milford, Conn., assignors to William Grunow, Jr., Bridgeport, Conn. Application filed August 2, 1906.

Two switching levers, each with a movable contact at one end engaging fixed contacts, are controlled by an operating arm which is retarded by a dash-pot device.

860,469. Branch Box. Morton Havens, Jr., Albany, N. Y. Application filed March 24, 1906.

An outlet box for branching the wires emerging from conduit is described.

860,477. Method of and Means for Charging Electric Furnaces. William H. Huffman, Niagara Falls, N. Y., assignor to the International Acheson Graphite Company, Niagara Falls, N. Y. Application filed February 15, 1907.

The method consists in depositing the raw material to be treated between flexible and rigid walls, surrounding the raw material and walls with a mixture having a relatively low conductive capacity, and withdrawing the rigid walls.

860,481. Electric Cut-out. Everett O. Jackson, Stillwell, Ill. Application filed February 6, 1907.

The movable member consists of a coiled wire, the elasticity of the coil securing more firm contact.

860,482. Contact Plug for Sockets for Electric Lights. Frederick W. Jaeger and Gustav A. Landsee, Milwaukee, Wis. Application filed May 4, 1906.

The contact is made through screw-threaded members provided with spring-arms which may be spread and automatically retained by a plunger.

860,560. Automatic Fire-Extinguisher Supervisory System. James G. Nolen, Chicago, Ill., and John D. Nolen, Toledo, Ohio; James G. Nolen assignor to the Automatic Fire Protection Company. Original application filed September 11, 1902. Divided and this application filed October 28, 1904.

The valve of a fire extinguishing system is arranged with electrical means for giving notice of its movement by impulses to a responsive signal device.

860,561. Art of Railway Signaling. Wesley T. Oviatt, Stratford, and Edward F. Latimer and William Grunow, Jr., Bridgeport, Conn. Application filed August 2, 1906.

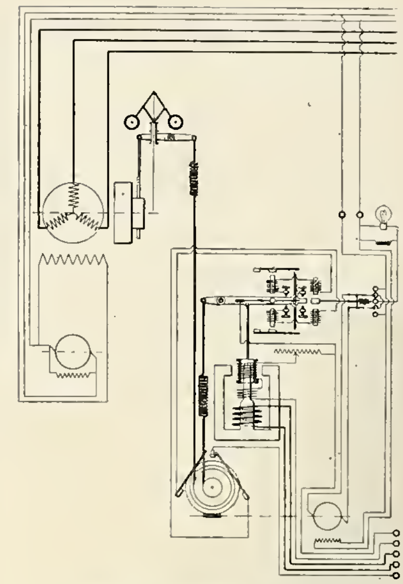
A safety system of railways has a section of roadway provided at each end with an electromagnetically controlled indicator and switches to be operated by a car in opposite directions. Circuit changing switches are arranged whereby when each car enters the section an indication is made on each indicator and the indications are cumulative always in the same direction so long as cars continue to enter, and subtractive in a reverse direction so long as they continue to leave the section, no matter which way they move.

860,568. Electric Incandescent Lamp and Connection Therefor. William J. Phelps, Detroit, Mich., assignor to the Phelps Company, Detroit, Mich. Application filed September 10, 1902.

A control switch and extension for "Hylo" lamps is attached to the lamp base.

860,572. Means for Controlling Electric Current-distributing Systems. Joseph L. Routin, Lyons, France. Application filed December 15, 1905.

With the generator is combined a volt-metric governor for tension regulation and a tachymetric governor for mechanical regulation. A dynamometrical governor, operated by variations of load, comprises a continuous current motor with independent excitations, a reversing switch for controlling motor, a mechanical device operated by motor and connected to the antagonistic couple of a watt meter. The mechanical device has a predetermined position for each value of the power delivered by the generator, and for preventing "hunting" is operated by the regulating movement to



NO. 860,572.—REGULATION SYSTEM.

set up a counter force tending to arrest the movement before complete re-establishment of equilibrium. (See cut.)

860,587. Electric Furnace. Ross C. Unger, Cleveland, Ohio. Application filed July 25, 1906.

The furnace is designed for small operations and consists of a casing lined with refractory material. Heat is generated in a granular resistance on the bottom of the furnace.

860,605. Fire-protection System. James G. Nolen, Chicago, Ill., assignor to the Automatic Fire Protection Company. Original application filed September 17, 1904. Divided and this application filed December 8, 1904.

A spindle journaled on the water pipe is arranged to be rocked by the flow of water in the pipe and to actuate a rocking contact switch, which connects with an alarm circuit.

860,606. Safety Fuse. Franz Oprendek, Vienna, Austria-Hungary, assignor of one-half to Samu Pollak, Györ, Austria-Hungary. Application filed September 12, 1905.

The fuse wire is wound on a storage spool and its free end arranged to connect terminals of an electric circuit. The fuse is thus easily replaced.

Reissue.

12,672. Electrolytic Cell. George A. Gabriel, New York, N. Y., assignor to the Bleach and Caustic Process Company, New York, N. Y. Application filed April 9, 1907. Original No. 822,109, dated May 29, 1906.

A porous diaphragm has a foraminous cathode in contact on one side and a gauze-embedded diaphragm on the opposite side. Insulating material limits the active surface of the first porous diaphragm.

PATENTS THAT HAVE EXPIRED.

Following is a list of electrical patents (issued by the United States Patent Office) that expired July 22, 1907:

432,512. Electric Stop Motion for Looms. D. E. Coughlin, Milford, N. J.
432,521. Electric Cut Out. S. D. Field, Stockbridge, Mass.
432,547. Telephone Exchange. J. A. McCoy, Medford, Mass.
432,561. Brush Reverser for Electric Motors. A. Rechenzaun, London, England.
432,571. Conduit System for Electric Railways. N. Seibert, Malden, Mass.
432,577. Dynamo Electric Machine. H. W. Spang, New York, N. Y.
432,618. Electrical Communicating System. A. G. Holcombe, Long Island City, N. Y.
432,619. Call Box for Electrical Signaling Systems. A. G. Holcombe, Long Island City, N. Y.
432,623. Electric Railway. R. M. Hunter, Philadelphia, Pa.
432,629. Electric Metal Working Apparatus. H. Lemp and J. Tregoning, Lynn, Mass.
432,630. Forming or Shaping Metals by Electricity. H. Lemp, Lynn, Mass.
432,644. Current and Switch Controlling Mechanism. E. W. Rice, Jr., Lynn, Mass.
432,645. Station-Box for Watchmen's Electric Time Detectors. J. E. Richards, Cedar Keys, Fla.
432,646. Motor for Electric Railways. M. H. Smith, Halifax, County of York, England.
432,651. Method of Working Metals by Electricity. E. Thomson, Lynn, Mass.
432,652. Welding or Other Dynamo. E. Thomson, Lynn, Mass.
432,653. Method of Welding Pipes by Electricity. E. Thomson, Lynn, Mass.
432,654. Elevtric Meter. E. Thomson, Lynn, Mass.
432,655. Dynamo Electric Machine. E. Thomson, Lynn, Mass.
432,656. Manufacture of Bands, Rings, etc., by Electricity. E. Thomson, Lynn, Mass.
432,657. Electric Lighting of Railway Trains. J. A. Timmis, London, County of Middlesex, England.
432,670. Conduit Electric Railway. B. Jennings, San Jose, Cal.
432,672. Method of Making Secondary Battery Plates. W. P. Kookogey, Brooklyn, N. Y.
432,673. Electric Railway. F. Mansfield, Melrose, Mass.
432,674. Electric Railway. F. Mansfield, New York, N. Y.
432,675. Electrical Railway. F. Mansfield, New York, N. Y.
432,707. Electric Motor. H. Humbert, Brooklyn, N. Y.
432,727. Method of Electric Welding. M. W. Dewey, Syracuse, N. Y.

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New Section of Paris Metropolitan Railway.

BY A. DE COURCY.

When entirely finished, the system of the Paris Metropolitan Railway will no doubt be one of the most complete in Europe. The project includes a number of subway and elevated lines which cross the city in different directions, forming a network which is to reach the principal districts. At present there are no less than four sections of the line completed, or nearly so, and three of these are now in regular operation. The first sections runs directly across town from east to west using a tunnel of elliptical section, with the tracks laid on wooden ties. A third rail of the usual kind for supplying current to the car motors is laid alongside the track. The part of the subway lying on the right bank of the Seine was constructed to the Trocadero station, not far from the river, as far back as 1900. This was done so as to carry the large amount of traffic which was taken upon the subway at the time of the exposition. But it was not until a comparatively recent period that the tunnel was extended from this point as far as the Seine in order to continue the new line on the left bank of the river.

What is characteristic of the South line is that follows in overhead structure for five stations before reaching the underground part, the total length of elevated road in the valley of the Seine being 2,516 meters.

Owing to the arrangement of the boulevards, there is no difficulty in erecting the elevated structure, since in the middle of the boulevard is a strip of ground planted with trees, which serves as a promenade, and the two paved portions for the vehicles pass along either side. Accordingly the middle strip is used for the elevated structure. Where the tracks run down from overhead into the tunnel there is a distance of 160 meters where traffic is interrupted, but this does not give any

Passiog from Overhead to Underground. A Typical View of the Elevated Structure.
One of the Elevated Statioos. The New Bridge over the Seine. (Eiffel Tower in the Distance.)

NEW SECTION OF THE PARIS METROPOLITAN RAILWAY.

in tunnel, following the Seine. Section No. 2, which already has been described in the Western Electrician, makes a semi-circular tour through the north district, with line No. 1 as the diameter. The new line, described in this article, runs through the south district, and completes a circle by joining the north section of the railway.

This new south line starts from the Place de l'Etoile, where there is a large underground station, or, rather, series of stations, the three principal lines of the city coming together at this point. Access is given from one station to the other by sets of staircases, since the stations lie on different levels, and it is necessary to cross over from one station platform to the other. Like the other two lines, there is a special underground station allotted to the South line. Starting from this point the incoming train makes a loop around the Place and comes back upon the other track lying next the outbound platform. From here the line proceeds in double-track tunnel until it reaches the bank of the Seine.

The tunnel sections of the line are built upon the same plan as for the former Metropolitan lines, it has several overhead and underground sections. The trains pass from the tunnel up to the overhead structure upon a rather steep grade, and afterward descend again into the tunnel. From Trocadero station the tunnel extends to Passy station on the Seine, at which point the tracks come to the surface and run for some distance upon a trestlework, which forms the approach to the bridge over the Seine. After crossing the bridge the road continues upon the left bank of the river as an overhead structure, making a semi-circular tour through the southern part of the city and reaching the river again at a distant point, where it crosses upon a second bridge and makes connection a second time with the transverse or No. 1 line of subway.

Overhead structure was made necessary in three sections of the profile, owing to the irregularity of the ground. The part of the city lying next the Seine is on a comparatively low level, so that the overhead structure had to be employed here, but upon reaching higher ground the line enters again into tunnel. Thus, from the station of Grenelle, upon the left bank of the Seine, the line trouble, as there are no cross tracks at this point, nor, in fact, at any of the other similar points. The tunnel section proceeds from the Pasteur underground station for five stations before the track comes again to the overhead structure. The tunnel passes by the Montparnasse railroad station.

Where the line passes under the Boulevard Raspail it runs parallel to a second tunnel which is to form part of a new line extending from the north to the southern part of town. At this point the two lines are parallel to each other, so that a transfer can be made, but in general the two lines are perpendicular to each other.

The second overhead structure is reached at the St. Jacques station, and this was made necessary from the fact that the line passes over the valley of the Bièvre, a small stream running through this part of town, and an elevated portion is needed in order to cross over the depression of the ground. The line runs thus for a length of 866 meters before passing again underground near the terminal point at Place d'Italie. Counting the two overhead sections as a total length of 3,382 meters, the line covers nearly one-third of the total distance from the Etoile to Place d'Italie, which is 8,970 meters. At the latter point the line is not far from the Seine.

From an engineering and construction view, the present section ends at Place d'Italie, and from here the line continues toward the Seine and across the river upon another section which was begun much later and which is not yet finished. The present description therefore relates to the line up to the latter station.

At the Place d'Italie is one of the large underground stations of the city. It is a double station, one part being the terminus of the South line proper, and the second the starting point for line No. 5, which crosses the Seine. Passengers thus make the transfer at this point, the two lines being side by side upon the same station platform, which is 20 feet wide. The south line makes a loop around the Place, and the tunnel of the second line follows another loop, the two running near each other. Considerable underground work had to be carried out at this point on this account. A new section, known as line No. 6, is to start from the Place, and will cross the Seine at a point farther along.

Referring to the design of the overhead structure, it is about the same as is used on the North line. The southern section has 55 spans of 22.5 meters, 21 spans of 27 meters and eight of 19.50 meters, besides nine spans of variable length. In all, there are 93 spans, besides the bridge approaches and two large spans over the squares. As before, the metallic structure is upheld upon iron columns of artistic design. The overhead stations are supported upon masonry pillars.

Upon the total length of the southern section there are 18 stations, either in the tunnel, overhead, or on a level with the ground, where the line comes out of the tunnel. The last-mentioned arrangement is the case with three of the stations, one of which is shown in the picture, with the structure of masonry arches in the foreground which leads up to the overhead metallic portion. The bridge over the Seine is built of a series of metallic arches suported upon piers. Above the principal platform of the bridge the Metropolitan tracks pass upon a raised structure which is supported on light iron columns.

On account of the comparatively large amount of overhead construction the preparatory work for the tunnel was less than usual, and consisted in displacing the sewers and piping. This was easy to carry out, and did not cost more than $200,000. But, on the other hand, a large amount of work had to be done where the tunnel passes through the ground occupied by the catacombs. These are a series of galleries which were formed by taking out the stone, which was abundant here. The galleries are under each other at different levels and without much order, and in some places the ground is honeycombed in this way. In many cases the galleries have fallen in, sometimes leaving great conical holes in the ground where the earth has fallen down over a large area. Such cavities are known as fontis, and are difficult to fill up. In the places where the galleries are in good condition they were braced by heavy sustaining pillars of masonry, and the foundation for the subway tunnel was laid above the pillars. Where the ground is hollowed by the fontis, wells were sunk which were filled up with beton, thus forming a kind of sustaining pillar in the ground. Upon the beton wells were placed arches extending from one to the other and intermeshed so as to form a solid structure. Upon the arches is laid the foundation of the tunnel, which is of unusual thickness. The amount of masonry which is thus buried in the ground is no less than 45,000 cubic meters, together with 47,000 meters length of timber, and the total cost of this part of the work was about $400,000, not counting the work on the tunnel proper. It is carried out over a length of 2½ miles.

The rolling stock of the new section follows the same lines as that in use on the preceding sections, using motor cars and a certain number of trailers upon the 500-volt third-rail system, with the multiple-unit method of control.

Regulation of Unipolar Generators.

In dynamo-electric machines of the unipolar type each armature conductor is separately connected to collector rings, and by means of connections between brushes bearing on these slip rings, the several conductors are placed in series. From this it will be seen that the armature circuit includes a number of sliding contacts between the brushes and slip-rings, introducing considerable resistance. Indeed the ohmic drop across these poor contacts at full load is a large part of the total voltage of the machine. Nor does this brush resistance remain constant in amount, for on account of the movement and changing surface conditions it is somewhat variable and unstable.

If the field winding be shunted across the generator terminals in the usual manner and the load increased, the larger current flowing through the brush-contacts results in an increased drop across these resistances, so that the external available voltage falls off, and the field excitation is impaired.

For an arrangement of field supply to correct this poor regulation of the generator at heavy loads, a patent has been granted recently to Elihu Thompson of Swampscott, Mass. The way in which Professor Thomson accomplishes the result is comparatively simple. The field magnets are excited by current from independent and auxiliary brushes which bear on collector rings connected to opposite ends of a single conductor. This conductor may in reality be one of the armature inductors connected in the terminal circuit, though in this case, it would necessarily be made larger than the others to prevent excessive heating on account of the added duty of carrying the exciting current. Or if desired, a separate conductor may be used for supplying the field winding.

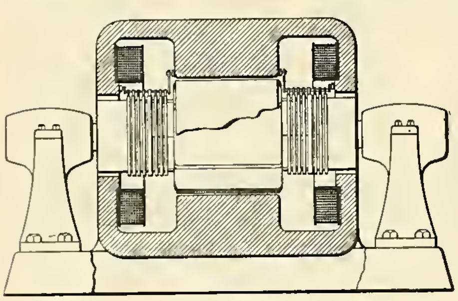


FIG. 1. SIDE ELEVATION OF A UNIPOLAR GENERATOR.

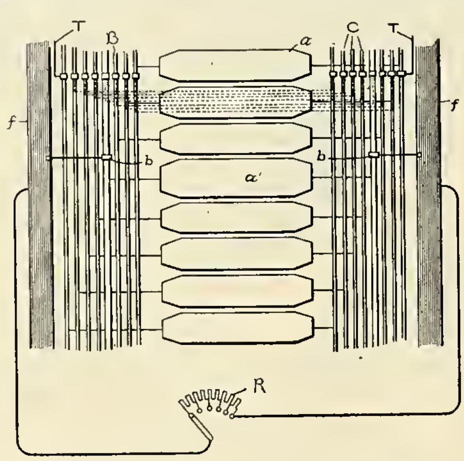


FIG. 2. PLANE DEVELOPMENT OF ARMATURE CONDUCTORS, RINGS AND CONNECTIONS FOR UNIPOLAR DYNAMO.

Fig. 1 is a side elevation of the type of unipolar generator to which the invention is applicable; the fields, slip-rings and inductors may be seen. Fig. 2 shows the armature conductors, rings and connections rolled out into a flat surface, as it were.

Referring to Fig. 2, where the several armature conductors are shown developed on a plane surface, each conductor is seen to be connected at opposite ends to a pair of collector rings (C). By means of the brushes (B) the several armature conductors may be connected in series with each other and to the external circuit.

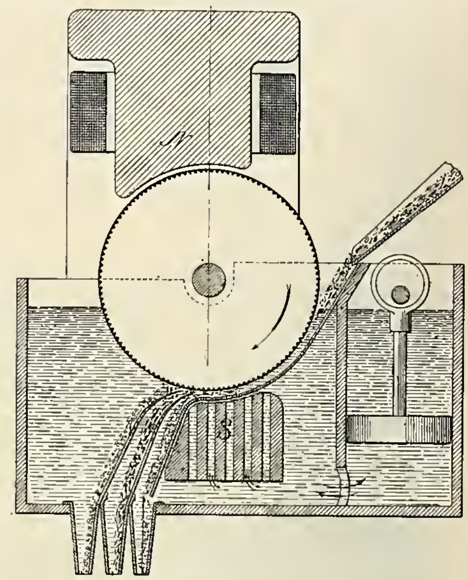
For the sake of simplicity, the brushes are shown all in a single line, but in practice they would be more or less distributed around the armature. The connections between the brushes at opposite ends of the machine are shown in dotted lines, and the machine terminals are indicated at (T) (T).

Auxiliary brushes which are not included in the armature circuit and which bear on a pair of collector rings connected to opposite ends of an armature conductor (a') are represented at (b) (b). These brushes are connected to the field coils (f) (f) in circuit with which is shown diagrammatically a field rheostat (R).

As shown in Fig. 2, the conductor (a') and the collector rings to which it is connected are made slightly wider than the other armature conductors and collector rings in order to enable them to carry the current for the field winding without overheating. If preferred, the conductor (a') may be left out from the armature circuit entirely and would then serve simply for supplying the field current.

Wait's Magnetic Ore Separator.

A magnetic ore separator in which the division of the ferriferous ore from the foreign material takes place under water or other fluid is the invention of Henry H. Wait of Chicago. The accompanying diagram shows how the apparatus is intended to operate. The product of the crusher is led through the chute at the right and delivered against the magnetic cylinder, which is revolving in the field of the powerful electromagnet shown. The fluid is kept in constant agitation by some means, as shown in the sketch, where a piston connected to a power-driven eccentric shaft serves to vibrate the water. By the aid of this vibratory motion of the fluid the material is brought into more intimate relation with the magnet which is given better opportunity for segregating and loosening the magnetic ores, it is asserted.



WAIT'S MAGNETIC ORE SEPARATOR.

Foreign matter, such as dirt, stones, etc., will be dropped in one of the nearer spouts, but the magnetic particles will be carried on until they have passed the farther divider either because they have adhered to the surface of the cylinder and so have been positively carried over, or because their apparent or effective specific gravity has been so modified that the particles are held suspended in the water so near the top of the stream of ore that its natural flow carries them over. Thus the division is effected by two distinct means. The invention has been assigned to the International Separator Company of Chicago.

Copper Degraded to Lithium.

According to the daily newspapers of last week, Sir William Ramsay has promised to communicate shortly to the Chemical Society an account of a discovery which, in the words of the London Lancet, "marks an epoch in the history of chemical science, since his investigations have shown that a given element, under the powerful action of radium emanations, undergoes degradation into another. In short," adds the Lancet, "the transmutation of elements is actually un fait accompli."

Readers will remember that several months ago a newspaper story was extensively published in connection with Sir William Ramsay's name, in which the statement was made that he had succeeded in producing copper synthetically from lithium, sodium and potassium. This was later denied by the distinguished chemist, who declared in an interview that he had never advanced to the point of such a statement.

The persistence of the story which has made its appearance for the second time within the past few days, lends some confirmation to this latter-day romance of the transmutation of metals.

From the testimony at hand it would appear that the noble metals are slowly breaking down and that gold, platinum, uranium and other elements of high atomic weight will disappear and their descendants be the commonplace elements. This would seem to teach that gold and other metals exhibiting high atomic weights have, after all, a complex, unstable constitution, the tendency of which is to resolve into simpler substances.

The emanation from radium, it was pointed out several months ago, seems to belong to the helium series. During its change it gives up enormous quantities of energy. If the distribution of this energy is modified by the presence of water, that portion of the emanation which is decomposed yields none; if in the presence of copper sulphate, argon. Similarly, copper acted upon by the emanation is degraded to the first member of its group, namely, lithium.

Protective Devices for X-ray Operators.

By Dr. Alfred Gradenwitz.

The danger resulting from the use of X-rays, both to the patient and physician, was a real danger in the early history of the art, when no adequate safeguard was available, while the action of these rays was not clearly understood. But improved methods are now available which make the use of this method of diagnosis or treatment safe when carefully applied.

In the case of diagnostical experiments an irritation or injury of the skin need not be feared, unless the very softest X-ray bulbs are used, and even then only in the case of a continued or repeated radiation on the same spot. Apart from the fact that in medical practice there is hardly ever a necessity of repeating radiations at short intervals, an efficient safeguard can readily be designed. In fact, as only "soft" rays of low penetrative power and high chemical action are objectionable, the greater amount of these can be eliminated by placing on the skin one or more layers of linen, or preferentially a thin leather sheet, which sufficiently

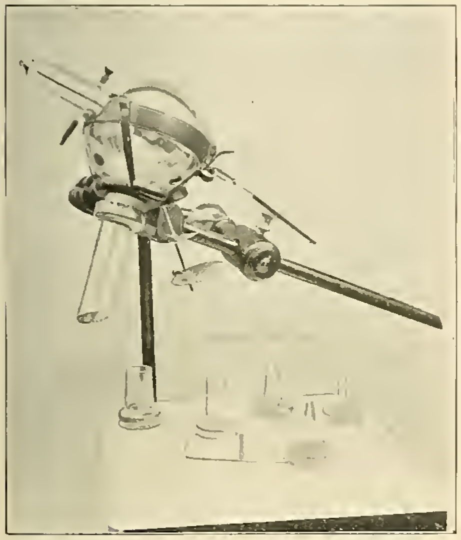


FIG. 1. LEAD-GLASS X RAY BULB.

absorbs the dangerous radiation. The time of exposure in the case of diagnosis is generally limited to one or two minutes.

Far greater danger to patients is likely to accrue from therapeutical methods, though the Holzknecht chromoradiometer is an adequate gauge of the intensity of radiation, measuring to some extent the applied physiological energy of the rays. The possibility of errors in using this instrument cannot, however, be said to be entirely eliminated, apart from the fact that its use necessitates a considerable amount of practice.

According to Herr F. Dessauer of the Aschaffenburg Electrical Institute the best way is to apply intense unit radiations, separated by adequate intervals. It should be remembered that with increasing penetration of the X-rays and increasing hardness of the bulb the physiological energy of rays, and along with the latter any danger, rapidly decreases. Only in the case of very long exposures will there be any risk of combustion with half-hard or hard bulbs, the only dangerous bulbs being the soft type.

Two methods have been suggested to protect the surroundings of the parts radiated on, according as either the sound skin is covered with a substance absorbing radiation or the bulb is enveloped with a protective sheath allowing a beam of X-rays of the same cross-section as the part to be radiated on to issue through a variable aperture. As the beam of rays then only strikes the affected part the remainder of the body need not be covered.

The first method is realized either by means of lead foils or special protective substances, such as have been suggested from time to time by various authors. The other method resulted in the construction of special diaphragm boxes, which, however, owing to their height and the risk of electrical discharge , are rather inconvenient. A far more satisfactory solution of the problem is embodied in the lead glass caps suggested by Dr B. Wiesner. In these devices the bulb is located in a hemisphere of lead glass, as shown in Fig. 1, the rays issuing through an aperture at the summit to which the lead-glass or metal tubes of different

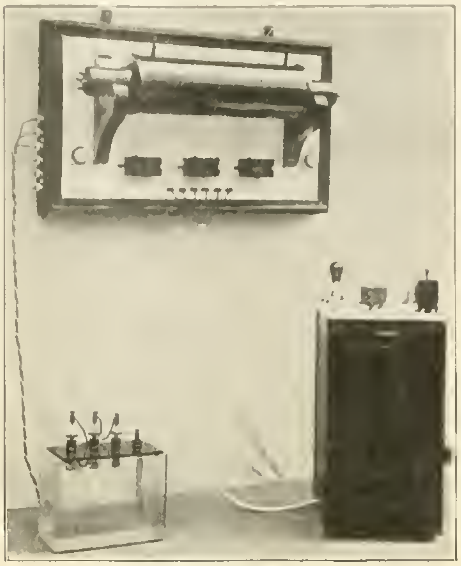


FIG 2. X RAY OUTFIT WITH SEPARATE CONTROLLING TABLE.

shape (according to the field to be treated) are attached.

Far more important than the protection of patients will be found the protection of physicians, as the danger to the latter, owing to the continued presence of noxious influences, is very much greater. While a prudent Röntgenologist will hardly be endangered by a single or even a repeated radiation, the effects of the latter if continually repeated, will result in certain forms of disease.

However, this chronic dermatitis can be avoided in any case through a certain amount of care and

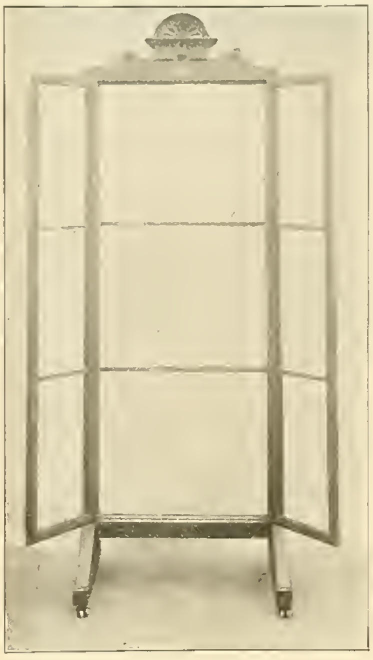


FIG. 3. PORTABLE LEAD-GLASS FRAME FOR USE IN X-RAY WORK.

attention. This, it is true, presupposes some self-control as well as the use of certain technical safeguards. As regards the former condition, the operator should never expose himself to the radiation without urgent necessity. First of all, he should never use his own hands, and generally speaking his own body, for practical demonstration or testing of the rays. The body of the patient, who is exposed to the rays only exceptionally, is a far more convenient object. In order to protect the operator against the risk of getting into the field of rays there have been designed adequate safeguards, of which a few will be described. In the case of the lead glass cap above referred to, the room not being filled with intense radiation, the operator will readily avoid the action of X-rays. In the case of unprotected bulbs, on the other hand, the operator should take every care to avoid the contact of the rays, which now penetrate throughout the room. In fact, such rays as are reflected diffusely (secondary rays) are bound to get everywhere, all objects in the room as well as its air being the origin of dangerous secondary radiation

The operator should therefore be located at a distance as far as possible from the bulb, while the controlling mechanism of the X-ray outfit should be separated from the induction coil, being arranged on a special table, as shown in Fig. 2, so as to enable the operator to control his apparatus from another corner of the room. Moreover, an impervious observing screen should be placed between the bulb and the controlling table. A convenient arrangement suggested by Dessauer is a transportable lead-glass screen with rotating wings protecting the operator both in front and on the sides. Fig. 3 illustrates such a screen.

Another method, which, however, is less convenient, consists of using a special switching cabinet lined with impervious substance on all sides and provided with observation windows.

Whenever the operator is not in a position to stay behind the protective screen or in the cabinet (which alternative will occur only in the case of diagnostical work), exposures should be abridged as far as possible. To this effect the room should be darkened immediately on entering it, and after first turning on artificial light (electric), a transi-

FIG. 4 PROTECTIVE GLOVE FOR X-RAY OPERATORS.

tion should be produced from this to yellow or red light, thus preparing the eye efficiently for immediately seizing any details of the X-ray image.

Apart from the above some special safeguards have been constructed. Diaphragms comprising large impervious surfaces, and leaving free only the part to be radiated on, will, for instance, be used to advantage. Trochoscopes will afford a protection in all directions, excepting the part to be examined. Projection screens should be carried by the diaphragm itself. If the fluorescent side of the screen be covered with lead-glass the face will be protected, while the screen will become so heavy as to be inconvenient if carried by hand.

In the absence of any diaphragm, which alternative should if possible be avoided, the hand working the projection screen should be protected either by metal armatures fixed to the right and left of the screen and covering the hand, or by means of gloves consisting of a convenient elastic protective substance (Fig. 4). These gloves are, however, hardly convenient, being either heavy or pervious to radiation. A more effective safeguard is a protective apron of elastic material.

Germans Coming to Study Electric Railways.

A cablegram from Berlin says that a government commission, comprising a number of experts, under the leadership of Herr Wittefeld, a prominent official of the Public Works Department, will start for the United States during the coming week to study the organization of the systems of electric railways throughout the United States. It is said to be the intention of the government to "electrify" all the railroads around Berlin, as well as portions of the main lines throughout Germany.

Measuring the Length of Electric Waves.

A new device has been brought out by Mr. Eisenstein, a German inventor, for measuring the length of electric waves, and for this purpose the apparatus shows the degree of resonance which is obtained. Slaby proposed to measure the length of a wave by the use of a form of open resonator which he designated as multipolar. With this arrangement the period of the resonator can be modified by shifting a sliding contact which is connected to earth, so that when it is slipped along the coil, about the position of resonance, there

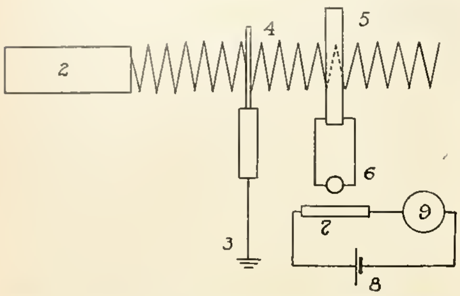


FIG. 1. MEASURING THE LENGTH OF ELECTRIC WAVES BY THE AID OF A SELENIUM CELL.

is produced at the free end of the resonator a series of sparks. By observing the intensity of the sparks one is able to fix the position of the slide at the proper point and find the position of resonance. The principal disadvantage of this arrangement is that the resonance position of the slide is very difficult to determine on account of errors in the observation of the sparks, and such a method is far from being exact, for this reason.

The present device is intended to give a much more exact and reliable means for finding the resonance position. At the same time a curve of the values of current near the desired point can be obtained by means of the slide combined with a secondary coil which is placed upon the resonator. Such a coil is used so that its current will operate an indicating device by means of light, heat or other radiations. The variable current in the secondary coil will therefore give a corresponding variation in the circuit of a galvanometer, which shows the current by a needle upon a scale, or by a curve traced on a strip of registering paper.

In the accompanying diagrams will be seen the method of operating the device. At (1), Fig. 1, is a resonating coil of the usual form, connected at one end to a handle (2) for shifting its position, while the other end is free. Upon the coil slides a contact piece (4), which is connected to earth at (3), or a large capacity may be used instead of the ground connection. A secondary coil (5) has a small number of turns and is given a variable position with respect to the main coil. The ends of the secondary coil are connected to an indicating device, and the latter is operated in

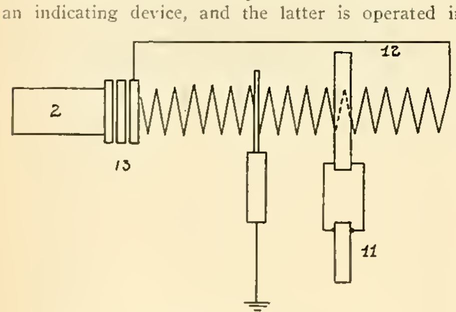


FIG. 2. MEASURING THE LENGTH OF ELECTRIC WAVES BY THE AIO OF A BOLOMETER.

several ways, either by the action of light upon selenium, for instance, by heat upon a thermopile and galvanometer, or in other ways.

In Fig. 1 the ends of the secondary coil (5) are connected to a small incandescent lamp (6) of low voltage. The lamp is properly placed opposite a selenium cell (7), which is connected in a separate circuit with a battery (8), and a suitable galvanometer (9). The coil can be shifted to the right or left, and when the sliding contact (4) and the secondary coil are brought near together the incandescent lamp receives a current and glows to a certain extent. The light becomes a maximum when the secondary coil (5) is directly over the point of resonance. According to the intensity of the light there will be a greater or less resistance in the selenium cell, resulting in a series of deflections of the galvanometer in its circuit, and the scale reading will correspond to the light of the lamp.

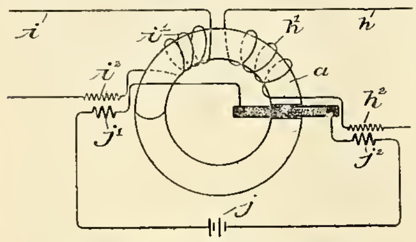
Instead of the scale there may be used a band of graduated paper whose movement corresponds to the displacement of the sliding contact and the secondary coil. In such case the galvanometer needle or pen will trace an ascending or descending curve, according to the current in the coil (5).

Instead of the selenium cell, the device which is shown in Fig. 2 can be employed. In the circuit of the secondary coil is connected a sensitive heat indicating device, such as a bolometer (11), and the current in the coil can be measured according to the reading of the scale, so that the indications of the bolometer show the position of resonance. With this arrangement, it is best to connect the free or right-hand end of the resonator by a wire (12) with a set of metal rings (13), so as to increase or diminish the capacity according as one or more rings are used. Such rings can be conveniently mounted upon the handle (2), and they can be connected together by a set of plugs placed between each ring, so as to vary the capacity.

As an indicating device, the bolometer may be replaced by a thermopile in the secondary circuit, which is more or less heated by the latter. A second circuit from the thermopile passes into a galvanometer. By observing the latter there may be obtained an indication of the current in the secondary as before, and curves can be traced as above mentioned. The above device has the advantage that the capacity and self-induction of the galvanometer circuit do not need to be varied throughout the experiment, and the readings can thus be made very easily.

Parcelle's Telephone Repeater.

Many attempts have been made to devise a successful telephone relay or repeater. Its invention will open up possibilities of telephone lines com-



PARCELLE'S TELEPHONE REPEATER.

parable in length with present long telegraph circuits. The reputed longest telephone connection is that involving 1,600 miles of wire established daily at 7 a. m., when the Omaha branch of a large Boston packing concern calls up and reports to the home office the shipments of the preceding day. Ordinary pole-line construction for distances exceeding this introduces distorting factors of capacity and other disturbing influences so that the transmission of speech is seriously interfered with. One way of solving the problem is to relay the incoming feeble current impulses, after the fashion of telegraph practice, and use the weak incoming currents to set up similar but stronger waves to be transmitted on to the destination. While simple to arrange for the telegraph, the inventors who have sought to provide a practical telephone relay have suffered many disheartening disappointments.

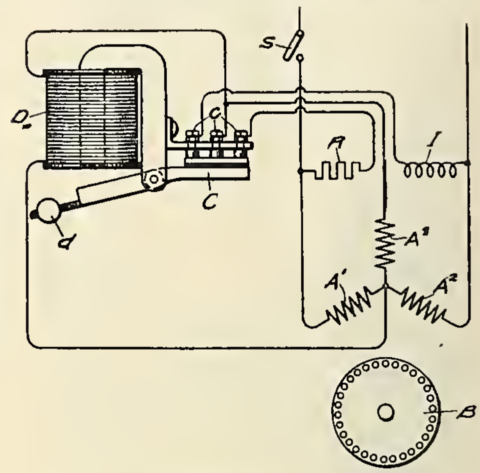
The telephone repeater has appeared in many different forms, involving the principle of arranging a powerful receiver to sound into a sensitive microphone. Sometimes the connecting medium has been the air, while some inventors have enclosed the whole apparatus and allowed the receiver diaphragm to operate a valve admitting compressed air to the transmitter. A telephone relay in which the energy of the received current is applied directly to producing pressure on the transmitter capsule without acting through diaphragms and intermediate means is the invention of A. L. Parcelle of Boston, on which a patent has been granted. Its application to a two-way line is clearly shown by the accompanying drawing.

In principle of construction the repeater itself is merely an open ring hinged at a point diametrically opposite to the end jaws which abut against a transmitter capsule. A small current flowing in the line will set up lines of force in the ring, causing the jaws to be mutually attracted, increasing the pressure on the grains of carbon in the transmitting capsule. Thus any variation in the line current is expected to produce a corresponding but magnified current change in the transmitter circuit. These local impulses induce still greater currents in the line to be sent on in the direction of transmission. It will also be noted that the two line circuits are linked by a nearly closed magnetic path so that some transmission might persist in case the local battery became weak.

The patented claims include several different forms of construction upon the same principle.

Automatic Starting Switch for Induction Motors.

Single-phase induction motors must be provided with some kind of starting device which establishes different connections during the period of acceleration from those used in the running position. Since without such arrangement this class of motors possess no starting torque, starting windings or phase-



CIRCUITS OF INDUCTION MOTOR WITH AUTOMATIC STARTING DEVICE.

splitting devices, or both, are ordinarily employed. These starting devices are ordinarily not designed to carry current for any considerable length of time, and must be cut out of circuit when the motor is up to speed. If this operation is left to an attendant the starting devices may be left in circuit because of carelessness. Further, if they are cut out of circuit and the voltage fails, so that the motor comes to rest and the current is again thrown onto the motor, it will not start and may be seriously damaged by the heavy current which will flow. For these reasons it is exceedingly desirable to employ a reliable automatic device for changing from the starting connections when the motor is up to speed.

The United States Patent Office recently granted a patent to Sven R. Bergman of Lynn, Mass., on a device for the duty just described. In principle the invention takes advantage of the change in the shape of the motor field as the motor speeds up. Although at starting a cross-field exists in the motor in quadrature with the main field, due to the starting devices, this field is much weaker than the main field of the motor, so that the shape of the resultant field is elliptical. As the motor speeds up the current induced in the secondary winding strengthens the cross-field, until when full speed is reached the motor possesses substantially a true rotating field.

A little consideration will show that any portion of the motor winding of different phase from the turns connected across the source of current will be the seat of an induced electromotive force having a component in quadrature with the impressed electromotive force, which will increase as the motor speeds up on account of the increase of the cross-field. Thus in a single-phase induction motor having a three-phase winding the electromotive force in the phase not connected to the source increases as the motor speed increases. The present invention utilizes this increase in induced electromotive force to operate a switch for breaking the circuit of the starting devices.

The accompanying drawing shows the circuits of a single-phase induction motor arranged with this automatic starting device. (A^1) (A^2) (A^3) are the three phases of the winding Y-connected, while below is shown the rotor (B), of the short-circuited squirrel-cage type. By tracing the wires it will be seen that phase (A^3) is connected through the contacts (c) to the phase-splitting starting device formed by the resistance (R) and inductance (I). The contacts (c) are connected to each other at starting by the pivoted contact (C), which is controlled by a magnet (D). This magnet is connected in shunt to the phase (A^3) of the primary winding. The adjustable counterweight (d) is arranged to close the contacts when the magnet (D) is de-energized.

When the motor is starting, the cross field is weak, the electromotive force induced in (A') is comparatively small and the magnet (D) fails to lift the contact member (C), so that the motor remains connected for starting with the phase-splitting devices in circuit. But as the motor speed increases the cross-field is augmented by the currents induced in the rotor. Consequently the electromotive force induced in phase (A) finally becomes great enough to cause the magnet (D) to open the contacts (c), leaving the motor in a running position.

On failure of the line current and stopping of the machine the contact (c) at once drops back to its starting position, so that if the supply is again established the motor starts without danger of injury. The patent has been assigned to the General Electric Company.

Facts and Problems of Electric Trunk-line Operation[1].

By Frank J. Sprague.

In studying different motors it has seemed wise to expand previous methods and to adopt one capable of wide application. Inasmuch as it was impossible within the limits of a paper already too long to apply this method specifically to all makes and sizes of motors, I contented myself with selecting one especially typical example of direct-current and 25-cycle alternating-current motors, supplementing the details of this comparison by some specific facts about other machines, namely, the smallest on regular interurban service and the largest in present locomotive service—presumably a sufficiently wide range for illustration of certain facts—leaving the application of the specific method to any other case of interest to an engineer.

In comparing capacities it is eminently proper that the weight efficiency of electrical equipments should be based upon each of two conditions: First, the total weight of motors and any connecting device necessary to transmit the power of the motor to the axle, this weight, if the trunk frame forms a part of the motor, including such additional part as is necessary over and above that required for structural purposes; and second, the total amount of electrical apparatus as above determined, plus every device for collecting or controlling the motors carried upon the car or locomotive.

Mr. Stillwell says that I should compare motors of equal capacities, not of equal weights and dimensions, and states that since the weight coefficients of all motors, of whatever make or type, increases with the size, there would not in such a comparison have been so great a disparity. Quite true, but the error of this reasoning is apparent if one reverses his proposal and compared an alternating-current motor of a given physical dimension with a direct-current motor of larger physical dimensions and weight. What a disparity would then appear! I do not know that I am particularly surprised at the remonstrance which meets the actual comparisons made in the specific instance illustrated, for the method, intelligently applied, is sufficiently instructive for those who wish to know the facts to find further application. The meaning and the force of the comparisons will not be brushed aside by ex-parte statements of isolated and uncorrelated facts, or by such a criticism of specific motor weights and capacities as distinguished Messrs. Stillwell's and Storer's comments, somewhat unwarranted in view of my specific statement that the motors were "both standard modern machines."

In order to avoid any just criticism of the curves submitted I selected not only standard modern machines of practically identical weight, but machines built by the same manufacturer, tested under like auspices and by identical methods, and by experts who had no thought that the machines would ever be compared in the matter I have shown. Not only are these machines of similar weight, but they are almost exactly the same dimensions, of the largest practical size which should be put on a truck with a 33-inch wheel, and as large as should be used with a 36-inch wheel when running in the open on a standard railroad. Gear and transformer weights were, as stated, eliminated.

That an erroneous conclusion might be expressed in comments based upon a hasty and cursory perusal of a paper is understandable, but that it should be allowed to stand after opportunity to ascertain the facts suggests either great preoccupation or a hiatus in memory. It is a wise father who is not ashamed of an adopted child, and I cannot but regret that Mr Stillwell has so long failed to recognize in motor X, whose weight, and speeds and capacities throughout a thermal range varying from two thirds of an hour to five hours were given with exactness a machine for which he is largely responsible. Its characteristics are based upon the official technical reports of the General Electric Company, the builders of this G. E. 69 B type for the Interborough Rapid Transit Company on Mr. Stilwell's general specifications, 418 of these machines now forming part of the equipment of that road. They are sometimes "rated at 200 horsepower at 300 amperes," but actually test to 241 horsepower with 75 degrees rise of temperature, according to the standard practice of the American Institute of Electrical Engineers. Several hundred more or these motors are in use on the London Underground Railways, and 268 motors of similar frame, known as the G. E. 69 C, built for 50 volts higher normal operation, nearly 100 less revolutions at the one-hour rating, but developing, notwithstanding, 232 horsepower with like rise of temperature, are in use on the New York Central Railroad. Type Y is the G. E. A. 603 25-cycle alternating-current motor, the largest of this type of machines built for motor car work.

Call these machines what one will, by any name which may smell more sweet, the comparisons are on identically the same bases, therefore absolutely proper, and in all fairness comparisons of any machines should be made with identically the same kind of data. When so made Mr. Stillwell's pyramid may be inverted and landed on its base, where it belongs.

A similar direct-current motor when equipped with commutating poles weighs about 400 pounds more, but in view of its extraordinary freedom from sparking it can with perfect impunity be steadily operated at an increase of potential which would much more than offset the increased weight. As an example of what can be done with this type of machine I have seen a standard motor of 75 horsepower nominal capacity temporarily fitted with commutating poles operated with an increase of 80 per cent. in voltage and develop over 250 horsepower without a sign of distress. Of course this is unusual and ordinarily prohibitive on account of the speed of the machine, but it illustrates the possibilities of an improvement which I have so steadily urged, and which now being adopted has so largely augmented the allowable working direct-current potentials. If Mr. Storer will compare on the thermal basis a quadruple motor equipment of this type with an equipment of 25-cycle alternating-current motors of like permissible speeds and capacities the comparison will be somewhat instructive.

With regard to 15-cycle motors, I enumerated with a good deal of particularity certain advantages which they individually offered as compared with the 25-cycle motor, and especially the reduction of individual weight. I assume that there is here little room for disagreement, but granting the full measure of these advantages, variable in the matter of capacity according to the nominal rating and the ratio of load to the hour capacity, it seems quite apparent that the increase in weight of the transformer will generally offset the saving in motor-weight capacity. Inasmuch as we are concerned not alone with motor weights, but with the total weight which must be carried by the individual drivers and within allowed wheel bases, this offsetting of the saving in weight in one part of the equipment by an increase in the other cannot be ignored, and the question properly arises whether the advantages are sufficient to warrant the adoption of the standard in spite of many well known objections.

It is a curious commentary upon the futility of prophecy when within a month of the announcement of the necessity of a new standard and within the hour of its repetition the responsible technical engineers of a great manufacturing corporation voice, not only for themselves but for a great portion of the engineering world, their disapproval of its adoption, and in the same breath announce a radical advance in 25-cycle motor construction which maintains the merits of a higher frequency and renders the attempt to lower it less advisable.

Comparisons based upon motors designed, but not built, are essentially unsatisfactory, and of course they will be more or less at variance, depending upon the size and make of motors selected. The 15-cycle single-phase alternating current motor is too new a machine to have any record behind it. In my paper I compared the weights of certain standard quadruple motor suburban equipments, designating the motors A and B, the former for 15 and the latter for 25-cycle, the weights being those officially given by the manufacturers. These motors were of competitive makes, the former being the Westinghouse and the latter the General Electric, but, as I stated, I did not deem the weights given as final. It will be therefore perhaps interesting to know that, eliminating the element of competitive manufacture and comparing recently official weights of 15 and 25-cycle equipments made by the former concern, there is an excess of total weight of a quadruple equipment of nominal 75-horsepower motors greater than that given in my paper.

Certain features of the New York Central and the New Haven machines have been given so frequently that it is unnecessary to refer to them further at the present moment, except to state that their weight coefficients are very different, and much in favor of the former machines. When large 15-cycle alternating-current and other types of direct-current locomotives are built there will be an opportunity to make further comparison on a like basis. It may be interesting to note here that the recent decision to adopt three-phase locomotives on the Cascade Tunnel was because of lack of guaranteed capacity of 15-cycle motors.

1. This is a portion (for available space does not permit the use of the entire communication) of Mr. Sprague's reply to some of the comments made upon his paper bearing the title "Some Facts and Problems Bearing on Electric Trunk-line Operation," presented at the annual meeting of the American Institute of Electrical Engineers in New York on May 21, 1907. See Western Electrician of June 1, 1907, for a condensation of Mr. Sprague's paper and for a report of the discussion which followed it, to which the author now replies.

MOVING DISPLAY OF ELECTRICAL HOUSEHOLD APPLIANCES.

Moving Display of Electrical Household Appliances.

A feature of the recent one-hundredth anniversary of the founding of the town of Arlington, Mass., was a large parade in which merchants and industrial and civic organizations participated. The Edison Electric Illuminating Company of Boston took a conspicuous part in the parade.

A five-ton electrically driven truck of the company, dressed as shown in the accompanying illustration, carried 12 ordinary 12-inch electric fans, six on each side, a 1900 washing machine with a motor at the rear and a sewing machine also equipped with a motor in the center. These appliances were in operation, being run by storage batteries. In addition, an outfit of the cooking and other appliances made by the Simplex company was carried. The unique display attracted attention and elicited much enthusiastic applause. It was a striking and interesting exhibit of the manner in which electricity may be employed to advantage in the home in which the electric light has been installed.

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CORRESPONDENCE relating to electricity or any of its practical applications is cordially invited, and the co-operation of all electrical thinkers and workers earnestly desired. Clear, concise, well written articles are especially welcome; and communications, views, news items, local newspaper clippings, or any information likely to interest electricians, will be thankfully received and cheerfully acknowledged.

REMITTANCES.—All checks, drafts and other remittances should be made payable to the order of the publishers, the **Electrician Publishing Company**, and addressed to the offices of publication, Suite 507, Marquette Building (204 Dearborn Street), Chicago, Illinois. U. S. A.

CONTENTS OF THIS NUMBER.

DEPARTMENTS.

DATES AHEAD.

Ohio Independent Telephone Association (special meeting), Southern Hotel, Columbus, Ohio, August 6th.

International Association of Municipal Electricians (twelfth annual convention), Norfolk, Va., August 7th to 9th.

Ohio Electric Light Association (annual convention), New Boody Hotel, Toledo, August 20th to 22d.

Michigan Electric Association (annual convention), Battle Creek, Mich., August 20th, 21st and 22d.

THE NEWS of the death of Mr. S. M. Hamill will be received with genuine regret. Of late years, owing to the absorption by the General Electric Company of the interests with which he was connected, Mr. Hamill had not been so prominent in the electrical field, but ten or twelve years ago few names were better known than his to electrical men. He was identified with the old Brush Electric Company of Cleveland, which was a force to be reckoned with in the days when practically all arc lighting was done on the direct-current series system, with open arcs. Mr. Hamill was a man of education and culture, but he was also a shrewd business man, and he played a conspicuous part in the upbuilding of the arc-lighting business.

THE CREEDS of Christendom have been the cause of wars and bitter dissensions as well as great joy and spiritual consolation to the believer, but happily the creeds of the electrical co-operator promise to sow no seeds of discord. As shown elsewhere, there are nine of these creeds now made public in the competition of the Co-operative Electrical Development Association. Nine is a mystic number, but nevertheless it is intended to have one ultimate co-operator's creed, written after scrutiny of those now in existence, which shall be the creed par excellence. The prize contest has aroused considerable interest, and no doubt the final creed will often be quoted to stimulate the esteemed new-business solicitor and all others concerned in selling electricity to renewed zeal.

WHATEVER Mr. F. H. Plaice of New Bremen, Ohio, says about selling electricity in small towns is entitled to the most respectful consideration, for he is the man, as readers of the Western Electrician will no doubt recall, who has built up an electric-light and power business in a town of 1,500 inhabitants until the earnings have reached about $8.50 a year for every man, woman and child in the place. That is certainly a most remarkable record—one which it would be difficult to match anywhere. Mr. Plaice is a great believer in the power and heating load, and in his recent paper before the National Electric Light Association he told why. This paper, illustrated with two interesting New Bremen diagrams not heretofore published and with some other additions, is printed in this issue of the Western Electrician and is worthy of the careful study of every station manager or contract agent, whether his plant is a large or small one.

CONTRARY to the legal opinion of Attorney-general James Bingham of Indiana, the Indiana Railroad Commission has held that the two-cent fare law, passed by the last General Assembly, applies to interurban electric railways as well as to steam railroads, and a suit will probably be instituted soon against some traction company to determine whether the law applies to interurbans, and thus settle a matter that involves, in a way, the constitutionality of the two-cent fare law itself.

In a formal opinion given the commission several months ago the attorney-general held that the law applied only to steam roads, and that there was no similarity between the steam and the electric roads substantial enough to warrant the application of the two-cent-fare law of the railroad to the operation of interurbans. Immediately prominent attorneys raised the question as to the constitutionality of the law if it did not apply to interurbans. They pointed out that the tendency of the higher courts of Indiana had been recently to class the steam and the electric railroads together and that every new opinion involving this point made the analogy and similarity between these two transportation agencies closer. This being true, it was argued that if the law did not apply to the interurbans it was not at all unlikely that the courts would declare it to be unconstitutional, as discriminative against the steam roads in favor of the electric roads.

But the state railroad commission itself feels that the law applies to the electric road exactly as to the steam roads. The members think that that was the intention of the Legislature and that the law makes the application very plain to all railroads. Recently many complaints have come to the commission that some of the interurbans are charging more than two cents a mile, especially for the short hauls. This brought the question up to the commission, and it was decided to bring a friendly suit against some interurban road under the law. A complaint has been filed against the Fort Wayne and Wabash Valley Traction Company, charging it with violating the two-cent-fare law, and the test case will very likely be brought against this company. The outcome will be awaited with interest by interurban-railway men not only in Indiana but in other states.

EARLY INDICATIONS are that the first convention of the Illuminating Engineering Society, which is in session in Boston as the Western Electrician goes to press, is a pronounced success. It is reported that the attendance is fairly large, and certainly the character of the papers scheduled on the programme is of a high order. Dr. Sharp's presidential address on "The Concepts and Terminology of Illuminating Engineering" was a valuable and scholarly contribution to a subject which has been somewhat neglected in the tremendous growth of the art in the concrete, while Mr. R. S. Hale's paper on "New Lights and New Illuminants from the Central Station's Point of View" may be cited as showing that practical considerations are not neglected. Indeed, illuminating engineering is eminently practical; it sprang from a demand—a condition, not a theory—which is one reason why its terminology is rather indefinite. Illumination by gas was not neglected, but the programme indicates (as does the attendance at the section meetings in Chicago at any rate) that the preponderance of interest is electrical.

The Illuminating Engineering Society is a very useful organization, and it is to be congratulated on the success of its first convention.

ONE OF the interesting papers read at the recent convention of the American Institute of Electrical Engineers was that of Professor Karapetoff of Cornell on the "Concentric Method of Teaching Electrical Engineering." Remarking that the technical schools "are supposed to prepare, not future professors, but men for industrial work, and that our first aim should be to comply with the needs of the industry," the author proposes that the teaching of electrical engineering should proceed from practice to theory, instead of from theory to practice, as at present. This would seem to be putting the cart before the horse, in homely phrase, but as the writer proceeds, he makes out a rather plausible case. He says that the student should be interested at the very start; let him plunge into his future profession—that is, the study of it—at the outset. "All auxiliary subjects of study [as mathematics and mechanics, physics and chemistry] must follow the principal study and not precede it, as is the case with the present system." "Let the freshman begin his work by making a simple but complete piece of apparatus, wherein all the essential operations enter in their simplest form; let him discover himself the necessity of all these operations, then begin to study them in detail. If a student cannot be interested in making a piece of machinery where he has to perform all shop operations, this student is not fitted for the engineering course, and should be advised to change his specialty."

In his freshman year the student is to be introduced to the whole scope of his profession, though in a very elementary, popular manner. The next year (second zone) he studies the same subjects from a somewhat more special point of view. The third zone represents the same subjects still more advanced, etc. This is what Professor Karapetoff calls the concentric widening of the student's mental horizon, and he outlines a course based on this idea.

The conception is ingenious and interesting, but it may be doubted whether it would result in any improvement over the present method. It would seem to be better to lay broad foundations at the start rather than to essay at once an attempt at the superstructure. Nevertheless, it is well to interest the student in laboratory work, while studying underlying principles, to a greater extent than is done at present.

Illuminating Engineers in Boston.

Boston, Mass., July 30.—The first annual convention of the Illuminating Engineering Society opened this morning at 9:30 o'clock at the Edison Building on Boylston Street, being called to order by John Campbell, chairman of the convention committee.

An event not on the programme, but which was thoroughly appreciated by the members, was the presence of Gov. Curtis Guild, Jr., who extended the greetings of the commonwealth of Massachusetts.

Mayor John F. Fitzgerald, who takes an active interest in all conventions of business men held in Boston, was present to make a brief address of welcome. The convention takes place during Boston's Old Home Week celebration, and the city is gay with decorations of bunting and is filled with visitors, while a number of special events of a public character, including parades, are scheduled as unusual attractions for the occasion, and will afford plenty of diversion in connection with the work of the convention for those who spend the entire week here. On the Public Gardens, the mayor has caused a large plot to be laid out in the form of a huge floral emblem representing the convention badge. There is a profusion of special electric illumination each evening.

There are two hundred ladies and gentlemen in Boston attending the convention, and the electrical engineering contingent is well represented. The programme covers a wide range of topics related to the general subject of illumination, and an excellent opportunity is afforded for the discussion of relative merits and applicability of various methods of electric and gas lighting, papers on both types of illuminants being given a place on the programme.

President Clayton H. Sharp of New York followed Mayor Fitzgerald, his address being listened to with much interest.

Dr. Sharp's subject was "The Concepts and Terminology of Illuminating Engineering." He suggested some logical developments in terminology leading up to simplified scientific methods of describing illuminating processes and measurements. He advocated, for instance, the use of the word "lumen" for the unit of luminous flux. "It is to be hoped," he said, "that in time lamps will be designated by their efficiencies and the efficiencies will be expressed in terms of lumens per watt. For the awkward expression foot-candles per watt per square foot we may substitute lumens per watt, the introduction of the notion of luminous flux and of the term lumen justifying themselves by reducing an expression of unusual complexity to one of very great simplicity. What the ultimate developments will be in concepts and terminology of the science cannot be foretold. The most obvious steps in advance are those thus outlined."

Secretary V. R. Lansingh reported that the society, which is now 18 months old, has a membership of 1,047.

The papers of the session are down on the programme as follows:

Tuesday morning—

Primary, Secondary and Working Standards of Light—Dr. Edward P. Hyde, Washington, D. C.

Illuminating Engineering and Central-station Practice—L. H. Scherck, New York, N. Y.

Illumination of the Engineering Societies Building—C. E. Knox, New York, N. Y.

The Present Status of Candlepower Standards for Gas—C. H. Stone, Albany, N. Y.

Acetylene—A. Cressy Morrison, Chicago, Ill.

Tuesday afternoon—

The Inverted Gas Light—T. J. Litle, Gloucester, N. J.

Acetylene Lighting—Nelson Goodyear, New York, N. Y.

A New Comparison Photometer—Dr. Charles H. Williams, Boston, Mass.

New Lights and New Illuminants from the Central Station's Point of View—R. S. Hale, Boston, Mass.

A Graphic Illumination Chart—A. F. Parks, New York, N. Y.

The Elements of Inefficiency in Diffused Lighting Systems—Preston S. Millar, New York, N. Y.

Illumination Photometers and Their Use—Preston S. Millar, New York, N. Y.

Tuesday evening—Informal, for members, ladies and guests, in charge of Mr. W. D'A. Ryan, and held in the Assembly Hall on the seventh floor.

Wednesday—

Electric Light as Related to Architecture—C. Howard Walker, Boston, Mass.

Check on Reliability of Photometric Curves—J. S. Codman, Boston, Mass.

Lighting of the Boston Edison Building—Dr. Louis Bell, L. B. Marks and W. D'A. Ryan, committee.

Coefficients of Diffuse Reflection—Dr. Louis Bell, Boston, Mass.

What is Street Lighting?—W. H. Blood, Jr, Boston, Mass.

The Metallic Flame Arc Lamp—C. E. Stephens, Pittsburg.

The Luminous Arc—W. D'A Ryan, West Lynn, Mass.

In the Assembly Hall there is an exhibit of photometric apparatus and of some new and novel illuminating devices.

Provision is made for the entertainment of the ladies who have come to Boston with delegates, sightseeing trips about the city and suburbs having been arranged for them.

On Wednesday afternoon a harbor excursion and dinner is the feature, members and guests all participating. The convention is considered a great success by those who have worked hard to set a precedent in this first convention of the society for a high standard of annual meetings. The next issue of the Western Electrician will contain a more detailed report of the proceedings. B.

Board of Supervising Engineers, Chicago Traction.

The work of rehabilitating the street railways of Chicago under the direction of the "Board of Supervising Engineers, Chicago Traction," to use the official title, has now been fairly begun. From a recent resumé of the minutes of the 23 meetings held between May 7, and July 16, 1907, inclusive, the following extracts will be of general interest:

May 7.—The Union Traction Company was authorized to purchase 14 additional new double-truck cars.

The following types of track construction were decided upon: First—A steel tie form with flat tie plate attached, laid in concrete material. Second—A wooden tie form, with flat tie plate attached, laid in concrete. Third—A wooden tie form, with flat tie plate attached, laid on crushed stone, with concrete between and over the ties, to carry paving.

The firm of Robert W. Hunt & Co. was employed to inspect the first 5,000 tons of rail purchased by the Chicago City Railway Company.

May 9.—The Chicago City Railway Company was advised that it would be required to furnish approximately $5,000,000 during 1907, $6,000,000 during 1908 and $5,000,000 during 1909—that is, during the three-year rehabilitation period.

May 13.—The chief engineer, Mr. Bion J. Arnold, was authorized to prepare plans for track construction work on Root Street, Wentworth Avenue, South Chicago Avenue, Cottage Grove Avenue and Indiana Avenue.

May 16.—Additional property being required by the Chicago City Railway Company contiguous to its proposed power-house site, that company was authorized to enter into a lease for the block bounded by Morgan Street, Thirty-eighth Place, Gage Street and the Stock Yards slip off the Chicago River, the lease to run for a term of 25 years.

May 27.—It was decided to adopt, tentatively, a standard distance between track centers of 9 feet 8½ inches on streets where double tracks are laid, and that curves at intersections branching off these tracks shall be laid with 80-foot radius switches on the outside track, both leading, first into tangents, then into compound curves.

June 7.—The Chicago City Railway Company was authorized to enter into a contract for the furnishing of electrically welded joints for track.

June 12.—It was resolved that auxiliary copper be installed to supplement the return carrying capacity of the rails and that the size and number of cables constituting said supplementary return circuit be determined by calculations based upon the amount of current to be carried.

June 25.—The contracts providing for the purchase of electrical energy by the Chicago City Railway Company were submitted to the board and approved.

Bids from various manufacturers of copper cable were discussed, and the Chicago City Railway Company was authorized to enter into a contract for the purchase of 10 miles of 1,000,000 circular-mil, concentric-laid, bare-copper cable.

June 28 (at Lorain, Ohio).—Arrangements were made with the Lorain Steel Company to roll 500 tons of rail from the rolls as then in operation, with the understanding that the steel company would forward to the board in Chicago a sample cut out of every sixtieth rail. It was decided that after these samples were received the board would take definite action as to the rolling of future rails.

June 29 (at Johnstown, Pa.).—The plant of the Lorain Steel Company at this place was visited for the purpose of investigating the Lorain Steel Company's facilities for building track special work and the exact processes of manufacture, including manganese steel for "hardened center work."

July 5.—The Chicago City Railway Company was authorized to contract for 60,000 tie plates, 50,000 yellow-pine ties, 1,000 66-inch No. 00 copper cross-bonds and other material.

July 8.—The question of how to handle street traffic during track construction was discussed. Three methods were considered practicable: The complete diversion of the traffic to other streets, so as to give the free use of at least one track upon the street where rehabilitation work is in progress; the closing of the street to traffic in about one-half mile sections, excepting at crossings, and the construction of two temporary tracks outside the location of the permanent tracks; the building of a single temporary track on the side of the street to allow the construction work to proceed with economy.

July 11.—The board decided to visit the plant of the Pennsylvania Steel Company and those of the William Wharton, Jr., Company of Philadelphia and the Bethlehem Steel Company of South Bethlehem, Pa., to take cognizance of the facilities of these concerns for furnishing certain material.

July 15.—The chairman of the board, Mr. Bion J. Arnold, was directed to write the Lorain Steel Company instructing it to proceed with the rolling of the remainder of the 5,000 tons of rail ordered each by the Chicago City Railway Company and the Chicago Union Traction Company.

Death of S. M. Hamill.

After an illness of seven weeks with typhoid fever and pleurisy, Samuel McClintock Hamill, who figured most prominently in the early history of the electrical industry, and who of late years had been connected with the General Electric Company, died at his home in Schenectady, N. Y., on July 29th.

Of late, Mr. Hamill was interested in a number of industrial and financial enterprises which necessitated his attending to many duties, wearing him out, so that when the attack of fever came he could not resist it.

He is survived by his widow and two small children, Mary B., aged 5, and Samuel M., Jr., aged 15 months. In addition to his immediate family, a brother, Hugh H. Hamill, of Trenton, N. J., and his sister, Mrs. Edward P. Wood of Princeton, also survive him.

Mr. Hamill was born in Lawrenceville, N. J., March 27, 1858, and was the son of the Rev. Samuel M. Hamill, D. D., and Matilda Green. He was educated at the Lawrenceville School, of which his father was for 50 years the head. In 1880 he graduated from Princeton University, with the degree of B. A., and three years later received the master's degree. For three years he was a teacher in the Lawrenceville School and for a time studied law.

In 1883 Mr. Hamill accepted a position with the Chicago, Burlington and Quincy Railroad. In 1886 he resigned to become secretary of the Brush Electric Company of Cleveland, Ohio. He was vice-president and general manager of this company when it was consolidated with the General Electric Company, and at that time moved to Schenectady, where he has since been connected with the General Electric Company.

At the time of his death Mr. Hamill was president of the Schenectady Trust Company, a trustee of the Ellis Hospital and the Old Ladies' Home, a director of the Y. M. C. A. and an officer and director in a number of electrical corporations.

He was a member of the Mohawk and the Mohawk Golf clubs of Schenectady, the University and Princeton clubs of New York city; the Ivy, Golf and Nassau clubs of Princeton, N. J.; Country Club of Trenton, N. J., and the Union Club of Cleveland, Ohio.

In November, 1900, he was united in marriage to Miss Maria Woodward Baldwin of Baltimore, Md.

The funeral services were held in Schenectady, July 30th, from the First Presbyterian Church, of which Mr. Hamill was a member. The funeral party left immediately after the services for Lawrenceville, N. J., when interment was had in the Hamill family plot.

Among the honorary pallbearers were President C. A. Coffin of the General Electric Company; F. P. Fish of the American Telegraph and Telephone Company, Boston; A. Butler Duncan, New York city; Gerardus Smith, Schenectady; Col. Robert T. Emmet, New Rochelle; W. L. R. Emmet, W. T. Hanson, Everett Smith, Schenectady; Blair Lee, Washington, D. C.; Pliny Fisk, New York; J. R. Lovejoy, E. W. Rice, Jr., Schenectady; Henry W. Green, Trenton, N. J.; Hon. Myron T. Herrick, ex-governor of Ohio; Robert McA. Lloyd, General Vehicle Company, New York; Rudolph Schrimer, New York.

Some experiments recently completed in France point to the possibility of ammonia manufacture by the passage of electric sparks through an atmosphere of nitrogen and hydrogen gases.

National Civic Federation and Public Ownership

Having previously made public the individual opinions of the committee on investigation, abstracts of which have appeared in the Western Electrician, the National Civic Federation has now given out the final report of the investigating committee of the commission on Public Ownership. The report, which gives in detail the conclusions of the committee on all the various questions concerning the public-ownership problem, and which presents a number of practical recommendations on the subject, is signed by all but one of the committee—Walton Clark of Philadelphia—who presents a separate paper giving his views. Charles L. Edgar of Boston and W. J. Clark of New York present a statement of minor exceptions.

The members of the committee who sign the report are: Melville E. Ingalls (chairman), chairman board of directors Big Four Railroad; Dr. Albert Shaw (vice-chairman), editor of the Review of Reviews; Edward A. Moffett, secretary; Edward W. Bemis, superintendent of waterworks, Cleveland, Ohio; William J. Clark, general manager of the foreign department of the General Electric Company; Prof. John R. Commons, Wisconsin University; Charles L. Edgar, president of the Edison Electric and Illuminating Company, Boston; Walter L. Fisher, president of the Municipal Voters' League, Chicago; Prof. Frank J. Goodnow, Columbia University; Prof. John H. Gray, Northwestern University, Evanston, Ill.; Timothy Healy, president of the International Brotherhood of Stationary Firemen; Daniel J. Keefe, president of the International Longshoremen's Association; Milo R. Maltbie, member of the new Public Service Commission for the Greater New York; H. B. F. Macfarland, president of the Board of Commissioners of the District of Columbia; Frank J. McNulty, president of the International Brotherhood of Electrical Workers, Springfield, Ill.; Prof. Frank Parsons, president of the National Public Ownership League, Boston; J. W. Sullivan, editor Clothing Trades Bulletin, New York; Talcott Williams, editorial writer of the Press, Philadelphia; Albert E. Winchester, superintendent of the South Norwalk (Conn.) Electric Works.

This committee made a thorough investigation of municipal and private workings of gas, electric light, water and street-railway plants both in the United States and England.

In the first place the committee finds that it is difficult to give positive answers of universal application to the questions arising as to the success or failure of municipal ownership as compared with private ownership. The local conditions affecting particular plants are in many cases so peculiar as to make a satisfactory comparison impossible, and it is very difficult to estimate the allowance that should be made for these local conditions. For instance, in making deductions from the financial conditions of Wheeling, as affected by its gas plant, as compared with those of Atlanta and Norfolk with their private plants, allowance must be made for the presence of natural gas in Wheeling. And the difficulty of reaching satisfactory results by the comparative method is not confined to special or local conditions. It is true, as well, of much broader questions. Thus any attempt to compare municipal with private electric-light plants in the United States would be fruitless if allowance were not made for the fact that in most cases such municipal plants are confined to street lighting and may not do commercial business. Again, in England consideration must be given to the fact that the municipal electric-light and street-railway plants have permanent rights, while the rights of private companies operating these particular utilities are limited as to the length of their existence, many street-railway franchises expiring 21 years after they were granted.

Emphasis is placed on the fact that the public utilities studied are so constituted that it is impossible for them to be regulated by competition. Therefore, they must be controlled and regulated by the government; or they must be left to do as they please; or they must be operated by the public. There is no other course. None of the committee is in favor of leaving them to their own will, and the question is whether it is better to regulate or to operate.

"There are no particular reasons," says the committee, "why the financial results from private or public operation should be different if the conditions are the same. In each case it is a question of the proper man in charge of the business and of local conditions. We are of the opinion that a public utility which concerns the health of the citizens should not be left to individuals, where the temptation of profit might produce disastrous results, and therefore it is our judgment that undertakings in which the sanitary motive largely enters should be operated by the public. We have come to the conclusion that municipal ownership of public utilities should not be extended to revenue-producing industries which do not involve the public health, the public safety, public transportation, or the permanent occupation of public streets or grounds, and that municipal operation should not be undertaken solely for profit."

As a means to carrying out its recommendations and to protect the rights of the people it is recommended that the various states give to their municipalities the authority, upon popular vote under reasonable regulations, to build and operate public utilities, or to build and lease the same, or to take over works already constructed. This is considered the only way that the people can be put upon a fair trading basis.

No municipal operation, it is declared, is likely to be successful which does not provide for: (1) An executive manager with full responsibility, holding his position during good behavior; (2) exclusion of political influence and personal favoritism from the management of the undertaking; (3) separation of the finances of the undertaking from those of the rest of the city; (4) exemption from the debt limit of the necessary bond issues for revenue-producing utilities, which shall be a first charge upon the property and revenues of such undertaking.

Danger is seen by the committee in the turning over of these public utilities to the present government of some American cities. Some of these cities are improving, but as a whole cities of the United States are said to be not up to the high type of municipal government found in England and Scotland. It is charged that the political activity of public-service corporations has in many instances been responsible for the unwillingness or inability of American cities to secure a higher type of public service, however, the report says, there seems to be an idea with many people that the mere taking by the city of all its public utilities for municipal operation will at once result in ideal municipal government through the very necessity of putting honest and competent citizens in charge. While an increase in the number and importance of municipal functions may have a tendency to induce men of a higher type to become public officials, the committee does not believe that this of itself will accomplish municipal reform.

The more important conclusions of the committee are summed up as follows:

"Public utilities, whether in public or private hands, are best conducted under a system of legalized and regulated monopoly.

"Public utilities in which the sanitary motive largely enters should be operated by the public.

"The success of municipal operation of public utilities depends upon the existence in the city of a high capacity for municipal government.

"Franchise grants to private corporations should be terminable after a fixed period and meanwhile subject to purchase at a fair value.

"Municipalities should have the power to enter the field of municipal ownership upon popular vote under reasonable regulation.

"Private companies operating public utilities should be subject to public regulation and examination under a system of uniform records and accounts and of full publicity."

On the general broad subject of municipalization the committee reports that the general expediency of either private or public ownership is a question that must be determined by each municipality in the light of local conditions. "What may be possible in one locality may not be in another. In some cities the companies may so serve the public as to create no dissatisfaction, and nothing might be gained by experimenting with municipal ownership. Again, the government of one city may be good and capable of taking charge of these public utilities, while in another it may be the reverse. In either case the people must remember that it requires a large class of able men as city officials to look after these matters. They must also remember that municipal ownership will create a large class of employes who may have more or less political influence."

Messrs. Charles L. Edgar and William J. Clark present several exceptions to the report. They do not agree with the statement, "There are no particular reasons why financial results from private or public operation should be different if the conditions are the same." In reference to the recommendation of the committee that public utilities which concern the health of citizens should not be left to individuals, Messrs. Clark and Edgar find that privately operated water systems were especially as regards their consideration for the public health as properly and successfully managed as the publicly operated water systems.

Exception is also taken to the sentence, "To carry out these recommendations effectively and to protect the rights of the people, we recommend that the various states should give to their municipalities the authority, upon popular vote under reasonable regulations, etc." The words "under reasonable regulations" were put into the report at the suggestion of Charles L. Edgar, and were intended by him to mean such regulations as would compel deliberate consideration not only by the people, but by their representatives, and would consequently prevent the superficial attractiveness of the scheme from overriding the "sober second thought" of the people. Messrs. Clark and Edgar strongly dissent from any definition of "regulations" which does not cover these points.

Walton Clark, third vice-president of the United Gas Improvement Company, in a separate paper dissents from the statement of the committee regarding waterworks, for the reason that his study of the report of the waterworks expert employed by the committee, and his personal investigations lead him to the conclusion that the water companies have made the more intelligent efforts toward adequacy and purity of supply, and that, all conditions considered, the result of their efforts has been and is a better and cheaper water supply and service than that maintained by the municipal waterworks department. He also dissents from the statement, speaking of politics in Glasgaw, Manchester and Birmingham, that these conditions are distinctly favorable to municipal operation, if by this is meant a municipal ownership that may be favorably compared with private ownership in the character of its results and in benefit to the city and citizens served.

On the general subject of municipal ownership, Mr. Clark says the investigation in which he has taken part has convinced him that municipal ownership has not proved equal to private ownership in benefits to the consumer, citizen or city. He does not agree that the way should be left open for any municipality to undertake any trading operation without special authorization by the Legislature of the state wherein it is located. "I cannot believe," Mr. Clark declares, "that the prescribed remedy for any ill should be a worse ill, and I cannot recommend that a municipality suffering, or believing that it suffers, under public administration of a public utility, should be given the right to engage in the operation of such utility for itself without such a course of procedure as will make sure that the sober second thought of the people shall have ample opportunity for development and expression before the community is committed to municipal ownership with the accompanying dangers and difficulties of which you are warned in the majority report.

"Because I believe that the general credit of municipalities should be conserved for the benefit of public and necessary improvements, from which, in the nature of things, private enterprise is excluded; and because I believe that a municipality should not in any event engage in any trading enterprise that will not pay its own way, and have the confidence of the citizens as financially sound, I think that municipalities should be prohibited by statute from making investments in trading operations, except with money borrowed on mortgage, or otherwise, the loan being secured by a lien on the plant in which it is invested, and on the right to operate the same, and on this only."

Mr. Clark concludes: "I am convinced that the condition of the British people, individually or collectively, has not been improved by the municipalization of the industries we have investigated. I am convinced that, under American conditions, the system of private ownership of public utilities is best for the citizens and the consumers."

British Association in Session.

The British Association for the Advancement of Science has been in session at Leicester, England, since July 31st, and the engineering section will continue its discussion of papers and the inspection of neighboring plants and railways until August 3d. On the first day of the session, Wednesday, July 31st, following the presidential address of Dr. S. P. Thompson, a paper on the present condition of gas and gasoline engines was read by Dugald Clerk. Next day, a joint session with the chemical section was called to discuss "Gaseous Explosions, with Reference to Temperature." Papers of electrical interest on the days of the session to follow are: August 5th, Sir W. H. Preece, "Pupin's Compensated Cable for Telephone Transmission;" J. T. Morris, "Note on an Oscillograph Study of Duddell Arcs of Low Frequency;" L. Gaster, "Developments in Electric Incandescent Lamps." August 6th, E. G. Coker, "The Equipment of the Engineering Laboratory of the Finsbury Technical Institute."

The physics section will hear some interesting discussions on the nature of the hypothetical ether, which, though explained as transmitting all electrical waves, as light, heat and electricity, has seemed to be undiscoverable by any instrument, though, as its chief apostles have explained, it must be infinitely more rigid than steel, or it could not transmit vibrations with such rapidity.

Lord Kelvin has devoted much work to the problem during the last year, and will have a paper on his conception of ether; Sir Oliver Lodge is to follow him on the subject of ether density.

The 1907 Edition of the Code.

The 1907 edition of the National Electrical Code is out. It gives the "Rules and requirements of the National Board of Fire Underwriters for the installation of electric wiring and apparatus as recommended by the Underwriters' National Electric Association." This latest edition of the Code contains 142 actual pages of rules as compared with 128 in the 1905 edition. In addition to the new matter there are many changes in the old rules, so that it is necessary, to be familiar with the Code, to obtain a copy of the latest edition. It is scarcely necessary to say that the Code has the support of the electrical interests as well as of the fire underwriters. C. M. Goddard, 55 Kilby Street, Boston, or W. H. Merrill, Jr., 382 East Ohio Street, Chicago, can give information about the Code.

ELEMENTS OF ELECTRICAL ENGINEERING.

By Geo. R. Metcalfe.

XXVII.—Central-station Apparatus and Electric Lighting.

Selection of Machinery.

In making the selection of machinery for a central station there are several important considerations which should be kept in mind. The most important element to be considered is the continuity of service, because any breaks in the service are almost sure to cause not only annoyance, but actual financial loss to consumers as well as to the central station itself. It is therefore necessary to keep the station operating and the supply of current continuous, no matter what the exigencies of the occasion.

Another important point to be remembered is to provide ample overload capacity. Most generators of modern design are built capable of sustaining a continuous overload of 25 per cent. and maximum overloads of 50 per cent. of their rated capacity for short periods without undue heating. The temperature which a generator attains under load really determines the capacity of the machine. The armature winding and the commutator will usually have the highest temperature, and with high-class insulation a rise in temperature of from 40 to 45 degrees C. above the surrounding air is entirely safe under conditions of full load. At 50 per cent. overload, the temperature would generally rise about 10 degrees higher than the figures mentioned, so that 50 or 55 degrees C. above the surrounding air is the maximum temperature which the machine should be allowed to reach, as any higher temperature is pretty sure to prove destructive to the insulation. In selecting a generator or motor, therefore, the machine should be rated sufficiently low so that its full-load temperature at the commutator should not exceed 40 or 45 degrees.

This assures that the machine will have a reasonably good overload capacity.

Another feature to be considered in the selection of generators is their ability to operate continuously with the least possible care and attention, as this quality in a generator tends to reduce the cost of attendance, and therefore the operating cost of the station. Under this head would be considered self-oiling bearings, provision for catching and carrying off surplus oil, fixed point of commutation, accessibility of brush-holders for adjustment, etc.

Other things being equal, the machine of highest efficiency is naturally the most desirable, but this is not always the case, especially if the efficiency is gained at the expense of simplicity and durability.

The first cost of a machine should not be considered until after the conditions already mentioned have been satisfied. The construction of the generator or motor should be very substantial, and its materials and workmanship should be of the very best. A compact, symmetrical form is desirable, and its center of gravity should be as low as possible in order to give it maximum stability.

As a rule, the simplest design is best, and in general it is well to avoid unusual, peculiar designs or any complications which are not absolutely essential. It is also desirable to select a design which will permit the armature to be removed and the field windings to be taken off conveniently and without completely dismantling the whole machine. On heavy machines, eyebolts should be supplied which will permit the machine to be readily handled by means of overhead cranes.

Extremely light weight is of no especial advantage in a stationary machine, and it is a mistake to select a generator of unusually light weight for its capacity, because the extra weight means greater strength and durability. It is also advisable to select standard types of machinery wherever such can be used, as not only is the first cost less than that of special machines, but extra parts can be ordered from stock and renewals readily made without the long delays necessary in procuring specially made parts.

The selection of auxiliary electrical apparatus is very largely dictated by the general character of the station. Where very heavy currents are generated, or where a high-tension system of distribution is installed, the selection of the proper circuit-breakers is highly important. The circuit-breaker has a function analogous to that of the safety valve on a boiler, and it is essential for the protection of the generators that the circuit breakers shall be capable of quickly and easily breaking their maximum current with certainty.

The selection of boiler and engine plant is governed so largely by the character of the fuel available and the type of generators used that it is hardly possible to lay down any general rules, as different cases differ widely. High steam pressures are almost universally used, and these call for the water-tube type of boiler. Where steam turbines are used, the boilers should either contain some provision for superheating the steam or separate superheaters should be installed.

In almost every case it is desirable to have the engines and generators direct-connected, and very few belt-driven generators, except those of quite small capacity, are used at present.

Large, slow-speed multipolar generators are designed for engines of the Corliss type, while the high-speed generators are mostly built for use with steam turbines. Smaller capacity generators of moderate speed are preferably direct-connected to self-contained engines of a speed corresponding to that of the generator.

Electric Lighting.

Electric lighting as a commercial proposition dates from 1879, at which time the first practical carbon filament lamp was produced. Previous to that time an incandescent lamp with a platinum spiral filament in a vacuum had been used experimentally, and there were also quite a number of arc lamps proposed as far back as 1840. There was no special incentive, however, for producing electric lamps prior to 1870, when the Gramme dynamo was first produced, as before this no economical method of obtaining current in commercial quantities existed.

The two main classifications into which electric lighting may be divided are incandescent lighting and arc lighting. The incandescent lamp, with its fine carbon filament, and the arc lamp, with its carbon pencils, supply practically all the electric lighting in use, although there are a few special types of lamps, some of which have been introduced quite recently, which are highly efficient, and give promise of large future developments.

Incandescent Lamp.

The incandescent lamp consists, broadly, of a fine filament of carbon, enclosed in an exhausted glass bulb with platinum terminals attached to the end of the carbon and leading out through the glass. When a current is passed through the filament its resistance is such that it is heated to incandescence. Being contained in a vacuum, the filament is not consumed, and therefore lasts for a long time.

Carbon is a substance particularly suitable for incandescent-lamp filaments, although quite recently metallic oxides of some of the rarer metals have been used for this purpose with considerable promise of success. Whatever substance is used for this purpose must be capable of withstanding a temperature of about 1,300 degrees C. and must be an electric conductor of very high resistance.

The carbon filaments were first made by cutting off thin strips of paper, bamboo and other substances, and later were made of thread treated with sulphuric acid to carbonize it. The modern filament, however, is a "squirted" filament. A carbon compound, known as cellulose, is made by treating cotton with chloride of zinc, the resultant product being a jelly-like mass. This material is squirted through a die, coming out in the form of a thread, which is placed in alcohol, which hardens it. After being washed and passing through different treatments to remove the zinc chloride, these threads are wound on forms and are carbonized by being heated to a very high temperature without access to the air.

The resultant filament is composed of pure carbon from which all volatile matter is driven off by the high temperature at which the filament has been carbonized. The heating is done in crucibles containing the forms on which the filaments are wound, which are packed in with powdered carbon.

After the filaments have been prepared, they are hard, although flexible like wire, and maintain the shape in which they are formed. The filament is then cut into proper lengths and its ends cemented to the platinum wires which lead in through the glass. Although platinum is very expensive, it has been found to be the only material suitable for this purpose, because its rate of expansion and contraction with heat is practically the same as that of glass, and as a vacuum must be maintained within the bulb, it is apparent that the inleading wires and the glass must expand and contract at exactly the same rate, otherwise there would be a leakage of air around the inleading wire.

If a current be passed through the filament at this stage of manufacture until it is raised to incandescence, it will be found to light up more or less irregularly, some parts of the filament being brighter than others. This is due to the fact that the filament, although fairly uniform in size, is not absolutely so, and the resistance of some parts is greater than that of other parts. To make the resistance of the filament absolutely uniform throughout its length, a process known as flashing is used.

A current is passed through the filament while it is immersed in a hydro-carbon gas considerably rarefied. When the filament becomes incandescent the carbon of the gas is deposited like a plating on the surface of the filament, the hottest parts receiving the greatest deposits, and the cooler parts less, the effect being to make the diameter as well as the resistance uniform. By this means any irregularities in the filament are entirely eliminated.

As the flashing process increases the diameter and decreases the resistance of the filament, the process must be stopped as soon as the desired resistance is attained.

The effect of the flashing is easily seen on the surface of the filament. Previous to this process the surface consists of a dull black color, which, after flashing, changes to a hard shiny gray color. The increased hardness of the surface considerably increases the length of life and the efficiency of the lamp.

[*To be continued.*]

Note.—This series of articles, intended to survey, briefly, the whole field of applied electricity for light, power and heat, was begun in the Western Electrician of February 2, 1907.

QUESTIONS AND ANSWERS.

Dynamo Design.

F. C. S., South Chicago: Please tell me why the series field windings are always closest to the armature in direct-current machines; that is, the shunt winding is always on top of the series.

Answer.

The reasons for such construction are entirely mechanical and economical. For instance, with the heavy series coils placed near the ends of the poles the wires between adjacent coils are shorter than if they were placed near the yoke (on multipole units). Some copper is thus saved.

Grounding to Water Pipe.

B. H. S., Belleville, Pa.: Is there any danger in connecting a ground wire from a telephone lightning arrester to water pipes in the cellar?

Answer.

The latest edition of the National Electrical Code refers to such a connection in the following words: "The ground wire of the protective device shall be run * * * in as straight a line as possible to a good permanent ground. This may be obtained by connecting to a water or gas pipe connected to the street mains. * * * When connections are made to pipes, preference shall be given to water pipes."

Duplex Telephony.

J. H. A., Windsor, Mo.: (1) Is the Chicago-New York long-distance telephone line duplexed? (2) Is duplex telephony practiced?

Answer.

Just what the questioner has in mind when he uses the term "duplex telephony" is not clear. By analogy from the familiar term "duplex telegraphy" it is possible that he refers to the possibility of two independent conversations taking place over the same circuit at the same time. Engineers of the American Telephone and Telegraph Company, which operates the long-distance line between New York and Chicago, say that this is considered impracticable. On the other hand, on many long lines, including that referred to in the question, the same wires are used for simultaneous telegraphing and telephoning without interference. If the latter meaning was the idea of the question, simultaneous telegraphing and telephoning is extensively practiced, but so far it has seemed impossible to arrange for two independent telephone conversations over the same circuit.

SELLING ELECTRICITY.

Under this heading will appear, from time to time, articles, suggestions and examples which will be of assistance in the constant effort to increase the existing demand for electric current and to create new demands.

Electrical Co-operator's Creed.

Subjoined are the nine winning contributions for the prizes offered by the Co-operative Electrical Development Association. It will be recalled that the association offered nine prizes, ranging from $100 to $10, for the best brief expression of the idea and purpose of the Co-operative Electrical Development Association. A further prize has now been offered to the nine prize winners here named for the preparation of a further creed, each having the advantage of the work of all the others, and it is thus hoped to select one which shall be the final electrical co-operator's creed. The nine creeds following are placed in the alphabetical order of the authors' names.

I believe in the cause, in its present worth, and future greatness.

I believe in the man who represents it.

I believe that the co-operation of such men in such a cause divides the load and multiplies the power; that it carries its message faster, serves its public better, and gains for each a larger share in the merited reward.

I further believe that lack of unity means waste of energy, weakened effectiveness and narrowing horizon.

I believe in hard work, in cheer, in loyalty, in honor, in intelligent work and that enthusiasm for the common good which willingly divides and eagerly assists.

I believe in our motto, and that in the spirit of "All together, all the time," the standard which we hold, we cannot fail to win the cause for Everything Electrical. LEWIS L. BRASTOW.

Whereas, A single ampere-turn of wire on an iron core will produce but a very insignificant magnetic attraction, though the ampere-turn is the fundamental unit of the most powerful magnets: and,

Whereas, A single incandescent lamp would look pale and lonesome if used alone to light a ballroom hall, though the incandescent lamp is the fundamental basis of the most brilliant and successful ballroom illumination; and,

Whereas, A single arc lamp applied to the lighting of a city's streets would be practically useless in preventing the after-darkness crimes of metropolitan life, though a sufficient number burning in unison throughout the night lend the safeness of day to a city night; and,

While, A single ton of coal, a single boiler, a single engine, a single dynamo, or a single electric car may be hopelessly inadequate to move the passenger traffic of a city's streets, yet the traffic of the streets of many cities is being smoothly and quickly moved by the combined united efforts of many such units;

Hence, It is evident that what is true of the physical forces, which we direct, and of their application to the arts and inventions, which reflect ourselves in nature, is equally true when applied to our own efforts and not only corroborates the national axiom, "In union there is strength," but evolves the commercial corollary, "In co-operation lies comprehensive success."

Therefore, be it resolved—

That we believe in co-operation as the natural supplement of individual effort.

That what benefits one in the electrical profession raises the general average of success to all.

That our own success and happiness in life depends largely on the success of those associated with us, and

That everything we do which promotes the interest of the general profession, and the business whereby we gain our livelihood, is indirectly a step in the promotion of our own personal welfare. HUGH A. BROWN.

I believe in electrical co-operation; in its soundness; its wisdom, and in its value to my associates and to myself, individually and collectively.

I believe in the more extended use of elctric current by the public for light, heat and power, and that through co-operation this result can be best obtained.

I believe that the interests of the allied electrical industries are my interests; that I am best serving myself by co-operating with them to the best that is in me.

I believe that I cannot know too much about things electrical; that the individual who daily acquires some fresh knowledge, who makes some little advancement each day, is the man who in the end comes to the top, and that co-operation is the means to the end.

I believe that the interchange of ideas, experience and suggestions is bound to be of mutual advantage; that men succeed only as they utilize the ideas and services of other men, and that co-operation is the keynote of success.

I believe in the necessity of harmony and in the loyal and hearty support of every man connected with the electrical industry to the principles of co-operative work.

I believe that co-operation means education, progress, efficiency and prosperity.

I believe that in unity there is strength, both individually and collectively, and that success will come by working "all together, all the time, for everything electrical."

I believe that co-operation is the most effective way to secure the most of what each one desires to obtain.

I believe in electrical development through co-operation.

Therefore, I will be a co-operator.

RICHARD E. BROWN.

I believe that co-operation is to be the life of the electrical trade.

I believe that more electrical supplies and current can be sold by boosting everything electrical everywhere all the time, with emphasis on my own goods, than by knocking the other fellow's goods to sell mine.

I believe that electric-light and power service ought to be used much more than they are and for more things than they are.

I believe that the first thing for every electrical man to do is to set the example by using all of these electrical necessities, conveniences and luxuries himself and then to talk about them to his lay friends.

I believe that until electrical men make daily use of these conveniences, they are talking from a second-hand knowledge only, and are not likely to enthuse the public much about them.

I believe that it is only by pushing that the general public can be brought to appreciate and use electrical conveniences, and that this pushing should be done by electrical men all together, all the time. J. R. CRAVATH.

I believe that in the civilized world today electricity is the greatest agent for doing the greatest amount of good to the greatest number of people.

I believe that in advocating the use of electrical service I am helping to make life more cheerful, hopeful, healthful and useful for all classes of people.

I believe it is desirable to take advantage of every opportunity to increase the sale of electrical energy, and that co-operation points to many opportunities for the use and development of electrical service which might not be discovered by individual effort.

I believe that every man engaged in the electrical business knows something about it which I do not know, but which I would be the better for knowing. I believe that co-operation is the best means for me to obtain such additional knowledge.

I believe that the true interests of electrical distributing companies and manufacturers of electrical appliances are identical with the interests of consumers, and that co-operation is essentially to the advantage of all.

I believe that the co-operation of the public is necessary for the permanent upbuilding of a distributor's business, and that this co-operation can only be obtained by means of good service, square dealing and courteous treatment.

I believe in the efficacy of individual effort, and that the way to obtain the fullest advantage from individual effort is by co-operation.

I believe that the best test of all work is results, and that in the co-operation of individuals, corporations and associations toward a common end, the highest results are assured.

I believe that the chief aim in my daily work is success, and that co-operation will help me make the victories of today the stepping stones for the achievements of tomorrow.

I believe in the potency of persistent labor, and that in order to enjoy the full fruits of my labors, I must be a co-operator with others who are working along similar lines.

I believe that the time to co-operate is now—and always. S. M. KENNEDY.

I believe that two horses can pull a bigger load than one. Same with men.

I believe that two men can do more by pulling together at the ye-o-ho than by pulling apart. I believe in the ye-o-ho.

I believe that I know a good deal, but some other man knows something I don't know. I can use that something.

I believe that a wise man learns from everybody—and shares his wisdom to get more.

I believe that the more people know of electricity and its appliances, the better they like it. I believe in teaching them.

I believe that most doors open inward. Therefore in PUSH.

I believe that the electrical business is interdependent and co-operation is the keynote.

I believe in sense, sand and suavity—in treating my customer as an intelligent gentleman. Then he will discover that I'm one.

I believe in giving my co-worker in the electrical field the glad hand of honesty and help and in grasping his as heartily.

I believe that the only pull is pulling together, "All together, all the time, for everything electrical."

CHARLES W. LAMB.

I believe that my first duty is to care for those who are dependent upon me; I believe that to fulfill that duty faithfully under present social conditions I must avail myself of the help of my fellows, and I believe that to secure that help fairly I must extend it as freely as I ask it.

I believe that the existing complexity of interests compels me to single out one and to work for that interest with unvarying fixedness of purpose.

I believe that in doing this, and to be a man among men, I must rise above nagging and knocking, small jealousies, petty wrangling and tainted competition.

I believe that my individual advancement is linked with inseparable ties to the advancement as a whole of the interest I have chosen to represent, and that whatever I can do to further that interest must invariably further my own.

I believe that success and prosperity are natural conditions, that failure and commercial calamity and unnatural and man-made, and that I must preach and act success and prosperity with unfaltering cheerfulness.

I believe that true contentment can be gained only through the consciousness of work well done, and that, since my chosen interest is electrical development, I must unite with my fellows in working all together, all the time, for everything electrical. PAUL LUPKE.

I believe in electri-city—the greatest "city" on earth.

Daughter of science and mother of progress.

Sister of civilization, handmaid of industry and first cousin to the Spirit of Peace on Earth and Good Will to Man.

Lightener of burdens, tamer of wilderness, annihilator of distance and goddess of light.

The most necessary of luxuries.

The most luxurious of necessities.

Who wouldn't believe in electricity?

I believe in co-operation.

Pennant-winning "team work," rather than individual grandstand play.

Constructive and profitable combination as opposed to destructive, unprofitable competition.

Greater general progress through reduction of individual friction.

Working together for the grand prize instead of quarreling together over scanty profits.

Co-operation! Who wouldn't be a co-operator?

I believe in electrical co-operation.

"All together, all the time, for everything electrical"—the application of the highest law of modern business to the greatest business of modern times.

The massing of forces to boost the sale of current and everything under heaven that uses current—the generator of an enlightened "current opinion."

The step-up transformer of low-efficiency selfishness to high-voltage helpfulness—the incandescence of enthusiasm against the resistance of conservatism—and the short-circuit to the final and complete electrification of the universe and to that millennium age when what isn't done by electricity won't be done at all. CHARLES A. PARKER.

I believe in co-operation.

I believe that if one-half the time, labor and money now spent in commercial strife within the electrical trade were turned to account in combating the natural competitors of the trade as a whole—if but a small amount of the energy now dissipated in fighting for the business that exists were devoted to the creating of new business—it would redound to the advantage of all.

I believe that this great advantage to all cannot be secured without the sacrifice upon my part of certain small advantages, the burying of certain animosities and perhaps the loss of certain immediate gains; nevertheless, I believe I am sufficiently broad-gauged and farsighted to forego the lesser advantage for the greater.

I believe that this can be done without the submerging of my individuality or the loss of any material advantages which I will get back manyfold, and of petty pride, which I can well afford to be without.

I believe the time for co-operative action is here. I am ready if you are.

FRANK B. RAE, JR.

The prizes for the foregoing creeds were awarded as follows: First, $100, Mr. Parker; second, $50, Mr. Rae; third, $25, Mr. Lüpke; three of $15, Messrs. Brastow, Kennedy, R. E. Brown; three of $10, Messrs. Lamb, Cravath, H. A. Brown.

Establishing Day Circuits in Towns of 10,000 Population and Under.[1]

By Frank H. Plaice.

When we look over the list of central stations in the United States we shall find many cities of between 5,000 and 10,000 which are not as yet enjoying the conveniences of 24-hour service, and if we extend our investigations to towns of less than 5,000 we shall find that continuous electric service is practically unknown.

The possibilities of the smaller locality have been overlooked or neglected, until today the average central-station management is honest in the belief that a day service in the little town is impossible. While we will admit that the average electric company operating in small towns has a precarious existence, still we will contend, and there are examples to prove the contention, that the companies are themselves entirely to blame for such a condition, and that the communities at large can in no way be held as being responsible.

Be that as it may, the small communities are rapidly awakening to their rights and are beginning to demand in no uncertain manner that their needs and conveniences be considered, and that electricity be placed on a par with gas and water and its distribution throughout the 24 hours be made universal.

As a business proposition it is a good policy to anticipate a request rather than comply with a demand, and we as public-service companies should meet the question promptly and then see to it that we make the new operating condition a profitable one.

The question as to whether a given community can or will support a day service is merely an excuse for delay and a very poor one at that, for there is no doubt but that any community that can maintain an electric-lighting plant will support the additional service if such support is sought for.

Rates and Methods in New Bremen.

It is this phase, the seeking for profitable new business by a small company which has undertaken the task of maintaining a 24-hour service in a town of less than 1,500, that I shall attempt to describe.

Generation is by gas engines using natural gas. As for competition, coal may be had at $3.40 delivered and natural gas for all purposes at 25 cents per thousand. There are no public contracts, the company being dependent upon commercial work alone. The earnings at the beginning of the day service, May 1, 1904, were somewhat less than $4 per capita per year.

With these conditions it was determined, for various reasons, that a 24-hour service should be attempted, and with that in view, future plans were laid. A sliding scale of rates on a basis of the number of hours of service was decided upon. As finally worked out this schedule was as follows: For the first 7½ hours, 20 cents; for the next 7½ hours, 10 cents; for the following 15 hours, 9 cents; for 20 hours thereafter, 6 cents, and for the next 30 hours, 3 cents. All after, 2 cents, or 7 cents for a three-hour service and 2 cents thereafter with no minimum, no meter rental and free renewals.

The constant to determine the hours of service was in practice, neither the actual maximum demand nor the maximum rated load installed, but a figure based more particularly on the area to be lighted and approximating three fourths watt per square foot of floor area. A customer was allowed to install as many and as large units as might be desired, the one using a large candlepower per square foot paying a much lower rate for his current than the economical customer who preferred small illumination. The object was to encourage or force free use of current, and the rapidly falling rate was to enable long hours of service economically.

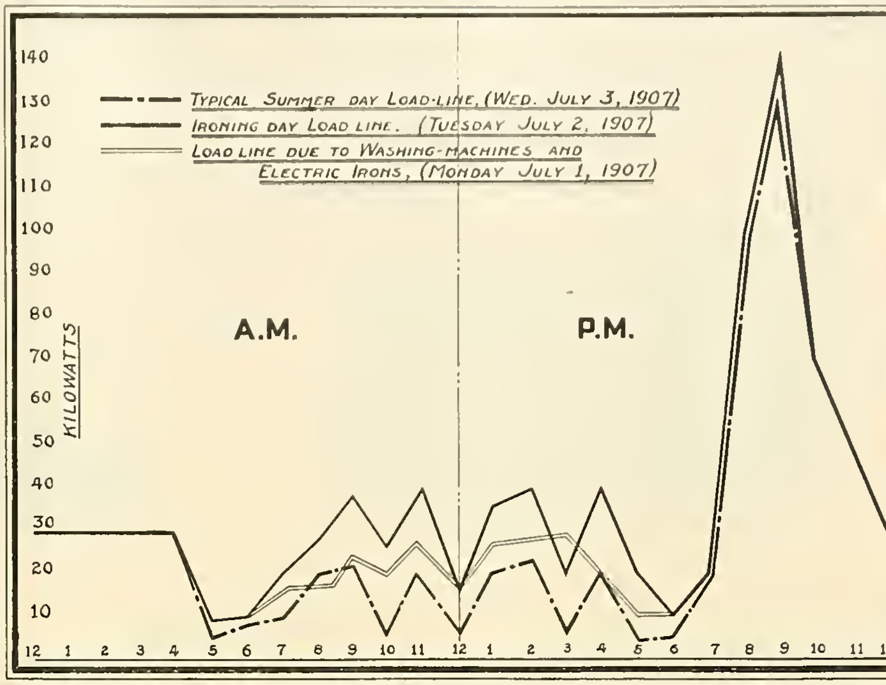


FIG. 1. HOURLY LOAD CHART OF THE NEW BREMEN (O.) ELECTRIC LIGHT COMPANY. (68 FLATIRONS CONNECTED.)

The plan has done the work well, the average output per month being 20,000 kilowatt-hours for a 250-kilowatt plant, and the average return to company, being five cents per kilowatt gross and 1¾ cents per kilowatt net.

Free wiring has been done for some years, and it was decided to extend this principle to any and all equipment that a possible customer might desire to make use of in connection with the new service, but such installations are on a rental basis and a charge of one cent per month for $1 invested is made. This method has been highly successful with the company, and under it is included all classes of mechanical equipment, as motors, shafting, pulleys, belts, wiring, lighting fixtures (except arc lamps, for which no rental is charged), heating utensils of all kinds; in fact, everything that will assist in the increased sale of current.

The only contract that is required on such installations is one showing the itemized ownership of same and the rights of removal on the company's option. The extent to which this plan has been followed is shown by the fact that of the 370 service taps connected to the lines nearly three-fourths of the number feed installations belonging to the company.

The service is as near high grade as most cities maintain, and this is best proven by the fact that during a two year bitter franchise fight between the company and the town, not one word has ever been said against the service.

Advertising.

Very little money has been spent in the usual forms of advertising, and while there is no doubt as to the great value of printed advertising in large places, where the public must be reached indirectly, the fact that in small localities the person doing the soliciting is or should be personally acquainted with every person in the territory, renders this form of advertising unnecessary. Personal work is so far preferable as to eliminate all value from paper or circular publicity.

This personal work may take many forms. The electric company can, with profit to itself, become the consulting engineer for all mechanical enterprises in its field, even though at the time there may be no opportunity to add any additional service thereby. Again, installing service on trial is another form of effective advertising. Trading in equipment that your service renders unnecessary is another, and an excellent form, for you thereby eliminate such equipment as a future possible competitor.

Along this line it has been the practice of the company to dismantle gas or gasoline lighting outfits as soon as electricity was installed, and in this way to do away with a future possibility that was unpleasant. The policy of the company has been to take special pains to secure the little customer, both lighting and power, and it has never refused to carry its service into premises for any service of 16 candlepower or over. The result of this has been that gas-lighting companies have acknowledged the effect of the central station's efforts on their business by sending a special agent into the town to see where the sales were going to.

Characteristics of the Service.

Flatirons are especially profitable as day load, and with something over 60 irons in service the company can claim a new kind of a peak load. (See Fig. 1.) This strikes the station about 10 o'clock on Tuesday morning, and on a hot summer morning has been known to reach over 150 amperes above normal, and, except for a drop at noon, lasts until four or five o'clock. On more than one occasion, this load, coming as it does with the motor peak, has necessitated a second engine on the load. Although using very little current, singly, still collectively sewing-machine and washing-machine motors are extremely good household current salesmen.

The company has been making experiments as to rural service with a view of extensive work in that line, having six miles of such lines in operation supplying a 24-hour service. The same conditions and rates apply as within the corporation. Fifteen motors, aggregating 50 horsepower and about 150 lamps, are connected with these lines and the results are very encouraging. In all, the company has at present connected to its lines 7,000 incandescent lamps of all sizes, 45 arc lamps and 90 horsepower of motors, earning on a capitalization of $15,000 (no bonds) an average income of $1,000 per month in a town of less than 1,500. (See Fig. 2.)

While the street lighting contract was lost on May 1, 1905, it hardly shows on the earnings chart for the reason that in the succeeding nine months

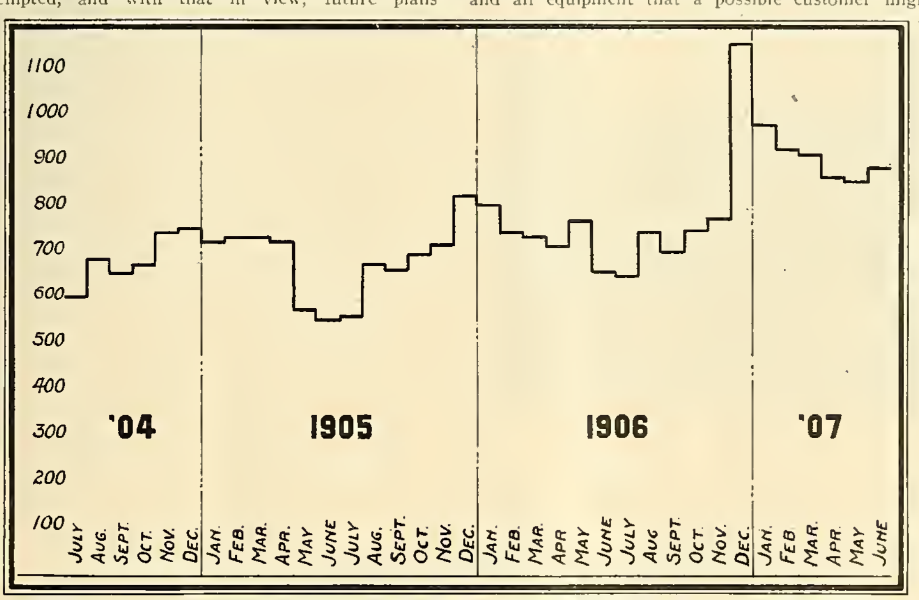


FIG. 2. MONTHLY EARNINGS CHART IN DOLLARS OF THE NEW BREMEN (O.) ELECTRIC LIGHT COMPANY.

1. This article consists of a paper presented by Mr. Plaice at the Washington convention of the National Electric Light Association, June 7, 1907, with some additions including the diagrams. The author is the general manager of the New Bremen (O.) Electric Light Company, which has for its motto, "We intend to light every building and turn every wheel within a radius of ten miles." The place has a population of but 1,500, and the remarkable results accomplished there by Mr. Plaice were first published in an article in the Western Electrician of May 4, 1907. The present article may be considered as supplementary, bringing out some points not covered in the first.

the loss was more than covered with new commercial earnings.

Especial attention is called to the flatiron load line, shown in Fig. 1. This will show very plainly the beneficial effect of irons on the day load of a small station, although it is more marked in the case of New Bremen than in many, for the reason that our customers nearly all wash on Monday and iron on Monday and Tuesday.

In conclusion, the company would recommend from its own experience that some form of demand system of rates be used, that great energy be directed to the securing of many little customers; that some form or method of free installation of equipment is desirable; that a personal rather than an impersonal form of advertising be used, but that the advertising allowance be of liberal proportions to the income; that co-operation in everything electrical is to be desired and that the little company should by all means join the associations, both state and national.

DISCUSSION.

Mr. Plaice (in addition): We have one customer that is a sort of combination customer. There were some six stores which combined into an arcade, forming a $60,000 concern, and they contracted with us for lights, and use a minimum of $900. They do not exceed the minimum. The next largest customer brings in $150.

George N Tidd, Scranton, Pa.: Mr. Plaice states there are 370 service taps. How many buildings are supplied? I understand that you use special machinery to promote a day load. I believe you milk cows by electricity. What do you do on Sunday when the day load is small? Do you operate your plant? If so, what sort of a load have you?

Lawrence Manning, Owosso, Mich.: I ask Mr. Plaice on what basis is his average rate of 12 cents per kilowatt-hour. Is that connected load or maximum demand?

Mr. Plaice: We are wiring 85 per cent. of the buildings in town. We have not as many service taps as buildings, but that is explained by the fact that some of our customers have two or three different services. We have customers with light service, who use current for power also; a number use it in their stores and in their houses as well, and they are all separate. That is the way the large number of services come in. In addition, we have quite a number of services through our country lines, which runs it up. We have not got all the coal-oil lamps out of the residences yet, but hope to eventually.

After deducting all the cost of current at the actual cost to us, interest on the investment, and allowing 10 per cent. for depreciation, we paid last year 40 per cent.

We use bare wire, and on the lighting end we wire up two 250-volt lamps in series, switches on each pair of lamps, fuse boxes outside of buildings, and do not get more than one ampere in circuit. Every installation is protected by kick coils and lightning arresters. All power motors are protected in this way also, except the small ones close to the station. We have 60 pairs of lightning arresters, and so far we have not been shut down by lightning, although our neighbors have.

One of our dairy farmers last June bought the first electric milking outfit that was installed in the state of Ohio. It took three men three hours to milk 50 cows. And this was repeated night and morning. The milking machine milks four cows at a time, and milks them all in 1¾ or two hours. It costs him about $6 a month for current, and he is satisfied.

Our Sunday day load is small; it doesn't make any difference whether we have any load or not; the engine goes just the same. At first we tried running 20 horsepower on the load, and we found once in a while the big farm motors would be slapped on us on Sunday, and so we maintain the same service on Sunday as on weekdays.

Our rate is not based strictly on the maximum demand of the customer, or the maximum that would be possible if he used the connected load. Our trouble has been to get customers to use lamps large enough and enough of them. We want them to use plenty of light. When a customer has poor light, and not enough of it, he will blame the company. There is another thing. We take a four-watt lamp, at 110 volts, and burn it at 120 volts. Instead of the customary 16 candlepower the customer gets nearly 22 candlepower and he also gets, instead of four watts, an efficiency not far from three watts. The four candlepower under that condition would give about six, eight candlepower about 12, and 16 candlepower about 22.

When it comes to motor business, our constant, which we take and divide into the meter reading, gives us the rate which the customer is entitled to. Suppose a customer has a constant of 10, and uses 15 kilowatts, you get 1.5. He would be charged for 10 kilowatts, or one hour of service, at 10 cents, and the other five kilowatts charged to him at six cents, which makes his total bill. If he uses current until he passes the two-hour mark, we charge two hours at nine cents, and all in excess will be charged at three cents, until he reaches the three-hour mark, when he is charged at two cents.

Frank W. Bullock, Jamestown, N. Y.: I understand you have natural gas at 25 cents a thousand, and also have about 90 horsepower in motors, and your lowest rate gets to two cents a kilowatt. I would ask if you have any competition with gas engines in power, or gas mantles in light, and the value of the gas in British Thermal Units. In the district where I am it has a value of 1,000 British Thermal Units per cubic foot, and we find, for large-motor service, in view of competition, we have to get down to something like one cent per kilowatt-hour. I understand in this territory you get an average of about five cents per kilowatt-hour on all your business, and I ask you if you have gas engines and gas mantles in competition with your business.

Mr. Plaice: In gas lighting we have no competition any more. The gas company is "licked" completely. We have not got a gas light on our lines. There is one isolated plant in our town, a factory, which only uses lights, possibly, for 15 nights a year, which is likely to come on in the holiday time. We did not care for that. For their day service they burned gas lights. We did not want to take their business. There are several gas engines in the town of larger sizes, but none of small size. Up to the present we have catered exclusively to the small trade. We have today applications filed for something like 300-horsepower load in large blocks. Two of them would be 125-horsepower blocks. One of these firms did at one time use a gas engine. There is one gas engine on the list, 25 horsepower, that we will probably take on. We have had for two years to fight for our rights. The town says we have no franchise, and we claim we have, and until that is settled we cannot do very much.

Beginning of Single-phase Service On New Haven Railroad.

The New York, New Haven and Hartford Railroad Company on July 24th began to run regular electric trains between New York city and New Rochelle, N. Y., thus marking the inauguration of a new era in the development of American main-line railways by alternating current.

The management of the railroad decided some years ago to investigate electric traction with a view of substituting the new power for the steam locomotive. These investigations were carried on in a very exhaustive manner until finally, about a year ago, the railroad decided to install the alternating-current single-phase electric-railway system, and a contract was made with the Westinghouse Electric and Manufacturing Company for the construction of 35 locomotives of this type. The Pittsburg company was also given the order for the power-house equipment, consisting of steam turbines, turbo-generators, switchboard appliances, etc., and Westinghouse, Church & Kerr Company, engineers, were given full charge of installing the entire system.

The East Pittsburg shops turned out the first locomotive last December. The power house was completed about the same time and the installation of the machinery began at once, while in the meantime the construction of the overhead work had also been started. The last two locomotives were shipped from East Pittsburg on July 22d. Preliminary runs, tests and trial trips were made on the new line for months under the supervision of railroad experts and electricians. These were watched with the utmost interest by the entire railroad world, and all proved very successful. The railroad company, being satisfied with the result of these trials, decided to throw the electric road open to the public, and the first electric train on the road left the New Rochelle station for New York on the morning of July 24th. Since the first of August, trains were run only as far as New Rochelle; on that date the schedule was extended to Portchester, and by September 1st the company expects to be running electric trains between New York and Stamford, Conn. The service begins with 35 1,000-horsepower locomotives, each capable of pulling a train of 10 coaches at an average speed of 75 miles an hour.

The inauguration of the single-phase system on one of America's foremost main-line railroads is of widespread interest. The New York Central Railroad, as is well known, uses direct-current motors, but the single-phase alternating-current system is advocated by many of the foremost electrical engineers of the day as furnishing the solution of the problem of transforming steam roads into electric railways.

In the development of the railroad business of the world Pittsburg genius holds a conspicuous place. The invention of the air brake by George Westinghouse, which was brought out just 40 years ago, was a most important step, and the electrification of the New York, New Haven and Hartford by Mr. Westinghouse's company is the most recent advance in American railway development. In the future all but a few of the heavy express trains on the New Haven road will be moved by electricity.

Test of an Induction Motor Driving a Paint Grinder.

The new large paint manufacturing plant of the Wadsworth-Howland Company of Chicago presents an interesting example of the use of induction motors for driving an entire factory. The electric-motor equipment comprises over 40 Allis-Chalmers induction motors ranging from one to 30 horsepower and aggregating over 300 horsepower. Four 30-horsepower motors operating at a speed of 900 revolutions per minute drive six lead mixers, and five 10-horsepower motors at 1,200 revolutions per minute drive the white lead and putty chasers, three of the number being used on tandem mills. Fourteen five-horsepower machines are used on No. 6 "A" sampling mills and others for driving 20-inch water-cooled mills. Nine three-horsepower motors at 1,800 revolutions per minute drive water-cooled mills, two one-horsepower motors drive seamers, individual tanks and other auxiliary apparatus throughout the plant. All motors are belted to paint machinery, which in most cases runs at slow speed, so it is necessary to belt to each machine or group of machines through a countershaft.

A test to determine exactly the power consumed was recently made on one of the paint mills used for grinding yellow ochre after it has passed through a mixer. The machine consists of two pairs of millstones about 30 inches in diameter mounted with axes vertical, the lower stones of each pair revolving while the upper stones are fixed. The latter are fastened to the frame of the mill while the lower revolving stones are carried on the ends of vertical shafts connected by spur gearing and driven from the main shaft by a bevel gear and pinion. The main shaft runs at about 135 revolutions per minute, and with the present belted outfit is provided with tight and loose belt pulleys. The mill is driven from a small countershaft located directly above the main shaft, the motor being suspended from the ceiling.

Paint mixed with linseed oil is fed from a mixer into the upper pair of stones, and after passing through them is discharged to the lower pair. The process is continuous, but when the mill is first started it requires considerably more power than after an hour or so of running, when the stones have become heated and the paint flows more easily. The power also depends on the rate of feed and the setting of the stones, for if the latter are too tightly adjusted the power required is very much increased.

Each grinder is provided with an individual 10-horsepower belted motor running at approximately 1,130 revolutions per minute at full load and equipped with a standard Allis-Chalmers potential starter. The following tests were made:

1. Motor running idle with belt off.
2. Motor running belting and countershaft; mill belt on loose pulley.
3. Motor running mill and grinding paint.

In tests 1 and 2 the readings of volts, amperes and watts were taken, Weston instruments being used for measuring volts and watts. Current was measured by a Thomson ammeter which had a range of only 15 amperes and hence was not available for load readings. In test 3, indicating wattmeter readings were taken at the beginning and end of the test, and in addition a Fort Wayne polyphase recording watt-hour meter was placed in circuit to record the total watt-hours during the run. A four-hour run was made, the mill being cold when started.

Allis-Chalmers motor No. 28,869, 10 horsepower, 220 volts, 26 amperes, three-phase, 60 cycles, 1,130 revolutions per minute:

1. Motor running idle (belt off).
   Volts, 224-228; current, 6.5-7 amperes. Total watts, 600.
2. Motor running belting and countershaft (Mill belt and loose pulley).
   Volts, 223-225; current, 7 amperes. Total watts, 900.
   This shows that power required for belting and countershaft, 300 watts, or 0.4 horsepower.
3. Motor running mill and grinding paint under usual conditions.
   Speed of main shaft on mill, 136 revolutions per minute.
   Volts throughout test, 220-226.
   Total watts at beginning of run (paint stiff) = 10,300.
   Total watts at end of four-hour run = 7,200.

This indicates the decreasing power consumption as the mill becomes warmed up. Total number of kilowatt-hours during four-hour run, as shown by recording meter, was 26. This gives an average of 6½ kilowatts input required to operate the mill. In all these tests the average watts, as shown by the indicating meter, were higher than the average from the recording meter. This, a 25-ampere instrument was overloaded part of the time and doubtless read low, while the indicating meter was a new instrument carefully checked before the tests and found to be correct within one per cent.

It was found that 386.75 pounds of paint was ground with an expenditure of 24 kilowatt-hours. With millstones in first-class condition it is thought this output could be considerably increased without materially affecting the power consumption. In the present test the stones had not been dressed for some time and the amount of paint ground was therefore lower than it would otherwise have been. The ratio of the wattmeter readings on the two sides of the circuit showed that the motor operated at an average power factor of approximately 90 per cent.

New Motor Rheostats.

The National Board of Fire Underwriters recently proposed a rule bearing on the vital part of a motor-starter, the resistance, which has aroused general interest. This rule stated that the resistance conductor should possess a low or negligible temperature coefficient. One of the arguments against the proposed rule was to the effect that resistance material of low temperature coefficient cost so much that motor-starting rheostats would have to be built with less material. This, it was stated, would require that the resistance material be embedded close to a heat-absorbing mass, and such construction would interfere with the rapid cooling of the rheostat.

In the light of this discussion a new motor-starting rheostat (Fig. 1) has just been placed on the market by the General Electric Company and is described by the maker as follows:

This line of rheostats, with no-voltage release, known as type SA, and with no voltage and overload release, type SQ, is constructed with a new resistance unit not only having a negligible temperature coefficient, but also permitting a ventilated construction of the rheostat.

The new resistance, designated the form P unit, consists of a low-temperature resistance material wound on a tube which is ventilated inside and out. The whole is covered on both surfaces with a special compound which effectively protects the wire and holds it in position. The unit so formed is absolutely fire and moisture proof, and, if accidentally raised to such a degree of heat as to melt the wire, will open the circuit without appreciable arcing. The design of the form P unit, furthermore, increases the starting capacity of the rheostat from a duty of 30 seconds to a duty of one minute without increasing the dimensions.

In addition to these electrical characteristics, the new unit permits many improvements in detailed mechanical construction. Because of the reduced space which the form P unit occupies, not only is the space required per horsepower much less, but more room is available in which to make internal connections. This, together with the fact that all leads are insulated with glass beads, eliminates danger from grounds or short-circuits caused by crowded leads. The glass beads are excellent insulators and are also absolutely fireproof.

The form P resistance unit as described is used in rheostats of the following sizes: From one-eighth horsepower up to and including 15 horsepower at 110 volts; from one-eighth horsepower up to and including 30 horsepower at 220 volts, and from one-eighth horsepower up to and including 35 horsepower at 550 volts. In rheostats up to two horsepower the form P resistance units are fastened to supports independent of the iron cover, these supports being fastened to the slate top of the rheostats (Fig. 2). This allows the resistance unit to be removed for inspection or repairs without disturbing other units or connections. In larger rheostats the iron grid type of resistance is used, the grids being treated with a compound which prevents rusting.

The mechanical features of the new rheostats have also received thorough consideration. Necessarily subjected to hard service, the switch arms, contact shoes, segments and connections are all designed to meet such conditions.

The arms of the dial switches are of rugged construction and will undergo heavy handling without injuring the contact between the sliding brushes and the segments. The springs which pull the arms to the "off" position encircle the pivot stud and are positive in action. The arms may easily be removed from the rheostat by slipping out a cotter-pin. The dead segments on the starters have been made of ample proportions to insure the proper breaking of the current when the switch arm flies to the "off" position.

In the smaller sizes the sliding contacts consist of copper shoes held down firmly on the segments by springs. On motor rheostats above 7½ horsepower, 110 volts; 10 horsepower, 220 volts, and 15 horsepower, 550 volts; brass blocks are provided with carbon protecting blocks which precede the brass blocks while starting; this prevents pitting. The contact blocks in all sizes are self aligning and can be renewed readily without removing the switch arm from the slate.

Care has also been taken with the stationary contact segments. The stationary contacts on smaller sizes are of brass, while on rheostats of larger sizes all the stationary contacts are made of copper and are renewable from the front. Rheostats in the larger sizes also have the initial contact point protected by an auxiliary button, which may be removed and renewed from the front.

The motor shunt-field circuit is made and broken on the first live segment of the starting switch. When the starting arm passes to the "off" position the field is discharged through the motor armature and the starting resistance. This resistance, however, is not in series with the field in the "running" position.

All of the rheostats are fire and moisture proof and are built to withstand the hardest service. They are suitable for starting direct-current motors ranging in capacity from one-eighth horsepower to 35 horsepower at 110 volts, and from one-eighth horsepower to 50 horsepower at 220 volts and at 550 volts. The general appearance of the rheostats is shown in the accompanying illustration.

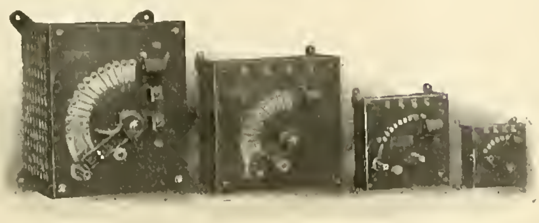


FIG. 1. NEW MOTOR RHEOSTATS WITH LOW-TEMPERATURE RESISTANCE UNIT.

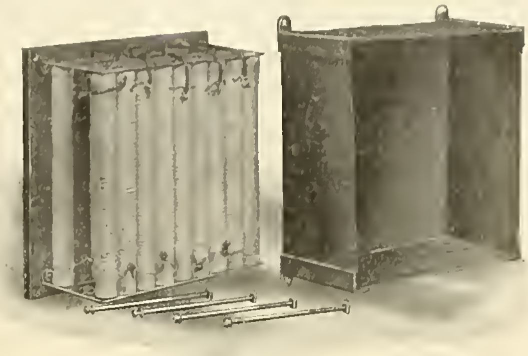
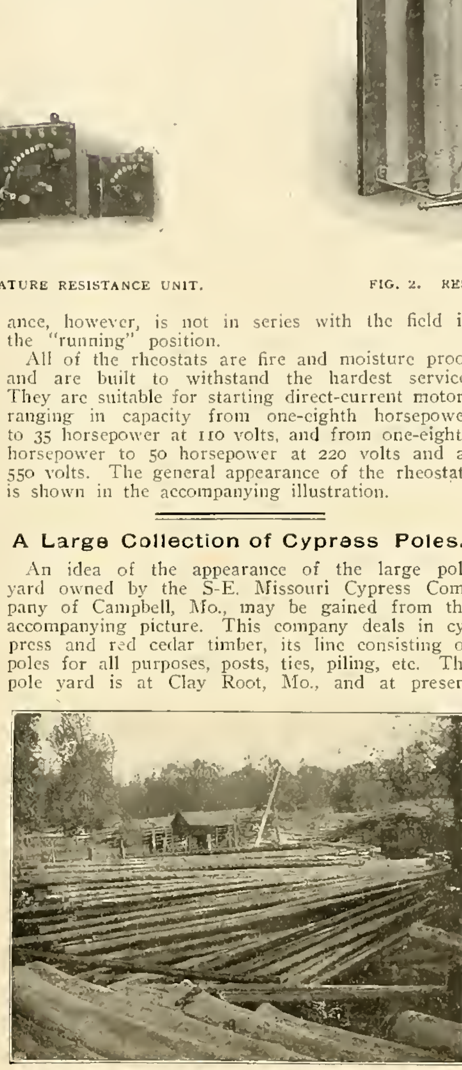


FIG. 2. RESISTANCE UNIT OF NEW MOTOR RHEOSTAT.

A Large Collection of Cypress Poles.

An idea of the appearance of the large pole yard owned by the S-E. Missouri Cypress Company of Campbell, Mo., may be gained from the accompanying picture. This company deals in cypress and red cedar timber, its line consisting of poles for all purposes, posts, ties, piling, etc. The pole yard is at Clay Root, Mo., and at present there is in stock about 50,000 poles of various lengths and sizes. Most of these poles were cut for use on trolley lines. Those shown in the picture are all cypress, the lengths and sizes ranging from 20 feet, five-inch top, to 60 feet, 10-inch top. There are about 10,000 each of 35 and 40-foot poles with seven and eight-inch tops, respectively.



POLE YARD AT CLAY ROOT, MO.

Electric Cooking Demonstrations in Elgin.

The electric-lighting company of Elgin, Ill., has been conducting some electric cooking demonstrations, of which the Elgin Courier of recent date says:

"Judging from the number of inquiries received by the demonstrator, it is only a question of a short time when many Elgin housewives will do their cooking with electricity. Contrary to the opinion in some quarters, patrons and prospective patrons of the lighting company, who install complete cooking outfits in their homes will not be called upon to pay lighting rates for current used in cooking. The plan, according to officials of the lighting department, is to establish a special rate, thereby making electrical cooking economical.

"Before the Saturday evening demonstration opened, the sidewalk in front of the company's show window was packed to the street with electric flat iron enthusiasts witnessing a modern kitchen scene. A pretty Elgin girl, who is an adept at ironing, stepped into the window and applied the electric iron to a week's washing sent in by a prospective electric-flatiron user. An electric fan stood on one end of the ironing board. While the audience perspired, ironing under such circumstances had no terrors for the young lady, because hers was the electric way."

Characteristics of Concrete Poles.

Some details of construction and accounts of recent tests carried out upon the new ferro-concrete poles will be of interest.

The reinforced construction consists of a series of continuous rods of twisted electro-carbon steel bound together by a spiral steel wire from the apex to the base of the pole. The concrete is then molded about the steel in adjustable octagonal forms. Poles over 35 feet will be constructed in the holes by upright forms. Gains for cross-arms and holes for bolts and steps are easily made while the concrete is plastic.

Surprising elasticity is displayed by the concrete poles. It is said that a pole 30 feet in length subjected to a strain of 3,100 pounds at the top deflected 30 inches from a straight line before cracking the cement. Fracture of the cement does not apparently weaken the strength of the concrete pole, for the reinforcement then becomes active and takes the strain.

A cedar pole of similar dimensions to the above is reported to have broken at 2,200 pounds, showing a crippling load equal to about two-thirds that of the concrete pole.

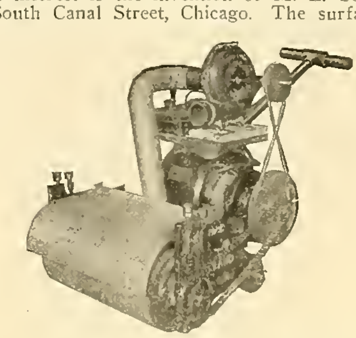
Makers of the new type of poles declare that accurate accounts of all expenditures for labor and material in their construction show that under average conditions the first cost of these reinforced concrete poles is about equal to or slightly greater than that of cedar poles set in the ground. With cement poles there is no long transportation, no unloading and loading, no cutting, stripping and shaving, no cutting of gains or boring of holes, no painting nor setting and tamping. The renewal cost is removed, as cement poles are apparently indestructible.

It is interesting to note that on account of the steel reinforcing rods, each pole provides a conducting path to ground for lightning.

This method of concrete-pole construction invented by William Bailey of Richmond, Ind., will be exploited by a company headed by A. C. Lindemuth of that place.

Electric Floor-surfacing Machine.

A new electric-driven floor-surfacing machine of some interest is the invention of M. L. Schleuter, 63 South Canal Street, Chicago. The surfacing is done by an eight-inch roller covered with sandpaper, which is easily taken off to be renewed by loosening a bolt. This sandpaper roll is backed up by a soft-rubber cushion half an inch in thickness and runs at about 600 revolutions per minute, being driven by a two-horsepower electric motor. An exhaust blower, also driven from the motor shaft, sucks all dust produced by the rolls into a canvas bag. The motor is supplied with current



ELECTRIC FLOOR-SURFACING MACHINE.

through a flexible cord from some adjacent outlet, and the machines are made for 110, 220 or 550 volts. While the assembled machine weighs a couple of hundred pounds, the friction between the rapidly revolving sand-roll and the floor helps to propel it. Danger of the roll grinding into one spot when standing still is avoided by the construction, in which auxiliary spring-mounted wheels lift the sandpaper roll off the surface when the machine is not moving. The ordinary roll supplied surfaces the floor within three inches of the baseboard, while a special edge roller is provided to be put on for finishing this strip.

Ohio Electric Light Association.

The thirteenth annual convention of the Ohio Electric Light Association will be held at Toledo, Ohio, August 20th, 21st and 22d. Headquarters will be at the new Boody Hotel. The officers and committees have arranged for an excellent programme of papers and plenty of entertainment. On Monday there will be a meeting of all the committees for organization and work, and in the evening there will be a theater party at the Casino for all.

Beginning Tuesday following the president's address the following papers will be read: "Factory Lighting," A. P. Biggs, Detroit, and J. Kermode, Cleveland; report of committee on uniform accounting, F. E. Crawford, Cleveland, and D. W. Low, Alliance, Ohio; "Luminous Arcs from the Standpoint of Central-station Operation," H. P. Grabhill, Ashland, Ohio; Report of committee on electric-heating devices, M. E. Turner, Cleveland; "Co-operative Commercialism in the Electrical Field," J. Robert Crouse, Cleveland; "The Best Form of Power for Stations of 500 Kilowatts Capacity or Less," Prof. F. C. Caldwell, Ohio State University, Columbus; Report of committee on high-efficiency lighting units, C. C. Collins and A. N. Cope, Columbus; "Helps to a Solicitor," Frank Maunsell, Toledo, J. D. Kenyon, Chicago, and A. S. Miller, Dayton; Report of committee on cost determination, M. E. Turner, Cleveland, and F. M. Tait, Dayton; "Best Ways to Meet Gas and Gasoline Competition," F. H. Golding, Dayton, Samuel Rust, Greenville, W. E. Russell, Massilon, Arthur Pomeroy, Cleveland, E. T. Selig, Mt. Vernon, and W. C. Anderson, Mt. Vernon.

Besides the papers and discussions there are other features on the programme which will be of business and technical value to the members. The badges of the association will be good for free transportation on all the city street-railway lines.

Special attention has been given to the matter of entertaining the ladies attending the convention. Aside from a large number of excursions and social gatherings a number of contests have been arranged in which the ladies will compete. There is already a long list of valuable and desirable prizes donated by the various electrical concerns.

W. P. Engle of Defiance, Ohio, is president of the association and D. L. Gaskill is secretary. Following are the heads of the various committees: Executive, W. E. Russell, Massilon; general arrangements, E. J. Bechtel, Toledo; entertainment, W. J. Hanley, Cleveland; reception, B. S. Young, Ada.

Denatured Alcohol Regulations.

The commissioner of internal revenue has issued the amended denatured-alcohol regulations which on September 1st will take the place of the regulations heretofore issued. Under the new regulations, in addition to denaturing warehouses on distillery premises, central denaturing warehouses may be constructed at such points as business interests may require, and alcohol may be transferred from denaturing warehouses by means of tanks or tank cars to consumers.

Manufacturers using completely denatured alcohol are not required to swear to an application for permit. Industrial or farm distilleries may produce alcohol from anything that contains fermentable matter. Industrial distilleries are divided into two classes. In the first class are placed distilleries of a surveyed capacity of 50 proof gallons. Distilleries of the second class are those that produce more than 50 gallons and less than 100 gallons of distilled spirits daily.

Manufacturers using specially denatured alcohol are, under the new regulations, relieved from keeping a record of the goods in the manufacture of which denatured alcohol is used.

New York Electrical Show.

The opening of the electrical show at Madison Square Garden, New York city, is announced by President George F. Parker for September 30th. The show will close on October 9th. All the larger interests in the electrical trade are said to be taking a keen interest in this exhibition and the management expects to put forth its best efforts to interest the trade and interest laymen in the latest and most up-to-date electrical appliances, inventions and devices. Madison Square Garden will be laid out with three avenues—Edison Avenue, Westinghouse Avenue and Franklin Avenue—with three cross streets. The interior will be decked with 300,000 electric lights. At each corner goose-neck lamp posts will mark the intersections and an electric arch is to mark the main entrance. Exhibits will be fitted up with all kinds of wireless appliances connecting with stations now in vogue. The New York Edison Company, one of the largest exhibitors, has in mind a plan for the exterior decoration of the Madison Square tower. German and French electrical merchants and inventors have signified their intention of exhibiting at the show.

Lignite for Electric Power Plants.

Government engineers are carrying out some interesting irrigation projects in northwestern North Dakota and eastern Montana. One feature of the present extensive work is that lignite coal, which is abundant in the district, is to be used in generating electricity for the operation of irrigation pumps. Current will be transmitted to considerable distances in some instances.

At Buford, N. D., near the Montana state line, a coal mine has been opened by the government close to the power station of the Buford-Trenton irrigation district. The coal from this mine will be run out on cars to the power plant, and the power will be used not only for the local pumping plant but also for the plants on the higher levels at Williston, over 20 miles away.

If the plan proves economical the development of cheap electrical power for various purposes will be a great incentive to manufacturing industries on The Slope, as it is called, as all over that section lignite coal is found in abundance and adjacent to the railroads and towns.

Plans are on foot for the establishment at Rockdale, Texas, of one of the largest electric power enterprises in the South. A syndicate of electrical interests represented by Joseph J. Henry of Denver, Colo., is arranging to invest not less than $3,000,000 in the installation of a power plant and the building of transmission lines to cities and towns in adjacent territory. Mr. Henry and others have been making an exhaustive investigation of the lignite coal fields at Rockdale, and their report is highly favorable. It is proposed to use the lignite for fuel, options having been obtained upon a number of the principal mines in this territory. It is said that the cost of the fuel at the plant will not exceed 50 to 75 cents a ton. Power and lighting contracts are now being made with towns and industrial concerns in the territory to be reached by the proposed system. It is stated that the prospects are favorable for enough business being obtained in Waco, Austin, Taylor, Belton, Temple, Cameron, Bryan and Marlin to justify the establishment of the big plant. There are many smaller towns which will afford a good business in the way of light and power.

Electricity from the Coal Fields.

A company proposing to construct a power plant in the heart of the Indiana coal fields and transmit electricity to Indianapolis and other large cities for lighting and power purposes is being formed by Frank M. Fauvre of Indianapolis. Articles of incorporation will be filed in a short time. The plan is to establish a large plant near Seeleyville and the mouth of a large coal mine. Because of high carrying rates it is figured that a considerable saving can be made by locating the plant at the mines. This plan was projected some time ago, but there was some doubts until recently about the right to establish a pole line for transmission across the country. The Supreme Court having decided that a pole line right-of-way may be condemned across the country for transmission has revived the project. Distribution of the electricity in Indianapolis will, it is understood, be effected through the Merchants' Heat and Light Company, which will extend its scope of activity after the new power plant is put in operation. There is considerable interest manifested in this undertaking, and the belief is general that the securing of electricity from a central plant in the coal districts is feasible.

Municipal Plant Project in Milwaukee Discouraged.

The Milwaukee News says that the movement started by Comptroller Bechtner to head off the building of a municipal electric-lighting plant is bearing fruit. Mr. Bechtner says the city cannot proceed because only $500,000 of bonds was voted upon. According to the News, a committee of prominent citizens has asked that the project be well considered. The committee says that the city cannot afford to proceed with the building of the plant and system at this time. It is argued that the money could be better spent in bridges and viaducts and street work. It is also suggested that Milwaukee is assured of light at a fair price through the protection of the state railroad commission, which may be appealed to at any time to determine whether $65 per lamp per annum is a reasonable rate. It is expected that the board of directors of the Merchants and Manufacturers' Association will send a communication to the council recommending that the lighting movement be discontinued for the present.

Indiana Telephone Items.

The Napoleon Telephone Company has filed articles of incorporation, capitalized at $15,000, to build a telephone system in Napoleon and extend the lines throughout Ripley, Decatur, Franklin, Dearborn, Ohio, Switzerland, Jefferson and Jennings counties. Jacob A. Meyer, Frank J. Grow, C. W. Foreman and Lafayette Cox are the directors.

The Burrows Telephone Company of Burrows has decided to construct and equip a new exchange building.

Although the State Tax Board at its recent session advanced the 1907 valuation of Independent telephone companies in a marked degree, the few appeals that were filed received due consideration by the board. Appeals were sustained on eight companies and rejected on two.

With the rapid advance of material and labor and the increased cost of construction and repairs, as well as that of operating a system per unit line, and the number of subscribers constantly increasing, it has become an absolute necessity in many instances for the Independent telephone companies of Indiana to secure better rates for their service. In Terre Haute, Logansport, South Bend, Richmond, Columbus and other cities rates have been increased in order to meet the conditions.

The Home Telephone and Telegraph Company of Fort Wayne has just completed installing 12,000 feet of additional cable at the Kendallville exchange. The next improvement will be made at the company's Auburn exchange, where an additional section of switchboard will be installed. The company is also turning its attention to its long-distance business and has commenced the work of stringing a new direct No. 10 metallic circuit between LaGrange, Ind., and Sturgis, Mich. The company is also in the market for material to string another direct metallic circuit from Fort Wayne to Auburn, and one direct metallic circuit from Fort Wayne to Payne, Ohio. S.

Flat Rates Conceded in Chicago Telephone Negotiations.

The committee on gas, oil and electric light of the Chicago council renewed its work on the proposed franchise for the Chicago Telephone Company last week. Those of the committee who oppose some of the provisions of the tentative ordinance were successful in having inserted a clause retaining the present $125 flat rate for business telephones in connection with the proposed new measured rate, the choice to be optional with the subscriber. It is said the ordinance will be reported to the council on September 3d.

It is also probable that a minority report will be presented at the same time. The opponents of the measure on the committee will ask that the following provisions be inserted in the franchise ordinance:

Giving the city the right to designate a purchaser for the company's property at the expiration of the grant.

Compelling the company to make long-distance connections with Independent lines wherever arrangements to this end can be made with the Independents.

Cutting down the dividend allowed the company from 10 per cent. to some more reasonable figure, probably six or seven per cent.

Establishing an efficient board of control to secure the enforcement of the ordinance, as in the street-railway ordinances. The present ordinance contains provision for a sort of board of control, but does not make adequate provision for it.

Mexican Telephone Extension.

The Mexican Telephone and Telegraph Company has just issued its annual report for the year ended February 28, 1907. The total increase in subscribers for the entire territory was 550, a gain of 106 subscribers over the increase of last year. The total increase in rentals for exchange service in all exchanges was $49,177. The larger increases have been made, as in the year previous, in the City of Mexico and Monterey. Saltillo has also made a good increase. Leon, Tampico and Vera Cruz also show fair increases in the number of subscribers.

During the year the new installation in the City of Mexico has been completed, and subscribers are now connected to the underground cable system, preparatory to cutting over from the old equipment to a new switchboard. The underground-conduit system was completed this year, consisting of 256,423 duct-feet of conduit, 110 manholes and 74 lateral connections to terminal poles. The conduit system covers the entire business portion of the city and extends into the more thickly settled residence portions. Relations with the authorities throughout the republic are said to continue to be of the most cordial nature. It is stated by T. G. Nee, assistant general manager, that it is planned to construct an extensive system of long-distance lines in the states of Nuevo Leon, Coahuila and Zacatecas. No mention of this proposed improvement is made in the annual report, however.

The Watefloo (Okla.) Rural Telephone Company has been incorporated by A. S. Reed, A. Marker, T. J. Rubble, J. M. George and Al Lynn.

Telephone Operators' School at Dallas.

It has been felt for some time that the Southwestern Telegraph and Telephone Company should have at its larger offices some distinct method or plan for training new employes in the work of operating without disturbing the service. As the service becomes more exacting and complicated it becomes very necessary that some method of training new employes be devised; with this end in view the company has established at Dallas, Tex., a school for operators, where those desiring to become operators may be trained for such work and taught to become proficient before being permitted to handle any actual service.

This school is located in the building occupied by the traffic department, and is in charge of a manager who has a principal in direct charge, she, in turn, being assisted by both an exchange and toll teacher, together with necessary assistants. The equipment of the school consisits of a recitation or lecture room and both a toll and an exchange operating room. The exchange operating room is equipped with a switchboard consisting of six positions, three of which are equipped for regular practice by the students. The other three positions are equipped with only such apparatus as is necessary for speed practice. The toll operating room is equipped with four positions of regular switchboard, with the usual equipment thereon, all of which is connected to the instructor's desk, arranged so that the various conditions which confront the toll operator may be carried out with the student, such as the use of the various tests, cut-offs, line troubles, etc.

Bell Output for June.

The American Telephone and Telegraph Company reports its instrument output for June as follows:

	1907.	1906.	1905.
Gross output	101,415	217,243	120,555
Returned	83,737	54,973	52,427
Net output	17,678	162,270	68,128
January 1 to June 30:			
Gross output	879,158	1,161,857	897,620
Instruments returned	537,607	358,335	283,542
Net output	341,551	803,522	614,078
Outstanding June 30	7,449,387	6,501,780	5,694,642

GENERAL TELEPHONE NEWS.

J. A. Ward is about to begin the construction of a telephone system in Dale, Texas.

W. H. Davenport & Co. of Hillsboro, Tex., have been given a telephone franchise in Amarillo, Tex.

The Maple Telephone Company of Geary, Okla., has been incorporated by Byron Baker and others.

The Oakwood and Owasa Telephone Company has been incorporated at Iowa Falls, Iowa, with a capital of $2,500. E. W. Wolf is president and George Baughman, Jr., secretary.

The Botna Valley Farmers and Merchants' Mutual Telephone Company has been incorporated at Oakland, Iowa, with a capitalization of $15,000. J. H. Spalti is president and George B. Clark, secretary.

The Union Telephone Company of Alma, Mich., is offering for subscription at par $25,000 of the treasury stock for the purpose of extension of plant. The company controls about 30 exchanges in central Michigan.

The officers of the Canadian Independent Telephone Association announce their annual meeting for September 4th, at Toronto, and extend a cordial invitation to Independent telephone men in the United States, particularly to the officers of their sister organizations, to attend and participate. The Canadian convention is being held during the Toronto exhibition, so that very low railroad and steamboat rates will be in force from all parts of the United States. A hearty welcome and enjoyable time is promised all who accept the invitation.

It is planned to have a representative of the International Independent Telephone Association attend all conventions of affiliated associations. To do this, it will be necessary to arrange a schedule of meetings without conflicting dates. It has been suggested that the schedule begin with the southern states in January, the various states following in the most convenient geographical order, at least 10 days apart. The associations are requested to advise with the International concerning this matter before fixing dates for meetings after the Chicago convention.

The Central Union Telephone Company held a meeting of instruction a few days ago at Springfield, Ill., for the operators, inspectors and district managers. The meeting lasted two days, the time being taken up with discussions and conferences as to the best manner of getting and maintaining service. The meeting was attended by 72 employes of the company, coming from all over the state. It is proposed to hold two more meetings soon for the benefit of those who were unable to attend this one; they will be held at Rockford and at Alton. A number of improvements in the toll system were suggested, and will be put into effect at once.

CORRESPONDENCE.

Continental Europe.

Paris, July 15.—Preparations are being made at Paris for the next annual automobile show, which will be held during the latter part of December. The occasion will be even more brilliant than usual, owing to the fact that it is to be the decennial exposition of the automobile industry. As such it will contain an interesting historical exhibit relating to the work of the early inventors in petrol and electric cars. The commission of the Automobile Club of France is now planning the different attractions for the show. Seeing that there will be an unusually large number of exhibits this year, a great amount of space will be needed. Even last year the commission had to erect a temporary building near the grand palace on the large grounds of the Esplanade des Invalides, where most of the heavy cars and also the stationary motors and dynamo groups were installed. This year there will be a much larger space covered and an ironwork building is to be erected for the purpose. To give an idea of the extent of surface covered by the annex building, this is to nearly equal the whole area of the grand palace and will be 30,000 square meters. As regards the electric features of the show, the electric lighting will play a prominent part as usual. All the new types of electric cars will be seen, as well as the combination petrol-electric cars, besides motor-dynamo groups, to which special attention will be paid, accumulators, spark coils, etc.

It is proposed to found a new electrical society in Paris which seems to be of great interest. This will be an electrochemical society and will be made up of scientists and engineers who are devoted particularly to electrolytic work or belonging to the numerous industrial firms engaged in operating electric furnace plants or similar establishments. As such industries are coming to the front in France there will no doubt be a great success in store for the new society. The project is being promoted especially by M. Robert Pitaval, a leading engineer of Paris, and he proposes to call it the Berthelot-Moissan Society.

The general director of public works at Madrid awarded the contract not long since for the construction of an electric tramway system in the town of St. Sebastian. Among other electrical operations in Spain I may mention that a new company has been recently formed under the title of the Galician Tramway Company. It proposes to transform the Corogna tramway system and to extend these lines as far as Betanzos. The company expects to install at least two other tramway lines.

In the region of Genoa, Engineer Zunim proposes to erect a hydraulic plant of some size which will utilize the water of the Orba stream and in this way furnish a large amount of power upon a network running through the Alexandrina province. He has already applied for a concession for such a plant. The amount of water to be had is estimated at 600 gallons per second during 10 months of the year. On the Orba stream will be erected a dam about 96 meters long, making a basin which will contain some 12,000,000 cubic meters. The plant is expected to furnish 2,600 horsepower and the estimated cost of the project is $500,000.

A syndicate has been formed in Italy for constructing an interurban tramway line running between the towns of Aquilia and Popoli. One of the large electrical houses is said to be interested in the project. Another tramway line of some length is to be run between the localities of Bassano and Castelfranco.

In Roumania the chief of army equipments has applied for bids for electrical material, especially for steam engines and electric motors, which are needed in the shops of the different departments, also for dynamos for electric lighting. A. DE C.

Great Britain.

London, July 19.—The report of his majesty's electrical inspector of factories is one always looked forward to. This year the document is even more comprehensive and exhaustive than usual and deals in great detail with all classes of electrical accidents upon premises which come within the purview of the Factory Acts. The report deals with the whole of the United Kingdom and shows that there were 37 non-fatal and two fatal accidents in the stations of electricity supply companies or local authorities; 14 non-fatal and no fatal accidents in private electrical generating stations, and 191 non-fatal and eight fatal electrical accidents in factories, engineering works, etc. These latter show an increase of 60 per cent. over the figures for the previous year, but the inspector sees no cause for surprise in view of the increasing use of electricity and the frequent lack of attention or knowledge on the part of the owner of the premises in the matter of taking proper precautions. In mines there have been six fatal accidents and the same number on railways and tramways. Several accidents have taken place through arcing at unprotected bare metal fuses, which exploded at the moment of switching on. This arrangement, especially when the fuse is near the double-pole switch, is condemned. In previous reports Mr. Rain has described a number of dangerous conditions of electrical plant encountered in sub-station on mines and quarry premises where the supply is taken from electrical power companies, and he again brings a similar selection to notice, many of which are ascribed to thoughtlessness or neglect. The office of electrical inspector of factories has only been created a few years, but already much good has been done as regards safety to employes by the reports and inspections of Mr. Rain.

Several electrically operated omnibuses are now plying in the streets of London. These have been built by the Electrobus Company, the formation of which last year aroused so much criticism, principally at the hands of the financial papers, that the great majority of those who originally applied for shares sought relief in the courts. The comparison between these and the numerous petrol buses is an object lesson in street travel, and to this extent the problem has been solved, but the commercial question decides, and we must wait.

It was mentioned at the last meeting of the London County Council that the futile electric power bill has, this session alone, cost the ratepayers $42,500, but the committee seeks consolation in the fact that $90,000 had been earmarked for this purpose.

Since the report upon the radio-telegraphic convention has been issued, several attempts have been made by the dissenting members to induce the prime minister to allow a discussion in the House of Commons, but without success. It appears that the government would never have appointed a committee at all but for pressure from private members, and would presumably have acted upon the advice of the departments affected.

A telephone users' association has been formed in London, apparently with the object of keeping reforms well under the notice of the authorities. There is considerable dissatisfaction at present at the withdrawal of the unlimited service rate, viz., $85 per annum, and the substitution of the message rate for large users. This means a considerably increased charge to all comparatively large firms.

Wireless telephone experiments are to be carried out between Oxford and Cambridge by the Amalgamated Radio-telegraphic Company.

Following upon the announcement of the probability of an electrical exhibition in Manchester next year comes the news that a gas exhibition is to be held there in the autumn of this year.

Some years ago when the London County Council purchased the London Tramways Company, it acquired a horse omnibus service which it worked for a short time as a portion of the tramway undertaking. An injunction was asked for, however, by other omnibus proprietors on the ground that it was ultra vires. This view was taken by the courts and the service discontinued, only to be immediately taken up by companies. The Mersey Railway in Birkenhead recently ran a service of motor omnibuses, ostensibly for the benefit of its own passengers, but this action has been condemned by the courts on the ground that it is beyond the company's charter, and also because it thereby sets up competition with the Birkenhead corporation tramways. Yet if the company went to Parliament for special powers, its bill would assuredly be blocked. C.

New England.

Boston, July 27.—The United States government is connecting all of the forts and signal stations in Boston Harbor with submarine electric cables which carry telegraph and telephone wires.

The new West Boston Bridge between Boston and Cambridge, which will be dedicated next Wednesday evening, will have four highly ornamented electric lamps on each of its eight towers. The lamps are bronze and the lights are each of 200 candlepower.

President Mellen of the New York, New Haven and Hartford Railroad Company is considering a plan for the establishment of electric spur tracks between the railroad and manufacturing plants over which to transport freight.

The Uncas Power Company has mortgaged its property to secure an issue of $150,000 bonds. The power company is constructing a large electric power plant on the Shetucket River at Scotland, Conn., and it has contracted to furnish electric power to the city of Norwich, Conn., where it will erect a transformer station.

The Hall Railroad Signal Company of Meriden, Conn., has filed a preliminary certificate of dissolution.

The Salem (Mass.) Electric Light Company has let the contract for an addition to its Peabody Street power plant.

The Massachusetts railroad commissioners have been asked to approve the sale of the Amherst and Sunderland street railway to the Holyoke Street Railway Company, which has also taken steps to acquire control of the Hampshire street railway. The acquisition of these roads would give the Holyoke company a direct electric-railway line through Chicopee, South Hadley and Amherst to Sunderland.

An electric railway between Kennebunkport and

York Beach, Me., a distance of 17 miles, has been opened for business. A person can now travel from Lewiston, Me., to Philadelphia, Pa., by electric cars.

The Metropolitan Home Telephone Company, which was granted a franchise by the Boston aldermen seven months ago, has done no work on its proposed system with which it is to compete with the Bell company. The president states that the condition of the money market has prevented it from raising the funds necessary to begin construction work. It is pretty generally believed that Max Koehler of St. Louis controls the company. Mr. Koehler says that after a trip to Europe he will come to Boston and spend $5,000,000 in getting the Home company into operating shape. B.

New York.

New York City, July 27.—The public meeting of the Utilities Commission on July 23d to consider plans for improving the traffic conditions at the Brooklyn Bridge was well attended and two of the plans presented seemed to meet the views of the majority. One is to require the Interborough and the Brooklyn Rapid Transit to enter into an agreement to run trains through from Coney Island and other points in Brooklyn to Harlem via the Third Avenue "L." The details of the plan consist in connecting the elevated tracks on the bridge with those of the City Hall branch of the Third Avenue line at an estimated cost of approximately $25,000. The second plan is to provide a moving platform across the bridge and to provide another platform or extend the bridge platform, if practicable, so as to land passengers down town in the neighborhood of Maiden Lane, with another platform running to Chamber and Church streets. Neither of these plans is a new one, but with the powers vested in the Utilities Commission it is expected that some action will soon be taken.

The newly appointed Block Signal and Control Board which has recently been appointed at Washington is expected to look into allegations made by many of the inventors of railway safety devices, who say that their inventions are being bought up but never utilized, and that the safety appliances "combine" is finding this method very profitable. By this method the combination, if there is one, is able to keep new manufacturing companies out of the field and reduce the expense of manufacturing these devices. Mr. W. P. Borland, the secretary of the Block Signal and Control Board, is reported to have said that the Eastern Railway Association is not a corporation but a sort of co-operative association which assumes to have for its object the protection of its members against infringement of patents on various devices.

Announcement has been made that the Manhattan Transit Company will operate several lines of automobile stages in the city, beginning some time in September. About 20 more stages have been ordered. Through its ownership in the Long Acre Electric Light and Power Company, which has recently been allowed space in the electric-wire conduits under the public streets, the Manhattan Transit Company has announced its intention of competing with the New York Electric Heat, Light and Power Company and has bought property for the erection of power plants. The transit company owns many valuable franchises for operating bus or stage lines throughout the city.

The engineers representing the Public Service Commission of the second district announced this week that the estimates for the elimination of all the grade crossings in the New York electric zone have been almost completed and would indicate that the state's entire appropriation of $300,000 would be practically exhausted if orders were issued for the elimination of all of these crossings. The more important ones will receive the first attention. It is also announced that the Division of Traffic has been created, with Frank Barry at its head. Mr. Barry, who for a number of years has been connected with associations of shippers, will make a study of rates and efficiency of service for the up-state commission.

A committee of bondholders of the United States Independent Telephone Company at a meeting this week decided to reorganize the company by foreclosure proceedings, which will wipe out about $5,000,000 of common stock sold to the public and $10,000,000 of common stock issued to a syndicate for securing an alleged New York city franchise. A new company is to be formed which proposes to bid in the Rochester, Syracuse and Utica operating plants and other properties and is to issue $6,000,000 of stock to be exchanged for the present outstanding bonds at the rate of 40 cents on the dollar. E. H. S.

Indiana.

Indianapolis, July 27.—A 50-year exclusive franchise has been granted the Deiterich-Murdock syndicate to operate city street-car service in Elkhart. The franchise is a substitution for the franchises originally granted to the Indiana Electric Railway Company and the Citizens' Street Railway Company. The terms provide for important reformations and changes for extensions, improvements of service, the use of the lines for all interurban companies and the construction and maintenance of a modern station at a convenient place, to be used jointly by all the interurban lines using the city tracks. The right to charge interurban lines 2½ cents per incoming and outgoing passenger, and a five-cent fare, with transfers, for local passengers within the city limits, are granted. Loading and unloading of freight in the streets are prohibited. The Murdocks say they will expend $150,000 on the plant and station in Elkhart.

At a meeting of the officials and stockholders of the Indianapolis, Huntington, Columbia City and Northwestern Traction Company in Indianapolis on the 26th inst., a committee of five was appointed to investigate the financial condition of the company and devise some plan of saving the property from being sold September 17th by the receiver.

The Toledo and Fort Wayne Electric Railway Company has obtained charter rights in Indiana and Ohio. The termini of the road will be in Fort Wayne and Toledo.

The Indianapolis and Louisville Traction Company will put its road in operation between Louisville and Scottsburg by August 5th, and between Louisville and Indianapolis by October 1st. The total distance will be 115 miles. The power station at Scottsburg is completed and the equipment in place. The line is being ballasted with broken stone.

C. T. Murdock, retiring manager of the Terre Haute Traction and Light Company, has gone to Boston, after five years of faithful service. Mr. Murdock was given a royal entertainment by the traction officials and employes Thursday evening previous to his departure. A farewell address was made by William S. Caldwell.

Representatives of outside capitalists are endeavoring to obtain an option on the Columbus Street Railway and Light Company's property. The company recently secured $3,000 on an expired option, and it is presumed that the same interests are again seeking to purchase the plant.

The Consumers' Gas and Light Company of Princeton has secured a site upon which to erect a new artificial-gas and lighting plant. The estimated cost is $60,000. Bids for the construction and equipment will be in order soon.

The joint committee appointed by the City Council of Bluffton and the Marion, Bluffton and Eastern Traction Company to conduct an investigation and test the municipal lighting plant, could not agree on the method of procedure. The city engineer and city expert insisted that the street arc lights be turned on to give the plant a sufficient load to make the tests in what they regarded a fair manner. The traction-company expert and members of the committee did not agree with them, and the result was a refusal to have anything to do with the tests, and they gave their attention to the investigation of the books and records. The council holds that this is contrary to the agreement and all that will be considered in the report is the present condition of the plant and the cost of producing current at present. A lively time is anticipated at the next meeting of the council, when the report is considered. S. S.

Illinois.

Peoria, July 27.—The R. Haas Electric Company of Springfield has commenced the erection of a new three-story building, which it will occupy when finished.

The contract for the building of the electric railway from Carthage to Nauvoo, Ill., has been let to the Federal Construction Company of New York. The entire right-of-way has been secured between the two towns except across one farm, where it will have to be secured by condemnation proceedings. Nauvoo is the old Mormon town, and has no connection except a ferry across the Mississippi. The sisters of St. Mary's Academy are financing the road, in order to make the place accessible from the nearby towns. In connection with the road the company will erect a power plant and waterworks for the town. The line will also be built across the Santa Fe bridge to Fort Madison. The Carthage branch will have a line running to Hamilton, across the river to Keokuk, where it will connect with the present Keokuk, Hamilton and Warsaw trolley system.

The Taylorville Utility Company will build its electric-light, heat and ice plant this fall. Contracts amounting to $80,000 have been let and work is to be commenced within 30 days. The total cost of the plant is estimated at $125,000, and all the money has been raised.

The David H. Wilson Company of Chicago has been incorporated with a capital of $10,000 to manufacture electrical devices and appliances. The incorporators are Henry J. Gibbs, Edward J. Kelly and Frank Richie.

The Masterson Electric Company of Chicago has been incorporated with a capital of $2,500, to do an electrical contracting business. Incorporators are Frank L. Masterson, Thomas F. Queenan and A. L. Flanigan.

Through passenger service between Springfield and Danville will soon be run on the Illinois Traction Company's system. At present the change of cars is made at Decatur. As soon as the new schedule is made the company will run three cars each way daily, and these will be known as the Capital City limited cars.

The Illinois Traction Company is short on freight cars for use on the Peoria-Bloomington line. The company had an order in for 20 freight trailers and 10 motor cars to be delivered on June 1st, but they have not been delivered yet.

A new speed record was made this week on the Peoria-Bloomington line by a special car which carried Manager Nelson and a party of Peoria city officials. The trip was made from the courthouse here to the courthouse in Bloomington in one hour and 16 minutes, the regular time being one hour and 50 minutes. From Bloomington the trip was continued to St. Louis, via Decatur and Springfield. The trip was made to show the Peoria officials some of the work that has been done by the company, and to see the various types of fender now in use by the company in other cities, as the company will equip the cars here with fenders in the near future.

The Illinois Traction Company is endeavoring to make a traffic arrangement with the Cincinnati, Hamilton and Dayton Railway for the joint handling of freight. The traction company has a St. Louis terminal and the Cincinnati, Hamilton and Dayton has no entrance to that city, its western terminus being Springfield. The traction company will also make traffic arrangements with the Indiana Traction Company. The latter company is now building to Danville from Crawfordsville, and when this system is finished the two systems will make an electric line from St. Louis via Indianapolis to Toledo, Ohio, Detroit, Mich., and Erie, Pa.

The survey for the Whitehall-Palmyra electric line has been completed, and the Illinois Traction Company has signed a contract to furnish the power to operate the road. The pottery at Whitehall uses 400 tons of coal a day and ships 2,800 cars of sewer pipe yearly to eastern points, which will make business for the new road.

The East Moline and Campbells Island Railway has been incorporated to build an electric railway from East Moline to Campbells Island. The incorporators are Joseph F. Porter, James S. F. Lardner of Davenport, Iowa, Burton F. Peck and O. E. Childs of Moline.

The Pekin Electric Light Company has finished plans for some extensive improvement in its plant. The present stack will be torn down and a new one erected in its place, which will be 20 feet square at the base and will be built of hollow brick. The boiler room will be enlarged to twice the present size and a new 25,000-gallon water tank will be built. V. N.

Northwestern States.

Minneapolis, July 27.—A franchise for an electric-light system at Bovey, Minn., has been granted to Frank McCormick of Duluth. The plant will be completed about November 1st.

The Albia and Centerville steam railroad will probably be changed to electric operation as a link in the proposed line from Centerville to Des Moines, Iowa.

The contract for the construction of an electric-light plant at Mount Ayr, Iowa, has been let to A. Bertenlanger of Omaha, Neb. It will cost $17,626.

Perley Lowe of Chicago proposes to develop the power of Place's Rapids, near Marinette, Wis. It is thought that about 1,500 horsepower can be developed.

The proposed electric railway from Davenport to Maquoketa, Iowa, has been financed, St. Louis capitalists having agreed to advance the necessary money for its construction. Most of the right-of-way has been secured.

Articles of incorporation have been filed for the Interurban Power Company of Duluth, Minn., capital, $100,000. Charles C. Cokefair heads the list of stockholders.

The Wausau (Wis.) Street Railway Company has voted to increase its capital from $120,000 to $400,000. R.

Mexico.

Mexico City, July 25.—The state of Coahuila has granted Rodolfo Garza and Guillermo de Velasco a concession to construct and operate an electric street-railway system in the city of Saltillo. This place had a mule-car system until about four years ago, when it went out of business, but since then the city has had a rapid industrial growth and the proposed system is assured good patronage.

It is reported that the 80 miles of the Salvatierra and Western Railroad, which is to be built from Salvatierra, in the state of Guanajuato, to Puruandiro, in the state of Michoacan, may be operated by electricity. Andres Bermejillo, a multi-millionaire of Mexico City, who is the promoter, is also the owner of the extensive street-railway system in Guadalajara, which is now being converted into electric traction and the electric-light and power plant there. C. A. Malau, head of the construction department of the Compania de Tranvias, Luz y Fuerza, which is the name of the Guadalajara company, has been appointed chief engineer of the Salvatierra and Western.

The survey for the Torreon and San Pedro interurban electric railway will soon be finished and the contract let for the construction of the line, which will be 26 miles long, traversing the richest portion of the Nazas River valley. The city of Torreon is rapidly becoming the center of a number of electric lines. In addition to that planned to San Pedro a line is to run from Torreon to Matamoros. An electric railway is already in operation between Torreon and Lerdo, a distance of seven miles.

The Campeche Light and Power Company, composed of Americans, which holds from the government the exclusive right to furnish the city of Campeche with electric light and power for 20 years, has purchased the plant and equipment of the Mexican Gas and Electric Company in Mexico City at a great reduction from the original cost of the plant. The price paid was $150,000. The work of dismantling and removing the plant to Campeche is now in progress. The concession is valuable, for the consideration paid for lighting the streets is guaranteed from the revenues of the state and city. The use of petroleum for street lighting is prohibited from the time the company's plant begins operation. The city agrees to pay $18,500 annually for 60 arc lights of 1,200 candlepower each and 200 lights of 50 candlepower each for lighting the streets, though it is expected that double this number of lights will be required. The city has a population of 20,000 and is spread over a large territory.

L. O. Harnecker of Mexico City is arranging to install a hydro-electric plant near Union de Tula, state of Jalisco, using the water of the Ayutla River. The power will be sold to industrial plants in that section.

Manuel Cuesta Gallardo of Guadalajara is organizing a company to install a great hydro-electric plant on the Santiago River. Mr. Gallardo owns the water and power rights on that stream for a distance of 25 miles. A concession has also been granted to him by the federal government for the use of the waters of Lake Chapala for irrigation purposes and for reclaiming land around the lake.

The electric power plant of the Sultepec Electric Light and Power Company at Temascaltepec is completed and has just been placed in operation. R. J. M. Danley is vice-president and general manager. W. D. H.

Pacific Slope.

San Francisco, July 24.—The telegraph strike in this city and Oakland has been settled by the companies agreeing to reinstate all their striking employes without prejudice at their former salaries and to arbitrate the question of advanced wages later on.

There is no new feature in the strike of the telepnone operators, but the 143 telephone linemen belonging to Local No. 151 have lost on their appeal to President F. J. McNulty of the International Brotherhood of Electrical Workers against the action of Mr. Sullivan, their chief official on this coast, who suspended them and organized Local No. 564 to replace their organization. The latter union has grown to a large membership and is holding the field in spite of all opposition.

The street-car strike has been quieting down, and this week the "owl" car service was resumed on all of the lines, the same as before the fire, with the exception of Ellis Street. Owl cars are now operated on Haight Street in place of Ellis.

The Donnels Flat Water and Power Company has been incorporated, with San Jose, Cal., as the place of business, and a capital stock of $1,000,000. The directors are William Bogen and associates.

The Roffey Electric Company has been incorporated in Oakland, Cal., with a capital stock of $100,000, subscribed in full by J. T. Roffey, Marion Griffin, Thomas Levison, I. M. Leach and A. B. Coffman.

The Board of Supervisors of Sonoma County, Cal., has granted the franchise applied for by Frank H. Burris to run lines over the county for the purpose of transmitting electricity for light and power. The Snow Mountain Power Company is expected to furnish current from a plant in Glenn County.

It is announced that the Southern Nevada Telephone and Telegraph Company will establish long-distance telephonic communication between San Francisco and Goldfield, Nev., this fall. Preliminary surveys have been made, and in less than 30 days the construction of a new metallic line will commence, extending from Tonopah to Reno, Nev. A long-distance line to Salt Lake City is also a possibility.

The Southern Pacific Railroad Company's engineers in San Francisco are preparing the plans for an electric power house to be erected in Oakland, Cal., for an initial installation of 10,000-kilowatt capacity. It will be a steam plant, using oil fuel, and located near the water front, so as to have a salt-water condensing system. It will supply power to operate the local electric lines of the Southern Pacific, which will be constructed in Oakland and in other parts of Alameda County during the next year and a half. Additional land has been purchased in Oakland to admit of increasing the scope of the new lines.

The Los Angeles Wave Power and Electric Company has closed a contract with the Atlantic, Gulf and Pacific Company to build a steel pier 700 feet long, into the ocean at Redondo, Cal. It is said that an electric power plant to be operated by means of a mechanical device actuated by the waves is to be installed at the outer end of the pier.

The Centralia-Chehalis Electric Railway and Power Company has been granted a franchise by the City Council of Centralia, Wash., for the construction and operation of an electric road between Centralia and Chehalis.

In the awarding of contracts for supplies for the municipal electric lighting system in Tacoma, Wash., Kilbourne & Soloman secured a contract for 375 Nernst lamps at $5,946; Westinghouse Electric and Manufacturing Company, 75 arc, air cooled transformers at $1,001, and the National Carbon Company, 50,000 carbons for $1,416. New bids are being received on the 4,000-kilowatt electric generating plant, as the time allowed for preparing the original bids was too short. A.

PERSONAL.

John Hissenrich has resigned as district head at Fargo, N. D., for the Northwestern Telephone Exchange Company.

A. Bromley Holmes, consulting electrical engineer to the Liverpool Corporation, has been given the degree of master of engineering.

J. R. Allen has resigned as local manager of the Northwestern Telephone Exchange Company at St. Cloud, Minn., but will continue to be identified with the company.

Hammond V. Hayes, chief electrical engineer of the American Telephone and Telegraph Company, has resigned and will be succeeded by J. J. Carty, chief engineer of the New York Telephone Company.

Sir Alexander Kennedy has received the degree of doctor of engineering from the University of Liverpool. In presenting the degree, Professor Watkinson referred to him as the founder of the first engineering laboratory.

Henry G. Pagel, superintendent of the Sheboygan (Wis.) street-railway lines, has been appointed superintendent of the Milwaukee-Northern Railway, with headquarters at Cedarburg. Mr. Pagel will take charge of the new line on August 15th.

J. N. C. Shumway of Taylorville, president of the Illinois State Electric Association, who is well known to all central-station men in Illinois, was elected to the presidency of the National Building and Loan Associations in Chicago last week.

J. P. Pulliam, of Fruitport, Mich., has been appointed manager of the Winnebago Traction Company of Oshkosh, Wis., succeeding E. B. Kirk, who has moved to Dixon, Ill. About $100,000 worth of improvements to the system are being planned.

Bernard W. Trafford, recently general manager of the Chesapeake and Potomac Telephone Company, which operates the Bell system in Baltimore, Washington and vicinity, has been appointed general manager of the Michigan State Telephone Company, to succeed James F. Land.

G. Winter of Austria, one of the inventors of the Winter-Eichberg system of single-phase commutator motors, died on June 19th. At the time of his death he was engaged in practice as a consulting engineer, but during earlier years had been associated with some of the best-known European electrical manufacturing companies.

H. Gilliam has been appointed electric superintendent of the New York, New Haven and Hartford Railroad, in charge of electric operation, with headquarters at Stamford, Conn. He will have general jurisdiction over the maintenance and operation of electric transmission lines, with accessories, power house and electric locomotives, on the New York division.

Mr. F. K. Parke has been appointed secretary of the Board of Supervising Engineers which has in charge the rehabilitation of the Chicago traction system. Mr. Parke, who was formerly auditor of the board, has had wide experience as an expert public accountant. Mr. L. R. Acton is the new auditor and assistant secretary of the board, succeeding Mr. Parke in the former position.

Mr. William B. Hale has resigned his position as general manager of the Mexican Telephone and Telegraph Company, City of Mexico, and is now engaged in special expert engineering work in Mexico which will probably keep him occupied for some time to come. Mr. Hale is pleasantly remembered in Chicago, where he resided for a number of years and was chairman of the electrical section of the Western Society of Engineers.

ELECTRIC LIGHTING.

Mount Ayr, Iowa, will install an electric-light plant.

Tecumseh, Neb., has issued $16,000 in bonds for an electric-light plant.

The Rogers Water and Light Company of Temple, Texas, and the Stephenville (Texas) Light and Water Company have been incorporated with a capital stock of $70,000 and $40,000, respectively.

Terrill, Texas, has voted bonds to the amount of $15,000 for a new lighting plant.

The plant of the Big Springs (Texas) Electric Light Company has been destroyed by fire.

The Cherokee (Okla.) Ice and Power Company has been incorporated with a capital stock of $50,000.

The Orange City (Iowa) Electric Light Company will rebuild its plant which was recently destroyed by fire.

The Sioux Falls (S. D.) Light and Power Company will soon start work on construction of its power dam.

The Minahan Building Company has been granted a franchise for an electric-light and heating service in Green Bay, Wis.

W. H. Horton has received a franchise to construct and operate an electric-light and heating plant in Heber, Ark.

The Duquesne Light Company of Pittsburg has filed notice of an increase of bonded debt from nothing to $10,000,000.

The North Side Heat, Light and Power Company of Springfield, Mo., will establish a $50,000 plant the coming year.

The Consumers' Power and Light Company of Waco, Texas, has been incorporated with a capital of $150,000 by Joseph J. Henry and others.

East Peoria, Ill., now rejoices in electric street lights. The system consists of some 40 lights, distributed throughout the city, and composed of arcs, 50-candlepower, and 25-candlepower incandescents. The city believes it has a splendid system and feels that it is not living in the shadowy past any longer.

The Davenport (Iowa) Gas and Electric Company has been reorganized with a greatly reduced capital and in the future will continue in business for the sole purpose of running the central steam-heating plant connected with the system. The old company was one of the public-utility companies in Davenport, Rock Island and Moline which were consolidated recently.

It is expected that the elaborate illumination of Niagara Falls which is to be accomplished by the use of the electric scintillator brought out by Mr. W. D'A. Ryan, illuminating engineer, will be effected the latter part of August. The apparatus must be placed on the Canadian side, involving customs regulations and a consequent uncertainty as to the exact date.

The Des Moines Edison Light Company has paid the city of Des Moines $1,454, being the franchise tax for six months. The electric-lighting company pays the city one per cent. on its gross receipts, the tax indicating that its annual receipts now amount to nearly $300,000. The Edison Light Company has had a tremendous increase in business within the past few years.

A new city ordinance went into effect in New York city on August 1st, compelling owners of electric signs which project beyond the stoop line to obtain licenses. These will be charged for at the rate of 10 cents for each square foot of sign. Under the ordinance it will be the duty of the Police Department to notify the Bureau of Incumbrances to remove all unlicensed electric signs.

Proceedings of widespread interest have been begun in Iowa to determine the legality of minimum rates on gas and electricity in all cities of the state. The case is that of the city of Fort Dodge against the Fort Dodge Light and Power Company. The council notified the company that its minimum rates were illegal and asked the company to reduce them. Failing to comply, the city attorney was ordered to begin ouster proceedings to test the law.

G. M. Gest of New York and Cincinnati has been awarded the contract for the underground system which the Peoria Gas and Electric Company will build this summer in Peoria, Ill. The plans were all made by Mr. Gest and call for a complete system. The wires will be placed underground in the business district, with a conduit on each side of the street. The intention is to commence work at once and get all the conduit in this year, and next spring to put in the wires. As the heavy load is in the business district, and the company is cutting out direct current and is operating a 2,200-volt three-phase system, the job will be a large one.

The city of Edmonton, situated in the central northern portion of the province of Alberta, Canada, has grown in recent years to a population of approximately 16,000 and become an important station among the coal-producing centers of Western Canada. In the expansion which has taken place there the municipal lighting and power plant for Edmonton has been outgrown and the initial equipment, which comprises Allis-Chalmers electric generators driven from high-speed engines, will soon be supplemented by a new plant in which gas power will be used, the first installation consisting of one 700-kilowatt gas engine and alternator, the former to operate on producer gas.

The Philadelphia Electric Company has filed a notice of increase of debt from nothing to $450,000. The bonds will be issued for improvements, it is reported.

B. S. Hare and associates have secured state charters for the Electric Valley Light Company, Braddock Fields Light Company and Jantha Light Company, all small towns east of Pittsburg, Pa.

A reduction of 10 per cent. in the cost of electric light has been made by the Rockford (Ill.) Edison Company and comes as a surprise to those who had anticipated a rise as a result of the company's securing control of the business in the city by purchasing the Central Heat and Power Company. The rate, which has been 15 cents a kilowatt-hour, will now be 13½ cents. The usual discount for cash will be taken off this price. The company says it has 2,500 patrons and that the reduction will mean about $8,000. The company feels that the increased patronage warrants the reduction. George Williams is the new manager of the company, and George N. Tidd is assistant manager.

ELECTRIC RAILWAYS.

A regular United States mail service will be established on the Winona interurban railway between Warsaw and Goshen, Ind.

The Enid, Waukomis and Oklahoma City Interurban Railway Company, with headquarters at Waukomis, Okla., has been incorporated for $200,000 to build an interurban line from Enid to Oklahoma City, via Waukomis. R. M. Brittin is president.

Surveys for electric-railway lines connecting Bozeman, Mont., with the Yellowstone National Park and with cities and towns within a radius of 100 miles are being run in Gallatin Valley. St. Louis capitalists have secured an option on the property and franchise of the Gallatin Light and Power Company, and it is said that construction work will be commenced within the next three months.

An important addition to Chicago's electric-road connections with outside points is expected to result from the purchase a few days ago of the Chicago Electric Traction Company's property by the Chicago and Southern Traction Company. The property consists of a trolley line running from Sixty-third Street and South Park Avenue to Harvey, by way of Morgan Park and Blue Island. It brought $350,000 cash. It is believed that the new owner will ultimately run its cars south from Chicago as far as Kankakee.

The Sherman-Dallas (Texas) Interurban Railway is expected to be in operation by January 1st next. Its length will be 63 miles. Exclusive of the termini, it will reach seven large and growing towns. It will directly touch a total population of 150,000 people and will be within easy reach of as many more. It is the longest electric railway ever projected in the Southwest. The power station, now being rapidly constructed in McKinney, will be one of the best-equipped and most modern in the country. The building is 100 by 130 feet in size and the machinery will be of the very latest type.

The Sheboygan (Wis.) Light, Power and Street Railway Company is offering its fine Lake View park district for sale, and announces that in the interest of all concerned it will go out of the amusement business. The decision seems to be on account of the opposition of some citizens to every progressive move of the street-railway company. Lake View covers 26 acres and has been developed by the company in a few years from a swamp to the leading amusement resort of the city. In case a purchaser is found the company will continue to run its cars to the park, but the company feels that there would be better feeling if the amusement property were in other hands.

The line of the Milwaukee Northern Railway, between Milwaukee and Port Washington, will probably be ready for operation early in September and all work is being pushed as rapidly as possible to that end. The Allis-Chalmers gas engines and complete power equipment are being erected in the main power house at Port Washington. Three-phase alternating current will be generated in the power house at 405 volts by three direct-connected alternators, each of 1,000 kilowatts normal capacity, driven by twin tandem gas engines, each with a rated capacity of 1,500 horsepower. This equipment, when in operation, will constitute the largest installation in America of gas-engine-driven electric generating units used for traction purposes.

POWER TRANSMISSION.

The York Haven Power Company has secured the contract to furnish power from its plant at York Haven, Pa., to the Valley Traction Company, operating almost 50 miles of line between Harrisburg and Cumberland valley towns. The Valley company will suspend operations at its Lemoyne plant and the York Haven company will also light several towns. The York Haven company is also furnishing power to the Pennsylvania Steel Company's works in Steelton.

The Columbus, Memphis and Pensacola Railroad Company has secured the capital for the proposed waterpower electric plant to be built at Aberdeen, Miss.

The Electric Bond and Share Company of New York city is proceeding to complete the waterpower electrical plant as originally planned by the old Cape Fear Power Company. This plant is located at Buckhorn, N. C., on the Cape Fear River. Eugene Maxwell, Raleigh, N. C., is the construction manager in charge.

The new law favorable to the development of rivers for waterpower in Wisconsin is having a good effect. In Rusk County alone four manufacturing companies, including the Menasha Woodenware Company, are developing an aggregate of 20,000 horsepower on the Flambeau and Chippewa rivers. This power will be used to generate electricity for use in manufacturing industries.

The Idaho Water and Electric Company has been incorporated at Wallace, Idaho, with a capital of $500,000. Idaho papers say that Charles G. Dawes of Chicago is largely interested in the project, the purpose of which is said to be to use the waterpower of the St. Joe River to generate electric power for use in drawing trains through the mountains on the Chicago, Milwaukee and St. Paul Railroad. It is said that the project contemplates the building of 16 dams in the St. Joe River.

The Red Fork (I. T.) Power and Development Company will build an electric power plant, expending about $100,000 for buildings and equipment of machinery. The company is planning to locate factories, to construct an artificial lake with a water surface of 111 acres, build an amusement resort, etc. F. L. Smart is president, Graham Burnham, vice-president and general manager, and J. E. Dunn, treasurer. J. Robert Burnham is engineer in charge, offices at Red Fork and Tulsa, I. T.

W. D. Boyce of Ottawa, Ill., has received from the Illinois and Michigan canal commissioners and the state of Illinois a franchise for a pole line on the towpath of the Illinois and Michigan Canal, and if conditions are satisfactory it is Mr. Boyce's intention to build a line from Marseilles to Morris and from Marseilles through Ottawa and then to La Salle, and from Ottawa to Streator for the purpose of distributing the surplus electric power which he proposes to develop from waterpower at Marseilles, Ill.

Among the applications for state charters for power companies in Pennsylvania are three which have in contemplation the use of streams not touched for this purpose. The Union County Power Company asks a charter for several creeks near Lewisburg, H. W. Orwig and associates being incorporators. The Penn's Creek Water and Power Company asks a charter for Hartley township, Union County, where it intends to locate a plant. The applicants are men identified with similar enterprises in the Juniata valley, being William P. Woods and associates.

PUBLICATIONS.

The "Everbest" Magazine, the little monthly publication of the Ewing-Merkle Electric Company, St. Louis, makes its appearance for July in attractive cover, with not a few items of value and several pages devoted to a lighter vein of electrical interest.

In a little circular from the Zoar Storage Battery Company, Zoar, Ohio, is given a number of testimonials from those who have given the batteries a trial. The company makes stationary and portable storage batteries for automobiles, isolated lighting plants, electric-lighting and power plants, gas-engine sparking, gasoline launches, marine engines, electric elevator, electric signs, show-window lighting and other purposes.

The Bryant Electric Company, Bridgeport, Conn., has just completed a convenient and serviceable new catalogue in which is illustrated and described the large list of electrical supplies manufactured by this company. A new and complete price list is also attached. Bryant goods were first offered to the trade about 18 years ago, and a glance at the new catalogue will show that the goods have been developed to meet every need which modern practice has created. Many new devices are catalogued for the first time, including handsome designs and serviceable construction.

Advance sheets of the Westinghouse Electric and Manufacturing Company's Bulletin No. 11376 on alternating and direct-current wattmeters, which will be ready for distribution in six weeks, contains much technical information in addition to the descriptions of the meters. The various parts entering into their construction are shown in detail. Meters for single-phase, two-phase and three-phase alternating currents and for direct current are catalogued. Some specialties listed are the portable testing and prepayment types of meters. The alternating-current meters operating on the induction and motor principle are made to include all classes of service with an extensive range of voltage, frequency and capacity for single-phase and polyphase systems for house and switchboard service. The principle of operation is the same for all styles, so that the meterman need familiarize himself with only one style of meter element.

A complete new catalogue of Jewell standard electrical measuring instruments has just been issued by the Jewell Electrical Instrument Company of Chicago. The line manufactured by this company includes direct and alternating-current meters, portable, laboratory and switchboard instruments. All these are thoroughly described with the aid of half-tone illustrations and detail drawings. The great improvements which have been accomplished in the art of electrical measuring are given attention in the catalogue, making it a valuable booklet.

The General Electric Company, Schenectady, N. Y. has designed a line of fuse boxes especially adapted for use in manholes where the most severe conditions are met, but which may also be used on poles, in cellars and elsewhere. Two general types are made—one with outlets for the cables at the sides, the other with the outlets at the bottom, known respectively, as types MD and Tailleur. In Bulletin No. 4512, recently issued by the General Electric Company, a description is given of both types of manhole fuse boxes, together with dimensions, weights, prices, etc., in tabular form, conveniently arranged for ordering.

MISCELLANEOUS.

The Electric Mail-box Company of Guthrie, Okla., has been chartered with a capital of $50,000 for the purpose of manufacturing a mail-box to operate with electric door bells. J. M. Brooks, G. W. Frazer and H. W. Pentecost are the incorporators.

Admiral Cowles, chief of the Equipment Bureau of the Navy Department, following the lead of the lighthouse service, has given orders for the equipment of five battleships, 10 colliers, six torpedo-boat destroyers, the converted yacht Mayflower and the dispatch boat Dolphin with the system of submarine-bell signals to assist in difficult navigation.

The settling of the commercial telegraphers' strike in San Francisco and Oakland, after a bitterly contested fight, has brought about a better feeling. A number of the old employes of the Western Union and Postal telegraph companies have returned to work, and the remainder of the strikers will be employed as fast as places can be found for them. They are allowed to claim some of the credit of the compromise through their president, S. J. Small, who met Commissioner Neill half way. The companies finally agreed to reinstate all of their striking employes without prejudice at their former salaries and to arbitrate the question of advanced wages later on. It seems unlikely that another strike will occur.

TRADE NEWS.

James Clark, Jr., & Co. of Louisville, Ky., have incorporated with a capital of $250,000 to do an electrical supply business. In a plant already established the company manufactures direct-current generators and motors, electrically driven machinery, etc.

An American consul in Central America states that a mining company is planning to erect an electric power plant at a waterfall near its mine and will probably be in the market for a complete outfit in connetcion therewith. Information may be had by referring to file No. 1234, Bureau of Manufactures, Washington.

Sealed proposals will be received at the office of the custodian of the Federal Building, San Francisco, Cal., until noon, August 29th, for furnishing and delivering motors, rheostats, chain drives, air compressor, circuit-breakers, conduit, wire, etc., at the postoffice and United States courthouse, San Francisco, in accordance with specifications, copy of which may be obtained at the above office, at the discretion of the supervising architect.

The western electrical trade will be interested to know that J. D. Kearney has started a manufacturer's agency business at 1005 Monadnock Building. Mr. Kearney is willing to take on one or two additional lines of merit. His large acquaintance in the West, particularly in Chicago and vicinity, should make him a desirable representative for any manufacturer seeking to establish a western branch on an agency foundation.

A recent visit to the advertising department of the Ohio Brass Company at Mansfield, Ohio, revealed the number of extensive improvements that have been wrought in this branch by Advertising Manager Charles E. Young. One can get an idea of the extent of the business of the company from so large and complete a printing plant. The Ohio Brass Company, through Mr. Young, has developed this extensive printing establishment to run only in conjunction with the company's advertising department. Mr. H. W. Young has recently been taken on as an assistant to Manager Young. Mr. Charles E. Young for a long time was connected with the advertising department of the Western Electric Company, Chicago. It will be noted with interest by Mr. C. E. Young's friends in Chicago that he has earned substantial recognition on the part of the Ohio Brass Company and that the company not long ago appointed him as one of its directors. He deserves much credit for the ability he has shown as a business developer.

BUSINESS.

Harvey Hubbell, Inc., Bridgeport, Conn., manufactures 21 kinds of plugs, for as many different purposes, all interchangeable and constructed on the push contact principle.

The Westinghouse electric works at East Pittsburg have established another new record. This time it is in the shipping department. During the month of May the company shipped no less than 750 carloads of electrical machinery, or an average of 30 carloads a day, aggregating 10,000 tons, and representing in value about $4,000,000. This exceeds by 110 cars any shipping record for one month that has ever been made at these works. The high record heretofore was held by the month of August, 1906, when 640 carloads were shipped. The shipments at the Westinghouse Machine Company's shops during May also reached the high-water mark. The Westinghouse Air Brake Company and the Union Switch and Signal Company both continue to keep all departments employed to their capacity.

ILLUSTRATED ELECTRICAL PATENT RECORD.

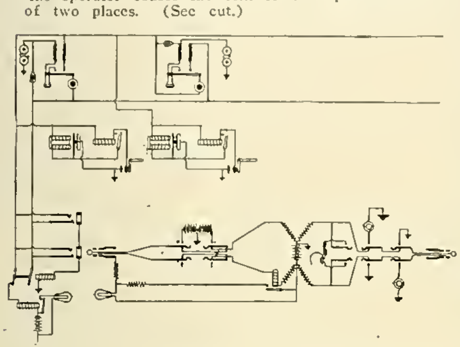
Issued (United States Patent Office) July 23, 1907.

860,627. Sectional Incandescent Lamp. George E. Bill and Albert D. Redman, Sr., Harrisburg, Pa. Application filed January 30, 1906.

The "Hylo" principle has been extended to making the lamp with a number of independent filaments each connected by leading-in wires to a switch in the lamp base. Twisting the lamp in its base controls the number of filaments in circuit.

860,647. Coin-collecting Apparatus for Telephone Exchanges. Claude D. Enochs, La Crosse, Wis., assignor to the Western Electric Company, Chicago, Ill. Application filed September 25, 1905.

The usual Western Electric line circuit is modified so that the line relay is normally between the tip side of the line and battery to ground. The coin closes a circuit arranged with locking relays, grounding the tip side at the sub-station and so operating the line relay. Only one contact in the cut-off relay is required, the ground constituting the return during signaling. Since the ring side of the line ends in the jack, signaling is impossible without grounding by the coin. A polarized coin-control relay governed by the operator causes the coin to be deposited in either of two places. (See cut.)



NO. 860,647.—TELEPHONE PAY-STATION CIRCUITS.

860,657. Cathode. Henry S. Hatfield, Brighton, England. Application filed August 20, 1906.

The electrolyte contains mercuric salts in solution, and a cathode is formed of some metal of the iridium group.

860,665. Electrical Connection. Paul Horan, Toledo, Ohio. Application filed May 21, 1906.

To maintain service during the repair of a broken conductor, as a trolley wire, a combination of grips, block and tackle is provided with a flexible conducting jumper between the severed ends, and carried on a retractile reel mounted on the block casing.

860,681. Contact-pole Retriever. Joseph F. Mackin, Columbus, Ohio. Application filed April 6, 1906.

A trolley pole retriever is fitted with a pressure cylinder, as for air, which operates to depress the pole when a valve is released by the trolley wheel leaving the wire.

860,683. Lightning Arrester. William J. Meyer, Bison, Kan. Application filed October 8, 1906.

A lightning arrester for telephone instruments combines a rotary switching device with a saw-toothed gap to ground.

860,726. Surface-contact Electric Railway. William M. Brown, Johnstown, Pa., assignor to the Lorain Steel Company. Application filed July 29, 1904.

The car is fed through surface contacts, normally dead but arranged to be connected by magnetic switches closed by the attraction of a magnet on the car.

860,771. Apparatus for Purifying Water. Alfred O. Tate, Brooklyn, N. Y. Application filed July 27, 1904. Renewed December 15, 1906.

Details are given of an apparatus for purifying water holding solids in solution by treating it electrolytically to disintegrate or precipitate the solids.

860,791. Moisture-proof Electric Motor, Dynamo, and the Like. Frederick W. Ells, Milwaukee, Wis. Application filed May 2, 1906.

The motor is entirely enclosed in a casing containing a moisture-absorbing material. Sight openings of transparent material are provided.

860,813. Dynamo Construction. Henry Leitner, Woking, England. Application filed August 9, 1905.

A shunt-wound dynamo has subsidiary magnets with poles distinct and separate from the poles of the field magnets, and fixed subsidiary brushes connected to the subsidiary magnets.

860,860. Multiple-station Telephone System. Arthur J. Farmer, Detroit, Mich. Application filed February 4, 1902.

An automatic system in which connectors at the central office are actuated by counted impulses from the calling subscriber.

860,861. Telephone Cable Terminal. Edward C. Flory, Santa Barbara, Cal. Application filed August 28, 1906.

Details of the moisture-proof construction of a telephone cable terminal box are given.

860,864. Wrought-metal Pole Arm. Martin E. Harrison, Parnassus, Pa. Application filed January 28, 1907.

The pole arm is constructed of sheet steel pressed into form and folded longitudinally to form spaced sides and connecting web.

860,867. Electric Lamp Socket. Thomas H. Hill, Philadelphia, Pa. Application filed August 31, 1906.

A socket of the pull-cord switch variety has some new features of the contact mechanism.

860,874. Ringing and Listening Key. Herbert L. Knight, Cleveland, Ohio, assignor to the Century Telephone Construction Company, Buffalo, N. Y. Application filed January 10, 1906.

An operator's ringing and listening key is novel in having rollers mounted on the lever, to engage the contact springs.

860,889. Method of Making Electrical Lugs. George A. Tower, Richmond, Va. Application filed September 13, 1906.

A terminal lug, adapted to be made from a flat sheet of metal is described.

860,902. Telephone Exchange System. Edward E. Clement, Washington, D. C. Application filed November 11, 1905.

A method of charging the storage battery through the signal devices maintains the latter inoperative.

860,907. Automatic Cut-out. George Eastham, Chicago, Ill. Application filed June 2, 1906.

Excess speed of the generator shaft causes a centrifugal device to open the battery charging circuit.

860,920. Lockout Device for Telephones. Daniel W. Kneisly, Dayton, Ohio. Application filed July 12, 1906.

Details of the mechanism of a lockout device for telephones are given.

860,945. Apparatus for Railway Signaling. Henry W. Spang, New York, N. Y., assignor to Charles H. Ketcham, Yonkers, N. Y. Application filed September 22, 1902.

The rails are arranged to be divided into electrically insulated sections. A polarized relay on the car responds to certain directional relations of the current furnished by batteries bridged across the track sections.

860,948. Safety Device. George G. Wacker, New York, N. Y., assignor of one-half to Gabriel L. Schiesser, New York, N. Y. Application filed June 19, 1906.

An extra contact on the car completes the circuit of a magnet operating a valve admitting fluid pressure to the semaphore cylinder chamber.

860,961. Meter. David Broido and Walter H. Lubach, Berlin, Germany, assignors to the General Electric Company, Schenectady, N. Y. Application filed May 4, 1905

The drawing shows a meter in which the metered current is carried through the armature which has three windings shunted by resistances.

860,972. Apparatus for Controlling the Motor and Driving Mechanism of Self-propelled Vehicles. Lucius T. Gibbs, Hempstead, N. Y. Application filed September 21, 1905.

A switcharm, operated by the vertical movement of a fly-ball governor, varies the field resistance of the generator.

860,976. System of Control. George H. Hill, Schenectady, N. Y., assignor to the General Electric Company. Schenectady, N. Y. Application filed November 14, 1905.

A system of multiple control for car motors is described. Two train wires are required to connect the master controller to the car relays.

860,977. Machine for Making Stems for Incandescent Lamps. John W. Howell and William R. Burrows, Newark, N. J., assignors to the General Electric Company, Schenectady, N. Y. Application filed September 19, 1903.

Electromagnets operate the pinching device which seals the stems.

860,979. Dynamo-electric Machine. Arthur C. King, Madison, Wis., assignor to the Northern Electrical Manufacturing Company. Application filed December 26, 1906.

The feature of construction is the soft steel pole-piece having its pole face case-hardened.

860,981. Alternating-current Machine. Marius C. A. Latour, Paris, France, assignor to the General Electric Company, Schenectady, N. Y. Application filed January 21, 1905.

This alternating-current motor comprises an armature core, a number of closed-circuit windings each distributed around the core, commutator having successive segments connected to the several armature windings, brushes bearing on the commutator of a width insufficient to bridge two segments connected to the same winding, and means for shifting a portion of the brushes relatively to the rest.

860,987. Electric Meter. William J. Mowbray, Brooklyn, N. Y., assignor to the General Electric Company, Schenectady, N. Y. Application filed July 20, 1905.

An integrating induction meter consists of a moving element mounted in inductive relation to a number of series and shunt coils which may be connected in series or in parallel with cumulative inductive effects.

860,997. Lightning Arrester. Charles P. Steinmetz, Schenectady, N. Y., assignor to the General Electric Company, Schenectady N. Y. Application filed December 28, 1900.

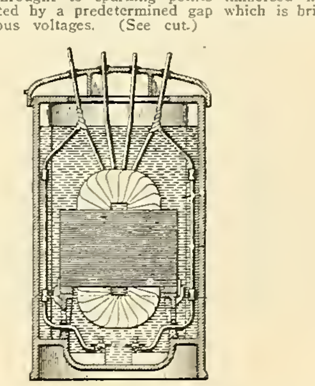
The feature of the arrester is a resistance rod made by mixing an iron oxide with a small percentage of binding material, molding and baking the rod, and rebaking it with its ends in contact with an oxidizable carbon compound, such as melted tar, in order to impregnate the ends with carbon to give greater electrical conductivity.

860,998. Controlling Alternating-current Motors. Charles P. Steinmetz, Schenectady, N. Y., assignor to the General Electric Company, Schenectady, N. Y. Application filed January 25, 1904.

The method of controlling the operation of repulsion motors consists in applying varying potentials, and for each potential varying the speed and torque of the motors by varying the angular displacement between the primary field and the line of the short-circuiting brushes.

861,003. Protective Device for Transformers. Edward A. Wagner, Fort Wayne, Ind., assignor to the General Electric Company, Schenectady, N. Y. Application filed December 18, 1906.

In order to prevent an excessive voltage being impressed across the windings, taps from the terminal wires are brought to sparking points immersed in oil and separated by a predetermined gap which is bridged by dangerous voltages. (See cut.)



NO. 861,003.—TRANSFORMER PROTECTIVE DEVICE.

861,004. Dial Switch for Regulating Transformers. Herbert I. Washburn, Overbrook, N. J., assignor to the General Electric Company, Schenectady, N. Y. Application filed November 14, 1905.

The contact arm, moving over a row of contacts, is driven through the mechanism of a set of cams and dogs by a handwheel shaft.

861,006. Circuit Closer. Frederic R. Wickire, Cortland, N. Y. Application filed June 23, 1906.

A traveling contact block makes contact successively with a series of fixed contacts. An independent circuit-closing device is adapted to break the circuit just before the traveling contact reaches and just before it leaves each fixed contact, and to close the circuit in the intervals between.

861,012. Alternating-current Motor. Ernst F. W. Alexanderson, Schenectady, N. Y., assignor to the General Electric Company, Schenectady, N. Y. Application filed December 10, 1906.

Coils are carried in a slotted armature and connected to the commutator by high resistance leads.

861,015. Block-signal System. Elmer F. Bliss, Schenectady, N. Y., assignor to the General Electric Company, Schenectady, N. Y. Application filed March 7, 1906.

In this alternating-current block signal system, line-wires extend along the track and supply the rail circuits of the block through transformers. Automatic means increase the ratio of effective primary to secondary turns upon abnormal flow of current.

861,018. Switching Mechanism for Electric Railways. Ed. W. Clark, Coalton, Ohio. Application filed March 26, 1907.

A supplemental contact is carried on the trolley arm, operating electrically controlled track switches.

861,019. Therapeutic Lamp. Harley E. Coger, Minneapolis, Minn., assignor to the Spear-Marshall Company, Chicago, Ill. Application filed November 20, 1906.

The device comprises an upper hood and a lower director, both conical in shape, hinged together at their bases, and containing an incandescent lamp of great heat and light-giving capacity behind which is a reflector.

861,021. Apparatus for Applying Insulation to Electrical Conductors. Louis W. Downes, Providence, R. I. Application filed July 7, 1904.

A carrier is rotated about the conductor and bears a hopper or chamber for the fibrous material. Carding means on the carrier conveys the fibrous material from the hopper and delivers it to the surface of the conductor in the form of a band or strand.

861,029. Transformer Core. Walter A. Hall, Lynn, Mass., assignor to the General Electric Company, Schenectady, N. Y. Application filed September 24, 1904.

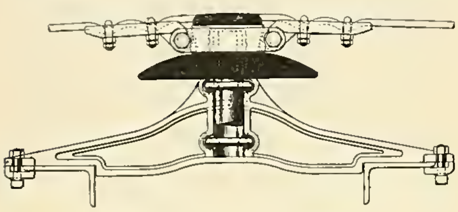
The core is composed of separate branches whose meeting edges have longitudinal ribs which intermesh to form a practically solid leg.

861,031. Electric Induction Furnace. Johannes Härdén, London, England, assignor to the Gröndal Kjellin Company, Limited, London, England. Application filed January 24, 1907.

Polyphase alternating currents of ordinary voltages are stepped down by transformers to enormous currents of low voltage, which are led through a primary winding on the central magnetic core of the furnace.

861,063. Insulator and Support for Electric Lines. Theodore Varney, Pittsburg, Pa., assignor to the Westinghouse Electric and Manufacturing Company, Pittsburg, Pa. Application filed June 4, 1906.

The insulator comprises a bracket holding a semi-cylindrical ledge in which a tubular pin is seated. U-shaped clamping bolts hold the pin on which a petticoat insulator is mounted, and attached to the insulator is a collar to which clamping ears are pivotally arranged. (See cut.)



NO. 861,063.—STRAIN INSULATOR.

861,064. Strain Insulator. Theodore Varney, Pittsburg, and Christian Aalbork, Wilkinsburg, Pa., assignors to the Westinghouse Electric and Manufacturing Company, Pittsburg, Pa. Application filed June 4, 1906.

The insulator comprises a long insulating tube in the middle of which a collar and an eyeband are fitted. A molded insulating sheath surrounds the eyeband and the exposed portions of the tube.

861,071. Strain Insulator. Christian Aalborg, Wilkinsburg, Pa., assignor to the Westinghouse Electric and Manufacturing Company, Pittsburg, Pa. Application filed May 2, 1906.

The insulating block has two oppositely tapering apertures in which plugs are located. U-shaped bolts project from opposite sides of the block into the smaller ends of the apertures and are secured to the plugs.

861,072. Dynamo-electric Machine. Ernst F. W. Alexanderson, Schenectady, N. Y., assignor to the General Electric Company, Schenectady, N. Y. Application filed January 12, 1907.

The coil conductors and the leads are distributed in the slots to produce equal leakage reactances between the circuits formed by any two adjacent coils and their leads.

861,073. Transformer. Claxton E. Allen, Lynn, Mass., assignor to the General Electric Company, Schenectady, N. Y. Application filed April 18, 1905.

The core is similar to that described in Patent 861,029 issued this week, the central leg being so shaped that each unit has a tongue and socket engagement with the remainder of the central leg so that its mechanical strength and rigidity is increased.

861,094. Strain Insulator. Harry P. Davis, Pittsburg, Pa., assignor to the Westinghouse Electric and Manufacturing Company, Pittsburg, Pa. Application filed June 4, 1906.

A rod having an enlargement at one end projects through one of the detachable end caps of a metal tube. An insulating tube surrounds the enlargement and extends through the metal tube from which it is separated by insulating material.

861,097. Apparatus for Applying Insulation to Electric Conductors. Louis W. Downes, Providence, R. I. Application filed July 7, 1904.

A [illegible] mounted on the carrier is adapted to hold a [illegible] of fibrous insulating material and is unwound, meanwhile receiving a longitudinal axial feed movement to enable the strand to be continuously disengaged at the same distance.

861,100. Electric Conductor. Charles E. Eveleth, Schenectady, N. Y., assignor to the General Electric Company, Schenectady, N. Y. Application filed July 28, 1905.

The connector has a threaded aperture which may be divided and clamped on the conductor by means of screws.

861,117. Electrogalvanic Apparatus. Frederick F. Hespe, West Hoboken, N. J. Application filed July 13, 1906.

A number of small copper-zinc couples are connected in series and arranged to be enclosed in absorbent felt.

861,125. Simultaneous Transmission of Telegraphic and Telephonic Impulses. Isidor Kitsee, Philadelphia, Pa. Application filed September 22, 1906.

Impulses of relatively great duration are secured by producing a sharp electrical impulse, impressing it simultaneously upon the circuit and a condenser of large capacity.

861,126. Transmission of Induced Impulses. Isidor Kitsee, Philadelphia, Pa. Application filed October 11, 1906.

The improvement consists in producing a sharp electrical impulse, storing the energy in electrostatic form and so converting the sharp impulse into a line impulse of relatively great duration.

861,135. Electric Annealing Furnace. Albert L. Marsh, Lake Bluff, Ill., assignor to the Hoskins Company, Chicago, Ill. Application filed February 18, 1907.

The furnace is of refractory material, and parts are grooved for resistance wires in which the heat is generated.

861,149. Strain Insulator for Electric Lines. Theodore Varney, Pittsburg, Pa., assignor to the Westinghouse Electric and Manufacturing Company, Pittsburg, Pa. Application filed June 4, 1906.

The insulator comprises a metal tube, end caps screw-threaded thereon and having outwardly tapering holes, taper tubes of insulating material seated in the holes and bolts projecting from the tubes and having taper heads seated in the tubes.

861,155. System of Electrical Distribution. John W. Achard, Philadelphia, Pa., assignor to the Electric Storage Battery Company, Philadelphia, Pa. Application filed April 15, 1905.

A switch for regulating storage cells is described.

861,162. Electric Bell. Charles C. Cadden, Cleveland, Ohio, assignor to the Century Telephone Construction Company, Buffalo, N. Y. Application filed December 1, 1904.

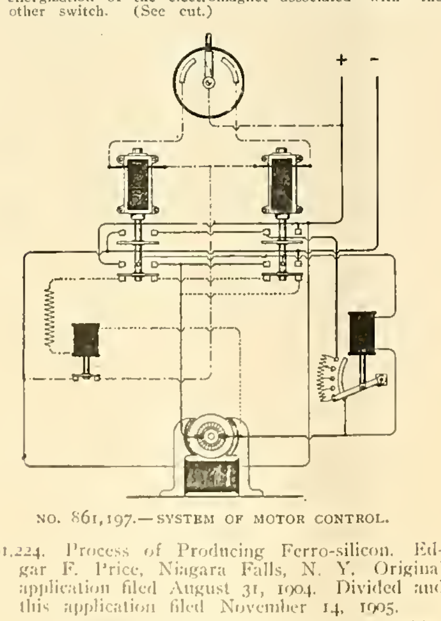
This bell, adapted to work on alternating current, is of the type having a hollow coil in which the striker armature is free to move and plays between the poles of a permanent horseshoe magnet. Novelty consists in the use of nonmagnetic screws as adjustable stops.

861,192. Unipolar Dynamo. Wilhelm Mathiesen, Leutzsch-Leipzig, Germany. Application filed January 25, 1907.

A disc armature is mounted on a shaft which is permitted to oscillate by a universal-joint bearing. The armature and poles are provided with spherical faces.

861,197. System of Motor Control. August Sundh, Yonkers, N. Y., assignor to the Otis Elevator Company, Jersey City, N. J. Application filed December 27, 1904.

In this combination of a motor, reversing switches and an electromagnet associated with each switch, there are means set into action by the opening of one of these reversing switches for preventing the immediate energization of the electromagnet associated with the other switch. (See cut.)



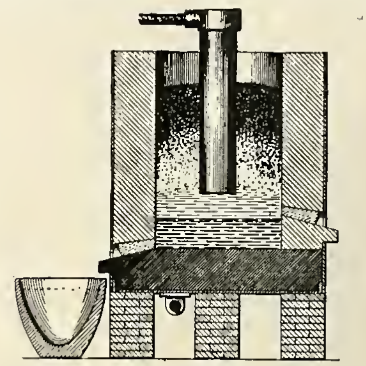
NO. 861,197.—SYSTEM OF MOTOR CONTROL.

861,224. Process of Producing Ferro-silicon. Edgar F. Price, Niagara Falls, N. Y. Original application filed August 31, 1904. Divided and this application filed November 14, 1905.

The process of producing ferro-silicon by smelting a silicon compound, carbon and iron, consists in establishing an electric arc of minimum potential to cause reduction within the charge and protecting the electrodes from the oxidizing and cooling effect of the atmosphere by a considerable mass of the material.

861,225. Process of Producing Silico-spiegel. Edgar F. Price, Niagara Falls, N. Y. Application filed November 14, 1905.

The process of producing silico-spiegel by smelting a charge of compounds or manganese and silicon, carbon and iron, consists in establishing an electric arc of minimum potential difference to effect reduction within the charge, surrounding the zone of reduction and protecting the electrode or electrodes by a considerable mass of the material. (See cut.)



NO. 861,225.—ELECTRIC FURNACE

861,226. Electrolysis. Giovanni Rambaldini, Grosseto, Italy. Original application filed January 28, 1902. Divided and this application filed December 28, 1904.

The principle of the process consists in employing an electrolyte of less specific gravity in contact with and above two other electrolytes serving as analyte and catalyte, each of the three electrolytes containing the same anion, and maintaining the levels of contact equal during electrolysis.

861,233. Automatic Trolley Pole. Hugh W. Fellows, Cahuenga, and Ira A. Cammett, Hollywood, Cal. Application filed July 16, 1906.

The tension of the spring is applied to the pole through a toggle-joint.

861,238. Attachment Plug. William C. Tregoning, Cleveland, Ohio, assignor to the Tregoning Manufacturing Company, Cleveland, Ohio. Application filed January 9, 1907.

Details of an attachment plug are given.

861,239. Controlling Switch. Harold E. White, Schenectady, N. Y., assignor to the General Electric Company, Schenectady, N. Y. Application filed May 12, 1904.

Combined with a resistance, a rotary controlling switch is adapted to be moved in either direction from its off position and has two sets of contacts differing by 180 degrees, the contacts of each set being connected to alternate points on the resistance. Contacts are movable relatively to the two sets and are arranged to be engaged serially and alternatively by both sets.

861,242. Can or Receptacle for Storage Batteries. Thomas A. Edison, Llewellyn Park, Orange, N. J., assignor to the Edison Storage Battery Company, West Orange, N. J. Application filed August 16, 1904.

This patent covers merely the can or receptacle whose features are a flanged bottom, the flange being welded to the body along its edge only so that the bottom may be separated from the body by the removal of a portion of the flange.

PATENTS THAT HAVE EXPIRED.

Following is a list of electrical patents (issued by the United States Patent Office) that expired July 29, 1907:

432,965. Electric-light Fixture. F. H. Aldrich, Cadillac, Mich.

432,973. Galvanic Battery. H. J. Brewer, New York, N. Y.

432,978. Electric Cut Out. H. A. Chase, Boston, Mass.

432,979. Electric Cut Out. H. A. Chase, Boston, Mass.

432,980. Fuse-block and Lightning Arrester. H. A. Chase, Boston, Mass.

432,988. Automatic Electric Switch and Cut-off. C. B. Doyle, Maywood, Ill.

433,022. Electromagnetic Cut Out. B. J. Noyes, Boston, Mass.

433,047. Test Circuit for Multiple Switch Boards. C. E. Scribner, Chicago, Ill.

433,051 Dynamo-electric Machine. H. W. Spang, New York, N. Y.

433,082. Dynamo Telegraphy. F. W. Jones, New York, N. Y.

433,120. Telephone. S. D. Field, Yonkers, N. Y.

433,147. System of Temperature Regulation. R. J. Pratt, Greenbush, N. Y.

433,170. Electric Railway. R. M. Hunter, Philadelphia, Pa.

433,174. Separator for Secondary Batteries. W. P. Kookogey, Brooklyn, N. Y.

433,181. System of Electrical Transportation. A. L. Parcelle, Boston, Mass.

433,269. Regulator for Dynamo-electric Machines. P. P. Belt, Fredonia, Kan.

433,360. Electric Switch. J. F. McLaughlin, Philadelphia, Pa.

433,375. Electric Heat Regulating System. F. M. Sparrow, Mattapoisett, Mass.

433,381. Electromagnetic Transmitter. J. T. Williams, Mount Vernon, N. Y.

433,391. Armature for Dynamos, Etc. W. S. Belding, Englewood, Ill.

433,392. Blank for Armature Coil Guards. W. S. Belding, Englewood, Ill.

433,393. Commutator for Dynamos. W. S. Belding, Englewood, Ill.

433,394. Power Transmitting Mechanism. W. S. Belding, Chicago, Ill.

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Electrical Equipment of a Welsh Colliery.

[From the London correspondent of the Western Electrician.]

During recent years there have been several instances demonstrating the fact that the original ideas of the promoters of large power schemes, in so far as these relate to companies dealing with scattered areas, have been far from realized. When making such a statement, however, one always has to except the prosperous Newcastle-on-Tyne company. In the Newcastle and South Wales undertakings are found the two extremes of success and failure, albeit the areas are somewhat similar in character, with perhaps some advantage to the Newcastle company from the manufacturing point of view. There are many instances in the areas of these electric power undertakings of independent plants being installed with results said to be more satisfactory than if a supply were taken from the power company. Especially is this the case with collieries, and South Wales seems to have been particularly favored with the attentions of clever consulting engineers, who have successfully advised their clients in this direction.

The South Wales Electrical Power Distribution Company's career has been an unfortunate one, due to a concatenation of circumstances of a varied character upon which no very clear light has yet been thrown, and the present position is a debit balance of over $300,000 and a board of directors, all of whom will retire at the annual meeting. More than one colliery in the district has its own electrical installation, and, due largely to the exceptionally low distribution costs in such an installation, the total cost per unit has worked out lower than any price offered by the power company.

The Cambrian collieries, the electrical equipment of which is illustrated and described in this article, are peculiar in that they were one of the original customers of the power company; but in the present condition of affairs, and the colliery company's experience of electrical working on a comparatively small scale, it was decided to install an independent plant. The collieries are situated in the Clydach Vale, shown in the picture, a branch of the better known Rhondda Valley, Glamorgan. They form part of one of the largest collieries in South Wales, the coal produced in the three pits of the company averaging about 1,000,000 tons per annum.

Up to about three years ago steam power was used exclusively for all purposes, but in 1904 electrical working was introduced for haulage purposes, coal cutting, pumps, etc., current being purchased from the South Wales Power Company. So satisfactory did this prove that it was decided to erect an independent plant, the contract for which was given to Siemens Bros.' Dynamo Works. The plan of the power plant shows an up-to-date installation.

The electric power developed by the two 1,000-kilovolt-ampere generating sets now working is mainly used for operating three-phase induction motors for a great variety of purposes. There are at present 21 induction motors in use, ranging from three horsepower to 220 horsepower, the total horsepower of motors being 1,890. Motors on the surface are supplied with three-phase current at low tension, the current being transformed for this purpose by static transformers from 2,200 volts to 400 volts. The bulk of the supply, however, is at 2,200 volts pressure, which is supplied to motors down the mine. Continuous current for exciting the main alternators, for lighting and for working the original motors, is supplied at a pressure of 110 volts by a steam-driven dynamo, or by two 70-kilowatt motor-generators taken over from the original plant.

The engine house contains one room only, which is provided with very large windows on three sides. It is spanned by a 15-ton hand-operated crane and is lighted by six enclosed arc lamps. The boilers are erected at the side of the engine house and are quite close to one of the pit heads, thus obviating the necessity for installing a coal-conveying plant. The boilers are four in number and are of the Lancashire type, suitable for a working pressure of 160 pounds per square inch, and tested up to 280 pounds to the square inch. Each is fitted with a Sugden superheater to give 150° F. superheat when the boiler is evaporating 9,000 pounds of water per hour. A Green economizer raises the temperature of the feed water from 60° to 200° F. when the boilers are evaporating at the rate of 30,000 pounds an hour. Weir feed pumps and a Korting injector are used.

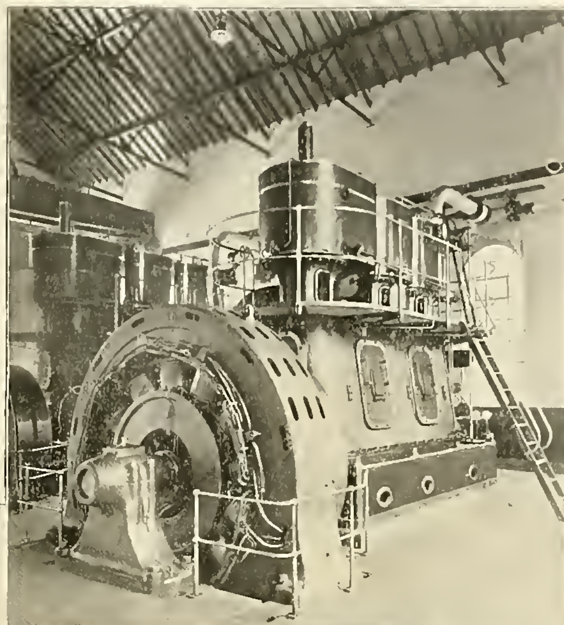
Space is provided in the engine room for three generating sets, but at present the plant consists of the two units shown, each consisting of a Belliss & Morcom vertical steam engine direct-coupled to a Siemens 1,000-kilovolt-ampere three-phase 2,200-volt 25-cycle alternator. The normal speed of the sets is 250 revolutions per minute, and it was found from tests on one of the sets that the momentary rise and fall in speed when full load was switched off or on was 5.2 per cent. and four per cent. of normal speed, respectively, while the permanent vibration in speed amounted to 1.6 per cent. A tachometer, belt-driven from the engine shaft, indicates the speed at which the sets are running.

Steam consumption tests show that the steam consumed per kilowatt-hour at full load is 17.3 pounds at a pressure of 155 pounds per square inch and a temperature at the stop valve of 472° F., the vacuum being 25.9 inches of mercury. At half load the steam consumption was found to amount to 18.6 pounds at a pressure of 163 pounds, a temperature of 461° F. and a vacuum of 26 inches. The engine is capable of carrying an overload of 25 per cent. for two hours and momentary overloads of 50 per cent.

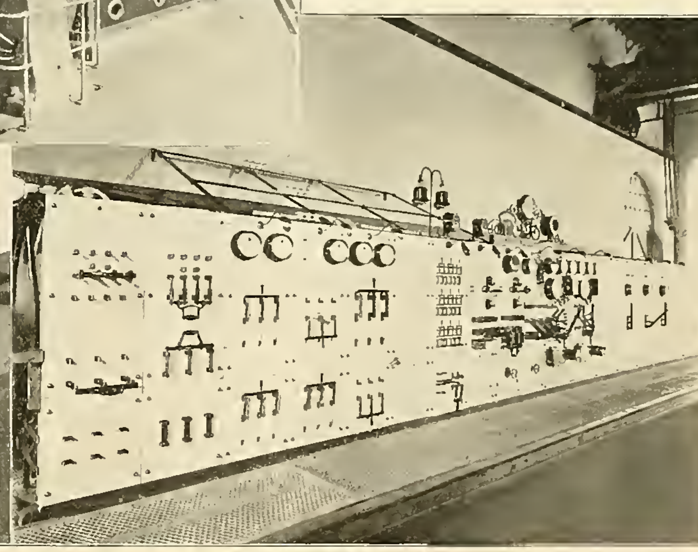
The Siemens three-phase alternators are of the rotating-field type, the phases being star-connected. They have a continuous rating of 750 kilowatts at a power factor of 0.75 and are capable of dealing with the same overloads as the engines. The temperature rise observed in tests was 38½° C. for the stator iron and 22.8° C. for the rotor winding. The machines are wound to have a wave form as nearly sinusoidal as possible. The percentage rise of voltage with full non-inductive load thrown off was about 4½ per cent., the specified limit being six per cent. The poles of these machines are circular in section and the pole shoes are laminated. The armature core is built up of laminated stampings, and the armature coils after being placed in the open slots are held in position by wooden wedges.

The two main engines exhaust into ejector condensers placed in the basement, each being capable of dealing with 13,000 pounds of steam per hour and producing a vacuum of 26 inches of mercury. The condensers discharge into a tank, and the centrifugal pump for pumping the condenser discharge back to the pond is capable of delivering 50,000 gallons of water per hour against a head of 80 feet when rotating at 1,450 revolutions per minute. The pump is directly driven by a 40-horsepower Siemens three-phase squirrel-cage motor of the ventilated type.

On the switchboard the high-tension apparatus



Power House at Cambrian Collieries.



Switchboard.

Alternating-current Generating Units in Cambrian Collieries.

ELECTRICAL EQUIPMENT OF A WELSH COLLIERY.

is mounted near to the wall, as illustrated, but the operating gear for the high-tension apparatus is mounted on separate panels in front of and at a certain distance from the high-tension gear. The operating panels contain only low-tension instruments and apparatus, the high-tension oil switches being operated from this board by levers. There is a passageway of three feet six inches between the operating board and the high-tension gear. There are three alternator panels, of which one is at present blank, and six feeder panels, of which three have been fitted up with apparatus. There are all the usual instruments and apparatus necessary for an efficient and reliable control. The high-tension panels next to the wall are insulated from one another by slate division pieces, and the front of each high-tension panel facing the passage way is provided with a substantial metal screen so arranged that the screen cannot be removed until the isolating switch has been opened. It is therefore impossible for an attendant to come into contact with the high-tension switch gear while it is under pressure.

G.

Insurance Company Gets a Verdict for Alleged Negligent Wiring.

Growing out of a fire alleged to be caused by defective wiring, a suit brought by a fire-insurance company against the central-station company in New York city has attracted considerable attention, by reason of exaggerated accounts in the daily papers. The matter has been investigated by Mr. W. H. Blood, Jr., of Boston, the insurance expert for the National Electric Light Association, and the actual facts in the case, as ascertained by him, will be of interest to the electrical fraternity.

The Appellate Division of the Supreme Court of New York state has affrmed the judgment of the trial court in the case of the Continental Insurance Company against the New York Gas, Electric Light, Heat and Power Company and others (the New York Edison Company). The case was tried before Mr. Justice Truax in December, 1906. It was asserted by the plaintiff that a building was destroyed by a fire which was started by the contact of a secondary wire upon a tin roof, or cornice, the wires having sagged on account of the negligence of the electric-light company.

At a former trial the plaintiff attempted to prove that the transformer was faulty, but it was shown, and later on admitted, that it was in perfect order and no trouble could have resulted on account of its condition. The plaintiff brought out the evidence in its case through a policeman and a fireman. No evidence was introduced to show that more than one wire touched the roof, or in what condition the secondary wires were elsewhere. On the other hand, the claim of the electric-light company was that only one wire touched the tin cornice, and that under such conditions no fire could have resulted; that the cornice was considerably rusted and that the fire burned outward rather than inward.

The testimony of experts for the National Electric Light Association was that an arc would not have lasted long enough to burn a hole in the tin and set fire to the wood, because the fuses in the transformer would have melted. Inspectors from the Board of Fire Underwriters and city inspectors testified that the wiring was in good condition when installed and was put up in the proper manner. Various employes of the electric-light company showed that when the wires were first installed, and several times previous to the fire, they were all in good condition.

The real question which came before the jury was whether the electric-light company had been negligent in allowing its wires to sag and rest uninsulated upon the tin cornice. The jury in this particular case decided that the company was negligent, which, of course, was a question of fact upon which juries might differ.

Some of the newspapers said that insurance companies pay an average of $25,000,000 a year for such losses, and that this decision makes it possible for them to get back most of their money and at the same time enforce perfect wiring of buildings. Mr. Blood's comment on this is as follows:

"As there are in all a very few similar cases, to my knowledge, pending against the total number of companies which are represented in the National Electric Light Association, this statement is not only misleading, but gross misrepresentation. No such conclusion, therefore, can rightfully be drawn from the decision in the case above referred to."

FIG. 1. POWER AND ALCOHOL BUILDING, JAMESTOWN EXPOSITION, CONTAINING FUEL-TESTING PLANT.

Electric Signs Taxed in New York City.

The electric-light companies of New York city sent out the following notice on the first of the month to its customers using electric signs:

"In accordance with a recent ordinance passed by the Board of Aldermen a small license fee will hereafter be required on all electric signs hanging at right angles from building fronts. It is also necessary to apply for a license permitting the erection of existing as well as new signs." "The ordinance provides that application shall be made to the Bureau of Buildings for their approval of the proposed sign and its method of erection." "Application must also be made to the Department of Water, Gas and Electricity for their approval of the method of construction." "When the approval of the above two departments has been secured these are attached to your application to the city clerk for the license itself, which will be issued upon the payment of the fee." "We enclose herewith application blanks covering the above, and should you so desire we shall be pleased to fill out the same ready for filing upon receipt of the data required by the city authorities." "We might add that the ordinance provides that these applications should all be in by August 1st, otherwise a fine of $10 per day will be imposed until such time as the license has been granted."

The tax on these signs is only 10 cents per square foot of frontage. It is expected that there will be a very large number of subscribers who have done nothing to comply with these new regulations and will be seriously affected by the heavy penalty, as the shortest time in which licenses could be issued would be three or more days.

Fuel-testing Plant of the United States Geological Survey, near Norfolk, Va.

By C. T. Wilkinson.

The fuel-testing work of the United States Geological Survey should be followed with close interest by all engineers, not only because it is important to all consumers, but also because in this branch of the government work it is undertaken to point out new paths for the development of the natural resources of the country by locating, classifying and testing all kinds of available fuel.

In Europe, where the fuel resources are now fully known, there has been no need for so powerful an organization as that which is now rapidly making the resources of this country as well known to the public as that of the older European countries.

Accurately compiled results of the more recent work of this branch will soon be published, and the following particulars of the plant in Virginia will doubtless be of interest.

Fig. 1 shows the exterior of the Power and Alcohol Building in the grounds of the Jamestown Exposition, and Fig. 2 is a plan illustrating the location of the boilers, gas producers and engines.

Steam-engineering Division.

New apparatus has been added as follows: A 250-horsepower Babcock & Wilcox boiler, with superheater, provided with a Roney stoker; a Jones underfeed stoker with fan, added to one of the old Heine boilers; two direct-current DeLaval turbine sets (Fig. 3), rated at 300 horsepower at 9,000-900 revolutions: also three Green Fuel Economizer Company's induced-draft fans.

The method of the work planned for this section is to be slightly changed, so that, instead of testing a great number of coals, more tests will be made of the same coal, different sizes and different methods of stoking or feeding, etc., being employed with the object of determining the most economical performance under different rates of combustion and the best ratios of grate and heating surfaces.

The Babcock & Wilcox boiler will be placed beside the two Heine boilers, which have been brought from St. Louis, all three having been provided with induced-draft apparatus in order to get a wide range of capacity. The Heine boiler provided with the Jones stoker has the usual arrangement for forced draft. The Babcock & Wilcox boiler was added to enable tests to be made of the same fuel with different types of boilers. It serves to represent the types employing a perpendicular flow of the gases through the tubes, the parallel-flow types being represented by the Heine boilers. The Heine boilers have been rebaffled or partitioned in such manner as practically to double their length

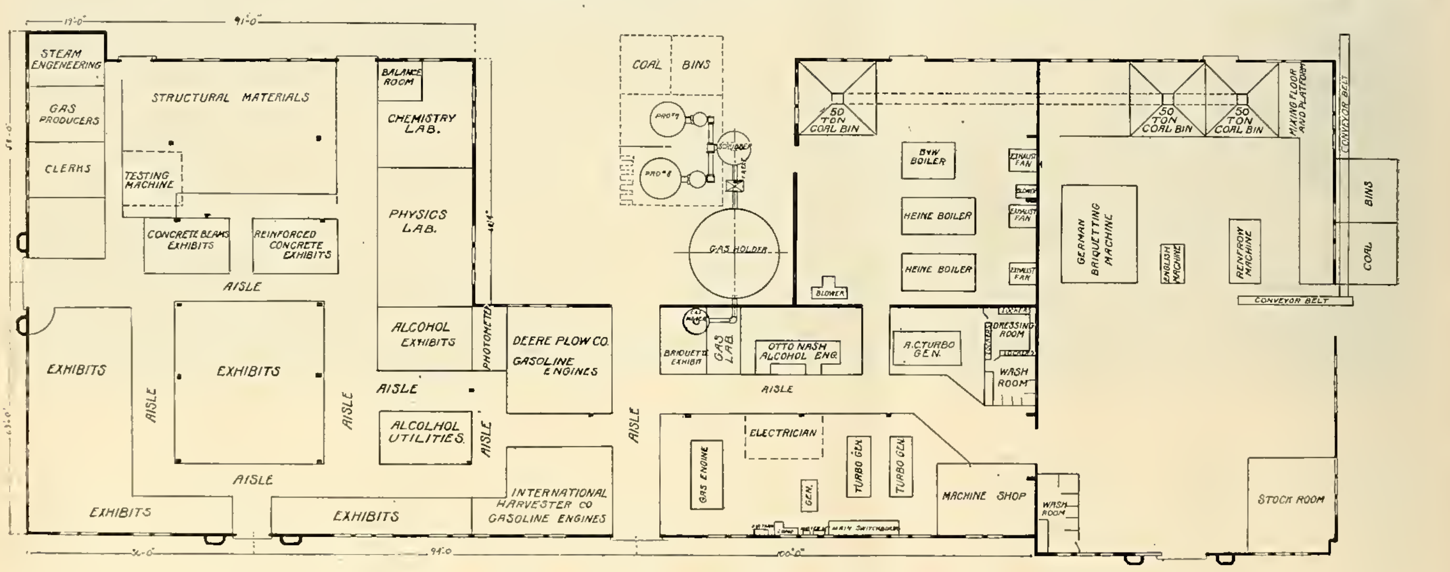


FIG. 2. PLAN SHOWING LOCATION OF BOILERS, GAS PRODUCERS AND ENGINES IN JAMESTOWN FUEL-TESTING STATION.

by compelling all of the heated gases to pass along the entire length of the tubes twice.

An additional alternating-current turbo-generator set may be installed as indicated (Fig. 2), to supply power for external and exhibition purposes.

The steam-engineering division, which has now practically succeeded in isolating the performance of the boiler from that of the combined performance of the boiler and furnace, will carry on continued tests with the object of still further determining the performance and efficiency of the furnace alone.

PRODUCER-GAS SECTION.

The apparatus in the producer-gas section is arranged as shown in Fig. 2 and Fig. 4. The gas producer, immediately on entering the building, passes through the meter and thence to a Westinghouse gas engine transferred from the St. Louis plant. Some slight changes have been made in this apparatus. For instance, producer No. 7 has been provided with a water seal at the base to permit the ashes to be removed without admitting air, and several holes have been bored at different heights, to be used for extracting samples of the gas. The purifying apparatus used at St. Louis has been removed. (This, it will be remembered, consisted of the usual chamber containing iron filings and wood shavings), since experience indicates that the danger from impurities has been considerably exaggerated.

A special steam pipe has been provided to insure a steady water pressure, since the pressure of the supply mains fluctuates considerably.

The gas engine is belted to a 200-kilowatt Bullock generator brought from St. Louis, which serves to drive the motors for the apparatus in the building, the machine shop, the briquette plant, the elevators and the conveyor. Any additional load required is obtained by means of a water-box resistance, which can be regulated by the switchboard attendant so as to maintain a steady full-load value.

The plans of this section include the following determinations: The proper length for a test run, the effect of the size of the coal, the best depth of the fuel bed, the effects of rapid load variations, the maximum returns from the different fuels, and the response of a producer plant to sudden demands for power.

ALCOHOL, GASOLINE AND ENGINES.

A new work of great importance is being undertaken by this section. Its equipment includes

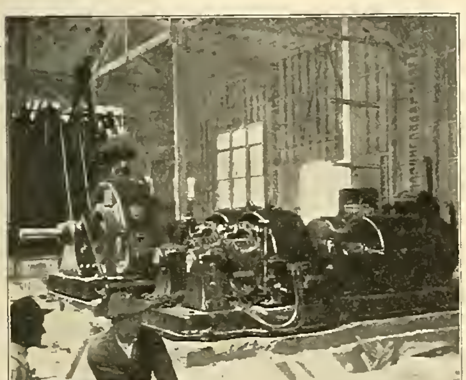


FIG. 3. TURBO-GENERATOR SET AT JAMESTOWN FUEL-TESTING STATION.

two 15-horsepower 250-revolution-per-minute Otto gas engines, two 15-horsepower Nash Company's engine, one two-horsepower International Harvester Company's engine, and two John Deere engines rated at 14 and 18 horsepower, respectively.

Experiments will be made covering the whole range of this field, but for the present the work will be confined chiefly to examinations of different carburetters, with the object of showing the lines along which a more efficient method of vaporization may be obtained. The other more prominent work is the examination of the kinds of fuels available, with special reference to gasoline versus alcohol, and an investigation of the use of kerosene as fuel for this class of engines, an investigation necessitated by the increasing demand of gasoline and the limited supply available.

DISTILLATION OF COAL AND COMBUSTION.

The study of the destructive distillation of the coal and its combustion in gas producers, coke ovens and furnaces, especially from the viewpoint of physical chemistry, will be undertaken by several divisions.

BRIQUETTING DIVISION.

The briquetting division, which occupies the large room at the end of the building, is putting down one large additional German briquetting machine, while the previous apparatus of English and American manufacture, that was used at St. Louis, is installed in the same room. The work of this division will be chiefly the manufacture of briquettes from various run-of-mine coals of the eastern fields, which will be tested on war vessels under the direction of the steam-engineering division.

OTHER PLANS.

The further fuel-testing work of the Geological Survey includes tests dealing with the spontaneous

FIG. 4. GAS-PRODUCER PLANT AT JAMESTOWN FUEL-TESTING STATION.

combustion of stored coals, in which an effort will be made to simplify the methods for its prevention, while a corps of specialists will be detailed to investigate closely the whole subject of explosions in coal mines with a view to eliminating danger from this source.

Electrical Exports for 1906-1907 Over $17,000,000.

Electrical machinery and apparatus exported from the United States during the fiscal year ended June 30, 1907, had a total value of $17,268,406 compared with $14,800,237 for the corresponding period of 1905-06 and $12,253,904 for 1904-05. This shows a sturdy continuance of the excellent yearly increase which the recent annual totals have indicated.

Of the countries buying electrical machinery and appliances from the United States all show a substantial increase in the value of electrical products purchased, with the single exception of one large customer—Great Britain—which decreased its electrical importations from the United States to the extent of half a million dollars.

The term electrical appliances used in the tables includes all telegraph and telephone instruments.

The following table gives the exports by months for the fiscal year ended June 30, 1907:

Months.	Electrical Appliances.	Electrical Machinery.	Total.
July, 1906	$ 577,084	$ 631,705	$ 1,208,789
August, 1906	744,775	624,304	1,369,079
September, 1906	677,821	726,600	1,404,421
October, 1906	863,287	743,749	1,607,036
November, 1906	749,357	624,611	1,373,968
December, 1906	827,646	635,855	1,463,501
January, 1907	674,367	903,082	1,577,449
February, 1907	599,855	714,207	1,314,062
March, 1907	590,999	919,825	1,510,824
April, 1907	583,780	748,618	1,332,398
May, 1907	619,393	800,566	1,419,959
June, 1907	754,276	1,080,960	1,835,236
Total	$8,262,640	$9,005,766	$17,268,406

The following table shows the value of electrical exports to the principal countries during the same period:

Exported to—	Electrical Appliances.	Electrical Machinery.	Total.
United Kingdom	$1,580,615	$1,139,165	$ 2,719,780
Belgium	206,846	....	206,846
France	82,975	715,363	798,338
Germany	388,369	105,793	494,162
Other Europe	217,544	439,266	756,810
British North America	1,327,222	1,909,858	3,337,080
Central America	225,949	71,475	297,424
Mexico	890,607	1,241,546	2,132,153
Cuba	469,470	92,079	561,549
Other West Indies and Bermuda	46,394	19,836	66,230
Argentina	262,537	129,151	391,688
Brazil	826,365	721,147	1,547,512
Other South America	661,257	162,568	823,825
Japan	400,983	1,233,002	1,633,985
Chinese Empire	....	60,950	60,950
British East Indies	....	278,867	278,867
Hongkong	....	18,442	18,442
British Australasia	195,14[illegible]	451,[illegible]	646,8[illegible]
Philippine Islands	[illegible]	64,1[illegible]	261,[illegible]
British Africa	77,8[illegible]	108,121	186,014
Other countries	205,[illegible]	15,[illegible]	[illegible]
	$8,262,640	$9,005,766	$17,268,406

British Association Discusses the Conception of Matter.

After a spirited discussion lasting for three hours of one session of the British Association for the Advancement of Science, in which the chemists and the electricians took sides in defending their respective conceptions of the atom, Sir William Ramsay announced the results of his recent experiments with radium emanations. The paper produced a sensation among his scientific audience and contained ideas that may require an entire reconstruction of the notions of the constitution of matter held heretofore.

The whole discussion is the result of the two differing views which have been adopted by scientists in their efforts to explain newly observed phenomena. One group has come to believe that there is no such thing as matter, but that it is only a manifestation of electricity. The atom changes its properties with the charge it carries and so is imagined as a sort of sphere enmeshing units of electricity—the electrons—which have come to be regarded as the ultimate grains in the structure of the atom-bricks that go to make up molecular structures. The number of these electrons determines the identity of the atom. In a figurative conception Sir Oliver Lodge says that the whole atom squirms with electricity, and when it escapes, as in radium, the atom will at a certain point change into something else.

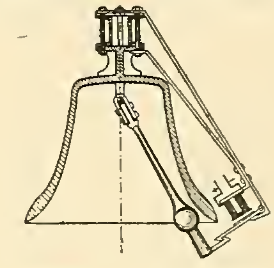
The chemists characterize the other school as being drunk on radium rays and decline to believe that matter is a form of motion or the atom an etheric whorl of electrons that may escape and affect the properties of matter that has existed apparently unchanged since the earth enjoyed an attenuated existence in the nebula of Laplace's hypothesis. Lord Kelvin, who closed the debate for the chemists, admitted that radium has opened the eyes of scientists to a host of new possibilities, but refused to coincide in the grossly electrical conception of the atom. (See also page 112 of this issue.)

Sir William Ramsay is now prosecuting experiments on gold and other substances that may, perhaps, furnish proof of his theory of the decomposition and transmutation of metals.

Electromagnetic Device to Increase Effectiveness of Bell Ringing.

Electrical means of ringing large bells either by the direct application of an electromagnet to moving the clapper or by the release of trip mechanism to bring the force of a spring or gravity into action have been used for many years. But a use of electricity whereby a very small current is enabled to effect a great increase in the loudness of the stroke is the ingenious invention which is embodied in a recent German patent issued to the firm of Bokelmann & Kuhlo in Herford.

The familiar form of swinging bell is shown in the drawing, in which the bell is rocked and the clapper, hanging free, strikes against the shell.



USE OF ELECTROMAGNET TO INTENSIFY STROKE OF BELL.

After fixing the clapper on a pivot to swing only in the plane of oscillation, a catch on the lower end is arranged to engage a latch which may be released by an electromagnet, as will be clearly understood from the sketch. Now when the bell is rocked and the clapper swings to the right it is held at that side until the bell has nearly reached the end of its swing in the opposite direction.

At this instant by a proper commutating device which may be affixed to the bearing of the bell the magnet is energized and the clapper, now in its highest position, is released and permitted a very much greater drop so as to strike the bell with an increased force. The current required to release the latch is very small, but it is explained that it effects a powerful blow of the clapper.

One-phase High-tension Power Transmission.[1]

By E. J. Young.

The recent advance in Europe of the Thury direct-current system of power transmission demonstrates the fact that unless an alternating-current system approaching it in simplicity of design and economy of material is developed it is only a question of time before the high-tension direct current will gain a footing upon this continent. Consequently the writer proposes a high-tension one-phase system having several desirable features not in common with either the direct-current or the three-phase system.

While the present three-phase system is more flexible than the direct current, it is more complicated and requires a considerably greater outlay for transmission material. The ordinary one-phase system is simpler than either of these two, but requires 25 per cent. more copper than the three-phase system and a proportionately greater amount than direct current. Then again, considering the strain upon the insulators as a standard of comparison, the fundamental difference between direct and alternating-current systems gives the former an advantage that no alternating-current system can overcome.

In Fig. 1 is shown a general outline of the proposed one-phase system. One-phase generating apparatus is supplying energy to step-up transformers—for convenience only one is indicated.

The center of the high-tension windings is permanently grounded, thereby reducing the electromotive force from line to ground to one-half that between the line wires, and in so doing placing one-phase transmission at least on a par with three-phase in the matter of economy of copper. At the receiving end the step-down apparatus is similar to that at the power station, the center of all high-tension windings being grounded. At the sub-station there is a motor-generator set consisting of a one-phase synchronous motor and a three-phase power and lighting generator. The set is started by an ordinary one-phase series motor operated by current from an autotransformer connected across the secondaries of the step-down transformers. The exciter may be on the motor-generator shaft as in Fig. 1, or operated by a separate motor as best suits the conditions.

An example will probably serve to illustrate the comparison between the different systems, especially those by alternating current. Therefore it is proposed to transmit 15,000 kilowatts 100 miles with 10 per cent. loss; the electromotive force to be 50 kilovolts from line to ground at the receiving end, and the alternating-current frequency to be 30 cycles. The following conditions for the three-phase line are assumed:

Power factor = 0.9.

Star-connected transformers with grounded neutral.

Electromotive force to ground = 50 kilovolts.

Electromotive force across line = 50×1.732 kilovolts.

By transmission formulas the copper section per line will be:

$$\text{Cir. mils} = \frac{D \times W \times K}{P \times E^2} \text{ in which}$$

$D = 100 \times 5{,}280 \times 1.02$ feet, two per cent. allowed for sag in conductors, etc.

$W = 15{,}000{,}000$ watts.

$K = 1{,}330$ for 0.9 power factor, three-phase.

$P = 10$ per cent. loss.

$E = 50 \times 1.732$ kilovolts.

Consequently: Cir. mils =

$$\frac{100 \times 5{,}280 \times 1.02 \times 15{,}000{,}000 \times 1{,}330}{10 \times (50{,}000 \times 1.732)^2} = 143{,}270.$$

$$\text{Weight of copper per mile of line} = \frac{143{,}270 \times 3}{62.5} = 6{,}876 \text{ pounds.}$$

As shown in Fig. 1, the center of the high-tension windings is grounded. The electromotive force of the one-phase system may therefore be double that to ground and still retain the same strain upon the insulators as in the three-phase system. One-phase conditions:

Electromotive force, 100 kilovolts.

Power factor, 0.9.

Constant K, 2,660 for 0.9 power factor, one-phase.

Therefore: Cir. mils =

$$\frac{100 \times 5{,}280 \times 1.02 \times 15{,}000{,}000 \times 2{,}660}{10 \times 100{,}000^2} = 214{,}890.$$

$$\text{Weight of copper per mile of line} = \frac{214{,}890 \times 2}{62.5} = 6{,}876 \text{ pounds.}$$

In order that the direct-current system shall be under the same conditions as the alternating current, the electromotive force to ground will be $50 \div 0.707$, or approximately 70.7 kilovolts. This will give practically the same strain on the insulators as would 50 kilovolts alternating current. By grounding the row of generators at the power and receiving stations, as proposed on the direct-current transmission from Monthoux to Paris, France, we have a potential of 141.4 kilovolts between line wires.

With K equal to 2,160 for direct current, all other factors remaining the same, we obtain:

Cir. mils =

$$\frac{100 \times 5{,}280 \times 1.02 \times 15{,}000{,}000 \times 2{,}160}{10 \times 141{,}400^2} = 87{,}270.$$

$$\text{Weight of copper per mile of line} = \frac{87{,}270 \times 2}{62.5} = 2{,}792 \text{ pounds.}$$

Comparing these results we find that as far as transmission material is concerned, the direct-current system is far more economical than either the three-phase or the one-phase system. There is practically no choice between the latter two. Therefore, any advantage the alternating-current system may have must necessarily be in the power house and the sub-station.

Comparing now the three-phase and one-phase with a view of estimating the probable saving the latter would represent in line material. On the one-phase system there would be at least 12 less insulators and pins per mile if steel towers were used, and 44 on ordinary pole construction. At \$2.50 per pin and insulator this would mean an initial saving of \$30, or \$110 a mile for pins and insulators alone. The cross-arms, etc., of the one-phase line would probably be longer and heavier than those of the three-phase line on account of the wires being farther apart, due to higher electromotive force, but this is more than compensated for by the poles being about five feet shorter, since the upper wire is done away with. There is also the difference in cost in stringing wires—three wires on one system and only two on the other.

One of the most important advantages of the proposed system, with reference to continuity of service in case of trouble on transmission line, is shown in Figs. 2, 3 and 4. In Fig. 2 the line is supposed to be grounded. The number of turns in the transformer windings is indicated in order to illustrate the effect of such an occurrence. With independent automatic circuit-breakers in each high-tension line at the power house and sub-stations—those at the power house operated by overload time-limit relays, and the sub-stations supplied with reverse-current relays operating with practically no time limit—the affected line will be cleared by the short-circuit.

We have now a 50-kilovolt transmission in which the ground serves as one conductor. At the receiving end the ratio of transformation is doubled, but at the same time the electromotive force is reduced one-half. Consequently the secondary potential will not be altered by one line being cut out of circuit on account of trouble or for repairs and inspection. In order to raise the system to approximately its original capacity the high-tension windings, being in two sections, are connected as in Fig. 3.

Upon removing the trouble and connecting the transformers as in Figs. 1 and 2 it would appear that, by simply closing the switches upon the repaired line, normal operating conditions are resumed. Although this last operation might result in conditions that could only be learned by experience; the illustration will show that as long as one line remains upon the insulators the service will neither be interrupted nor the transmitting power of the line very much reduced. In the event of the above trouble occurring upon the three-phase or direct-current lines the effect is different. With three-phase the entire system will be interrupted; with direct current, one-half the motor generators will stop. It will therefore be seen that the necessity of a duplicate line is much less needed on one phase than on either of the other systems.

Owing to the high electromotive force of the alternating-current system the space occupied by the high-tension bus-bars, etc., as ordinarily installed, would represent a considerable portion of the station. Consequently a diagram of the station distribution, requiring small space but giving ample insulation, the high-tension lines being under oil, is shown in Fig. 4. Although applicable to three-phase or one-phase, it will obviously present less complications when used with the latter.

In Fig. 4 are shown four independent transformer units placed in a single case partitioned into four chambers. Each chamber contains a transformer, the switches necessary for its operation and the interconnecting bus-bars between adjacent transformers. The lines (C) and (D) lead to low-tension generator bus-bars; (A) and (B) lead to high-tension line switches, which are controlled by overload relays; four lines, that is (A) and (B), being necessary in order to facilitate inspection or repairs of individual transformers while others are in operation. It will be seen that any transformer may be cut out of circuit from adjacent units by the disconnecting switches (S), which, under normal operating conditions, are all closed; (S_1) and (S_2) indicate double-pole double-throw remote-control switches for connecting the high-tension coils either in series across (A) and (B), or, in the event of trouble on one line, in parallel from ground (G) to the unaffected line. The interconnecting switches (S_3) and (S_4) connect the bus-

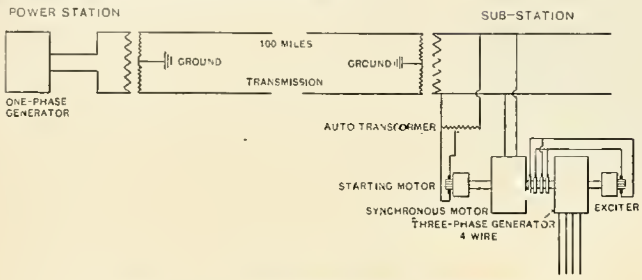


FIG. 1. OUTLINE OF PROPOSED ONE-PHASE TRANSMISSION SYSTEM.

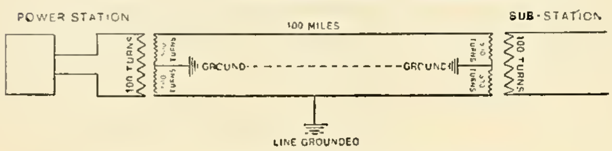


FIG. 2. PROPOSED SYSTEM WITH LINE GROUNDED.

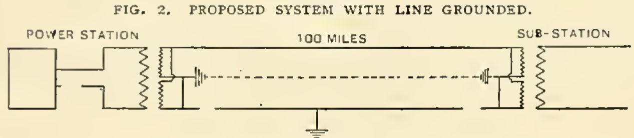


FIG. 3. HIGH-TENSION WINDINGS IN TWO SECTIONS.

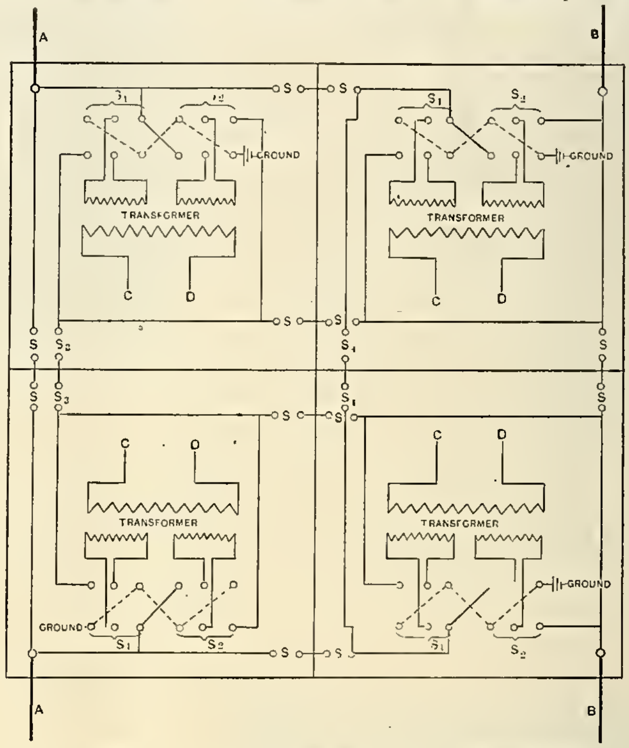


FIG. 4. DIAGRAM OF STATION DISTRIBUTION FOR PROPOSED SYSTEM.

1. A paper presented at the convention of the American Institute of Electrical Engineers, Niagara Falls, N. Y., June 26, 1907. Mr. Young is electrician for the Michigan Lake Superior Power Company, Sault Ste. Marie, Mich.

bars in different chambers. Under ordinary operating conditions all transformer switches (S_1) and (S_2) would be thrown to the right, thus putting the high-tension windings in series. In the event of line (A) being cut out, all switches (S_1) could be thrown to the left, thereby placing the two windings in multiple from (B) to ground (G); if line (B) is disconnected, all switches (S^1) would be to the right and (S_2) to the left. Since the cooling coils have been dispensed with the intention is to place the entire case in a pit surrounded by running water, or to have the oil withdrawn from case and cooled externally as is proposed in certain transmission plants.

Notwithstanding all that has been said in favor of the one-phase system it has several disadvantages. In the first place the generating apparatus costs more than three-phase, but less than direct-current apparatus. The inability of operating large induction motors is also a serious disadvantage which would necessitate the use of motor generators in many cases. Then again, there might be greater liability of surges in the one-phase circuit due to the larger current carried by them, but the troubles accompanying star-connected transformers, as explained by Mr. J. S. Peck, are entirely eliminated. The number of transformers upon the system, as shown in Fig. 4, will be much less with one phase, and the entire switching apparatus is not only reduced but also greatly simplified.

In the preceding suppositions the writer appreciates the fact that a number of factors which would enter into the design of a transmission system of such length and capacity have not been considered, the case taken being simply to illustrate a general theory of the proposed system. On comparatively short transmissions the disadvantages of one-phase operation and distribution would no doubt counterbalance any advantage it presents. However, where very long lines are contemplated, such as the 250-mile line in France, or electrifying railway systems in this country, one phase is not only the simplest, but unites maximum reliability of service with a minimum number of transmission wires.

Wiring Conditions in Sheboygan, Wis.

Fire underwriters' representatives have made a thorough inspection of electrical conditions in Sheboygan, Wis. In general the interior wiring throughout the mercantile and manufacturing districts of the city is fair. The majority of recently installed electrical equipments generally conform to the National Electrical Code requirements. Of the old equipments many are said to be in a poor condition. A considerable amount of weatherproof wire, commercial lamp cord and unlined brass sockets have been used. While numerous other violations of the code exist, they are of a less serious nature. No series arc lamps are in use in buildings. There is in force an ordinance providing for the regulation and inspection of electrical wiring by the city. This ordinance is, however, old and of little value, it is said, and steps have already been taken toward the adoption of a modern ordinance which will provide for the licensing of contractors as well as to define more clearly the power and duty of the municipal inspector. An agreement has been signed by the contractors, public service company and the municipal inspector that they will be governed by the code in all of the future installations. The present city inspector is well qualified for his office, and it is believed he will discharge his duties with impartiality and firmness.

A New Type of Insulator for High-tension Transmission Lines.[1]

By E. M. Hewlett.

The transmission of large amounts of power over long distances has reached such proportions that the voltage necessary to transmit this energy makes the problem of line insulation difficult. The so-called "pin" type of insulator has been enlarged to meet the greater demands until it has approached, if not already passed, the limits of good construction. Mr. Buck has given this matter a great deal of study in his high-potential transmission work, and, being dissatisfied with the mechanical features of a pin insulator, has devised a method of line construction involving the use of "suspension" and "strain" insulators. The suspension insulators support the line from above, hanging vertically beneath the cross-arm (or other point of suspension). The strain insulators are used at turns and at intervals of, say, every mile, to support and "anchor" the line, also as pull-off insulators on curves and to dead-end lines.

It is intended in this paper to describe a porcelain insulator which the writer has designed to carry out this method of supporting of high-potential transmission lines.

Each insulator unit is a flanged or petticoated disk with an enlarged central portion having two interlinked semi-circular holes. It is called a "link insulator" because it is used to insulate the interlinked tie-wires. The holes in the insulator are so arranged that the tie-wires which pass through them exert a compression strain on the porcelain (Fig. 1). Should the insulator break, the loops of the tie-wires will still be intermeshed (Fig. 2), and as the disks are used in series, with a factor of safety, the remaining disks will prevent a ground being formed until the break can be repaired.

The link insulator for suspension (shown in Fig. 3) is a petticoated disk, while the strain insulator (Fig. 4) is a disk with a grooved flange. The mechanical and electrical features of the two forms of insulator are essentially the same. The petticoats and flanges are so arranged that one side of the insulator is always protected from rain.

A diameter of 10 inches for both types of insulators has been found by experiment to be most convenient, and such insulators are suitable for a working voltage of 25,000 volts per disk. For higher potentials the disks are placed in series; for instance, four 10-inch disks would be suitable for a 100,000-volt line. As the separate disks arc over wet at approximately 65,000 volts, the rated voltage of 25,000 volts is within safe limits. The 10-inch disks were tested and did not fail with a load of three tons.

The insulators described above being made of one piece of porcelain, no cemented fittings or sections are necessary. They are not affected by extreme heat or cold, having stood the test of a severe winter. Tests prove that insulators with sheltered surfaces stand a much higher rain test than a much larger insulator which has no dry surface, as, for example, a flat disk without the flange or petticoat.

Fig. 5 shows a possible method of line support, using 10 towers per mile, in which the line is anchored at the end of each mile and at curves and suspended at intermediate towers. From the cut it will be noted that the conductor is looped around the strain links at the anchorage towers. The use of this type of insulator does away with torsional strain on the cross-arms, giving it a decided advantage over the pin insulator. It is obvious that the link insulator is adaptable to a great variety of conditions.

Fittings have been designed for use with these insulators to fit the conditions thus far presented, but each case should be considered as it comes up and such fittings designed as are necessary.

1. A paper read before the American Institute of Electrical Engineers at the Niagara Falls convention, June 26, 1906. Mr. Hewlett is an engineer of the General Electric Company.

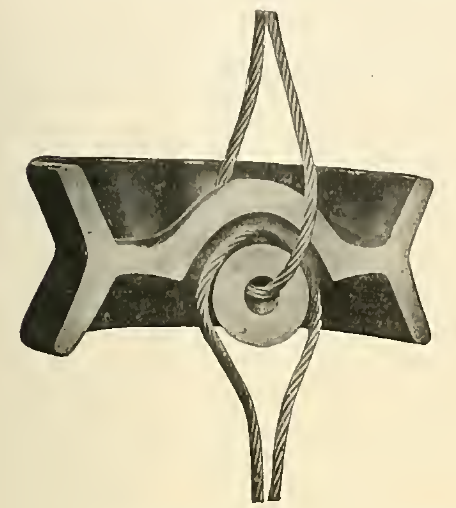


FIG. 1. TIE WIRES ARRANGED TO EXERT A COMPRESSION STRAIN ON INSULATOR.

FIG 2. LOOP OF TIE WIRES INTERMESHED IN A BROKEN INSULATOR.

FIG. 3. LINK INSULATOR FOR SUSPENSION.

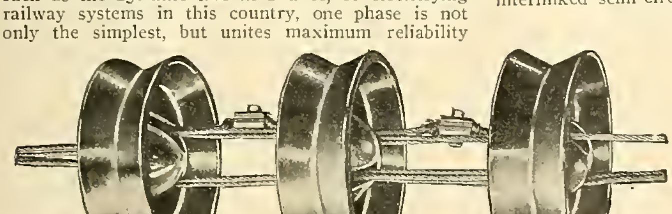


FIG. 4. STRAIN INSULATOR.

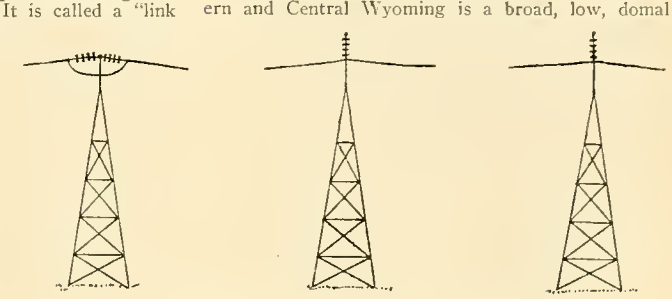


FIG. 5 METHOD OF LINE SUPPORT USING LINK INSULATORS.

Copper in the Hartville Uplift, Wyoming.

North and east of North Platte River in Eastern and Central Wyoming is a broad, low, domal mountain mass, with a maximum height of about 6,000 feet above sea level, which is known as the Hartville Uplift and which is similar in many respects to the Black Hills of South Dakota. Throughout this entire area copper is so widely distributed that, although no large deposit has yet been discovered, valuable beds of ore may at any time be found.

During the field season of 1906 Sydney H. Ball of the United States Geological Survey, while investigating the iron ores of this region, visited the copper mines and prospects. An account of this work is published by the Survey in its annual volume on economic geology (Bulletin No. 315), copies of which may be obtained on application. Mr. Ball gives an account of the history and production of the region and describes the ore deposits, which occur in the form of fissure veins, lenticular or globular masses of ore that outcrop at the surface and pinch out at slight depths, and blanket or bedded deposits. The fissure veins have not been sufficiently developed to establish their character beyond doubt.

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DEPARTMENTS.

DATES AHEAD.

Ohio Electric Light Association (annual convention), New Boody Hotel, Toledo, August 20th to 22d.

Michigan Electric Association (annual convention), Battle Creek, Mich., August 20th, 21st and 22d.

Canadian Independent Telephone Association (annual meeting), Toronto, September 4th.

Accounting for electric-lighting companies is a subject of great importance, for the need of standardizing and systematizing the accounts of central-station companies is urgent. The accounts should be kept by the most systematic, orderly, intelligent plan that may be devised, so that without being too complicated they will show the costs, profits and losses of the various departments of a business which is of necessity somewhat complex. The system of accounting should also be standardized, so that, with alterations which do not affect the general plan of arrangement, it may be adapted for small or large companies. Thus one company could compare its work intelligently with that of another, perhaps in a distant city or state, if both used practically the same system of accounting. Furthermore, standard accounts throughout the whole country, if that result may be achieved, will be of the greatest assistance in negotiations with public authorities. With a uniform system of accounting in the various states and municipalities made as simple as is consistent with its purpose, the municipal critics, if honest, could study the electric-light and power business to some purpose. They will find, as a rule, that the tremendous and mysterious profits which they suspect do not exist.

If it is true, as some enthusiastic motor-car writers have declared, that electric-railway operation is destined to be superseded by gasoline motor cars, it is curious that almost invariably railway passengers prefer to ride on electric cars rather than on any other. A case in point is related by the Indiana correspondent of the Western Electrician. The taxpayers of La Grange County, or some of them, at any rate, have filed proceedings to compel the Valley Traction Company to abandon the present means of locomotion. When the subsidies were voted in several townships in aid of the construction of this road the company entered into a contract to operate its cars by electricity. This was never done, but instead a motor car propelled by gasoline was installed. When this car was destroyed by fire a small steam locomotive was put in service, and the object of the proceedings is to compel the carrying out of the original purpose of operating the road by electricity.

Here is a case where the patrons of the road have tried the gasoline car and yet they stubbornly insist on the electric service that was promised them. It is to be observed, too, that the gasoline car was destroyed by fire. This fire may or may not have been caused by the gasoline, but at any rate it will hardly be denied that gasoline fumes are highly inflammable and are a source of danger. The electric railway has made its great success because of its popularity with the public and its economy of operation under ordinary conditions. It is very doubtful indeed if the gasoline cars on railways will ever be received with equal favor. Their use so far is confined to little-used branch lines with scanty and intermittent travel, and it is unlikely that they will ever be seriously entertained for extended use on street or interurban railways or trunk-line railroads.

American electrical men may well take pride in the swelling tide of exports of electrical machinery and appliances from the United States. The total value of such exports for the fiscal year ended June 30, 1907, was $17,268,406, which may be compared with $14,800,237 for the corresponding 12 months ended in 1906 and $12,253,904 for 1905. The increase of the value of electrical exports of 1907 over those of 1906 was nearly 17 per cent.

Electrical exports are divided into two classes by the Bureau of Statistics of the Department of Commerce and Labor—electrical appliances (including telegraph and telephone instruments) and electrical machinery. These classes were nearly equal in value for 1907, the figures being: Electrical appliances, $8,262,640; electrical machinery, $9,005,766. Comparison with other years, however, shows that the ratio of increase is greater with the appliances than with the machinery.

Five countries are pre-eminent as consumers of American electrical manufactures, taking together two-thirds of the whole. They are, in order, according to the figures of 1907: British North America, $3,337,080; United Kingdom, $2,719,780; Mexico, $2,132,153; Japan, $1,633,985, and Brazil, $1,577,512. It will be of interest to compare the electrical exports to these countries for the last three years. Here are the figures:

British North America—1905, $2,381,731; 1906, $3,046,309; 1907, $3,337,080.

United Kingdom—1905, $2,445,457; 1906, $3,181,796; 1907, $2,719,780.

Mexico—1905, $1,570,821; 1906, $1,725,954; 1907, $2,132,153.

Japan—1905, $1,508,412; 1906, $920,898; 1907, $1,633,985.

Brazil—1905, $470,474; 1906, $1,106,004; 1907, $1,577,512.

Thus it will be seen that our next-door neighbors, Canada and Mexico, are buying electrical goods from us in steadily growing amounts, while the demands of Brazil are increasing surprisingly. The United Kingdom did not do so well in 1907 as the year before, but better than in 1905, and is still one of our very best customers. Japan showed a lull the year after the war, but has more than made up for it. The values of the electrical takings of other countries from the United States are shown in the table given on another page. The one disquieting feature is the fact that, so far as distinctively classified, the Chinese Empire took electrical machinery only to the amount of $60,950 in 1907, and no electrical appliances at all, unless under the heading "Other countries," which must, indeed, be the case. But even in the case of China an increase of 150 per cent. over 1906 is shown, and of course if this rate of increase can be kept up for a few years nothing better could be asked for.

Taken altogether, the statement of electrical exports from this country for 1906-1907 is highly creditable to the electrical manufacturing industry of the United States.

An insurance company obtained a verdict in New York city against a central-station company for loss sustained by a fire said to be due to negligent wiring, and the verdict has quite recently been affirmed by the Supreme Court of the state. This decision is one of considerable importance, although it is far from being as disquieting to the electric-lighting interests as some of the daily papers, evidently obtaining their information from insurance sources, have led their readers to believe.

The fire causing the suit occurred in 1900, and the jury, in considering the particular evidence brought before it, came to the conclusion that the wiring had been done in a negligent manner, and found for the plaintiff. It does not follow, of course, that every ridiculous newspaper charge of a fire caused by electrical means is to be believed; most of such accusations are entirely unfounded. And if perchance the fire is actually of electrical origin the fault may be due to no fault in the equipment or manner of installation. Most electrical fires, like all other fires, are due to carelessness, and it is often the case that the neglect or inattention of the user or his employes is the cause of the trouble. Evidently the negligence of the company or individual making the installation must be proved in each case. Furthermore, the art of electric wiring has greatly advanced in the seven years that have elapsed since the time of the New York fire on which this suit was based.

So it will be seen that a calm consideration of the situation will show that the electrical interests, with the present-day zeal for the best construction obtainable, have little to fear from the precedent set by this decision of the New York Supreme Court. Nevertheless there should be no disposition to minimize the importance of the fact that in New York state, at any rate, an insurance company suffering loss may recover from an electric-light company where it can establish that the latter's negligence was the cause of the fire. Mr. W. H. Blood, Jr., of Boston, a former president of the National Electric Light Association, is the insurance expert of that association, and he briefly reviews the New York decision and the facts pertinent thereto in a brief summary which is given on another page of this issue.

ILLUMINATING ENGINEERING SOCIETY.

The convention of the Illuminating Engineering Society held in Boston on July 30th and 31st was productive of many valuable ideas on the producing, installing and distributing of lighting facilities for public and private use. Incidentally it may be said that the number of papers contributed to the symposium of the convention was larger than the members could fully assimilate while in session, and less time for discussion was available than might have been profitably spent in that manner.

This was not due so much, however, to the actual length of the programme itself as to the difficulties encountered at the outset by reason of the "Old Home Week" celebrations that were in progress in the city. The first session of Tuesday, the opening day, was necessarily brief, and several papers scheduled for the morning were not read until the afternoon. Wednesday morning's programme was also augmented by postponements from Tuesday afternoon's list, so that rather hurried reading and pressure to finish the session characterized the closing proceedings.

Departing from his usual custom of speaking extemporaneously, Mayor John F. Fitzgerald of Boston, who had been invited to be present to welcome the members on behalf of the city, read a carefully prepared brief address upon the progress of illuminating as a science. While in no sense technical in character, it was a resumé of the advancement made that formed a very fitting introduction to the subject as a whole.

Dr. Sharp's Presidential Address.

John Campbell of Boston, chairman of the convention committee, introduced Dr. Clayton H. Sharp of New York, the president of the organization, and the presidential address proved to be one of the most interesting of the session. An abstract of it is given on page 108.

In the discussion on the address of the president, V. R. Lansingh of New York said that the present method of calculating illumination by calculating different points and from that getting the average intensity was not only laborious, but not altogether satisfactory, and the method which Dr. Sharp had outlined would be not only of theoretical importance but also of practical importance to the practicing illuminating engineer, and he felt that it could be used with good results. Mr. Lansingh called attention to the fact that the National Electric Light Association had broken away from the old method of rating arc lamps, namely, the arc lamp to be of certain efficiency according to its watts, and it is now proposed to rate the arc lamp with regard to its flux of light rather than to the wattage consumed. He said he would like to see the society take some attitude with respect to the lamp manufacturers who are today going in exactly the opposite direction, who are rating their lamps by the watts, and not by the candlepower or the flux of light. J. R. Cravath of Chicago did not think it was desirable to throw overboard the consideration of the unit of foot-candles or candle-feet, as it was necessary to have some definite concept of power in the conduct of illumination tests. In similar manner, one would not want to throw over all reference to kilowatt, simply because there is such a unit of the kilowatt-hour.

Standards of Light.

The first regular paper considered was that on "Primary, Secondary and Working Standards of Light," by Dr. E. P. Hyde of Washington. The paper was discussed by Dr. Louis Bell of Boston, P. S. Millar of New York, A. E. Forstall of New York and others. After the luncheon adjournment the discussion was continued.

At the afternoon session C. O. Bond of Philadelphia called attention to the fact that at the present time a meeting of the International Incandescent Photometric Committee was being held at Zurich, and that it is discussing the question of standards of light and of standard photometers.

Mr. J. E. Woodwell of Washington, as secretary of the committee on nomenclature and standards, stated that he was in close touch with the meeting being held in Zurich, and expected to report full results thereof.

J. T. Marshall of New York city, in response to the question of President Sharp about the reproduction of a light standard from incandescent lamps provided all the present primary standards were lost, said he thought a very close approximation of the standard could be made by making the large number of lamps which were cut to the right length and which were of proper diameter and were treated to the right resistance, and by putting a certain wattage through them we could expect to get the average candlepower from this, and it would be a means of getting an approximate reproduction; but he would hesitate to make a reproduction in that way, unless, say, 1,000 lamps were made today, 1,000 next week, and 1,000 lamps a week later. If these results agreed pretty closely with one another, he would think they had gotten pretty close to a reproduction of the present standard light.

Practical Illuminating Methods.

The next paper was "Illuminating Engineering and Central-station Practice," by Mr. L. H. Scherck. Mr. Scherck treated this subject in an interesting way, and, among other things in his paper, said: "Of course, to satisfy the public, you must give proper service from your plant first of all. You cannot sell a thing unless you have it. Your lines must be correctly designed and kept up for the present and for increasing business. Your meters must be carefully checked, but as a rule this end of the business is carefully watched.

"Then you must go a step further and see that practical illuminating engineering methods are applied to the benefit of your patrons; there is nothing in the business of electric lighting which is more important to the owners of your property, to the public, and from a selfish standpoint to yourself, than the matter of illuminating engineering. Don't consider any place too small to be given some little attention on this score. I think that the central-station manager should try to see in every way that the patrons obtain the best advice on illuminating matters, in large cases by perhaps advocating the employment of competent consulting illuminating engineers; in other smaller cases, by advice obtained without charge from the lighting company itself."

Other Papers of Tuesday.

F. R. Nugent then read the paper on "Illumination of the Engineering Societies Building," written by C. E. Knox of New York city.

The next paper was that on "The Present Status of Candlepower Standards for Gas," by Mr. C. H. Stone of Albany, N. Y. The discussion on this paper was participated in by A. E. Forstall of New York to a considerable extent, Mr. Stone replying.

Following came a paper entitled "The Inverted Gas Light," by T. J. Litle of Gloucester, N. J.

A. Cressy Morrison of Chicago was not present, and his paper on acetylene had not been prepared. Nelson Goodyear of New York city read a paper on "Acetylene Lighting."

Discussion on Photometers.

Dr. Charles H. Williams of Boston then presented a paper on "A New Comparison Photometer." This was followed by a paper on "Illumination Photometers and Their Use," by Preston S. Millar of New York city.

H. Calvert of Philadelphia remarked that since illumination and light intensity have become of such great interest and importance, it seemed that the one thing mostly desired was some instrument by which could be measured or recorded the illumination and its intensity in any given room; it not infrequently happens when the lighting is laid out according to prearranged plans that the intensity is either not enough or too great. He inquired of Dr. Williams, in comparing light of different colors, say the Welsbach and the mercury-vapor lamp, whether the insertion of the blue glass spoken of is sufficient to make a good comparison, and whether the system is commercially on the market.

Dr. Louis Bell of Boston said he did not think anyone had a full realizing sense of the imperfections of photometric methods applied to illumination until he tried it. The photometry of a single source is a comparatively simple matter, but the moment one goes into illumination the trouble begins, and the further he goes the deeper the trouble seems to be. The fundamental difficulty with all illumination measurements is that the light does not come from one direction, and when the illumination comes from a variety of points the trouble begins; when you are trying to determine illumination of a test plane of any kind acting by translusion or reflection, Lambert's rule of the cosine wave does not apply; it is only sufficiently near for angles of incidence of small value, nearly perpendicular incidence, so that there is no special difficulty with any kind of screen with reasonable uniformity. When the light comes from all around, the variations from Lambert's law are absolutely fatal to any form of screen which he had seen.

George H. Stickney of Lynn, Mass., stated that he was interested in the subject and in Mr. W. D'A. Ryan's instrument especially. With the improved instrument of Mr. Ryan, he had made measurements recently, thoroughly calibrating it for different angles of latitude and azimuth. The variations in the calibrations were very small indeed; the instrument is read from the calibration and not from the inverse square calculation.

J. T. Marshall of New York city thought the general impression made on the audience by Mr. Millar's paper, so far as it relates to the Marshall photometer, was to give it a black eye. He said if in the particular instrument which came under Mr. Millar's observation, the photometric lens was of slow sensibility, a more sensitive lens could be substituted. He said, while changes might be made in the accessories, the fundamental principle of the photometer could be obtained.

L. B. Marks of New York said that it was not desirable to have the impression go abroad that there were no measuring instruments that were good enough for ordinary commercial service. He referred to the recent adoption of specifications for arc lamp illumination by the National Electric Light Association, and he thought if care is used for the measurement of the illumination of street arc lamps, for example, fairly accurate and reliable figures could be arrived at.

W. D'A. Ryan called attention to the point in Dr. Sharp's address, to the fact that the principal thing is the flux element, the amount of light delivered by the lamp irrespective of how it may be equipped; the tendency today is mostly on the initial basis, taking the initial illumination of the lamp without any relation to the relative depreciation of lamps under operating conditions, so that for the luminous flux, and with the time-element factor, they could get down to practical working conditions.

Chart for Illuminating Engineers.

The paper on "A Graphic Illumination Chart," by Mr. A. F. Parks of New York city, was then read. Mr. Marks said that Mr. Parks had given a very valuable graphic illustration of a chart for which illuminating engineers would have a great deal of use. Heretofore it had been necessary to take a certain equation and apply it individually, but this chart will enable illuminating engineers to avoid the laborious calculations by simply following the lines of foot-candles indicated in the chart.

Mr. Preston S. Millar then read the paper on "The Elements of Efficiency in Diffused Lighting Systems." An abstract of this paper will be found on page 111. Mr. Marks discussed it briefly.

The Lighting of Buildings.

At the session on Wednesday morning the first business was the paper on "Electric Light as Related to Architecture," by C. Howard Walker of Boston. Mr. Walker, who was the designer for the city's Home Week decorations committee, in speaking of the relation of electric lighting to architecture, deprecated the sacrifice of architectural principles in securing desired illumination. There should be discrimination between lighting arrangements designed to enhance the effect of architecture and those which are simply spectacular with architecture for the background. Any system of lighting which tends to diminish the effect of space should be avoided.

The next paper presented was on the "Lighting of the Boston Edison Building," the paper being prepared by Messrs. Bell, Marks and Ryan. There was considerable discussion.

Street Lighting.

"What Is Street Lighting?" was the subject of an interesting paper by W. H. Blood, Jr., of Boston. Mr. Blood's paper showed that the lighting of streets was prompted by three motives—to assist in the prevention of crime; to ornament and make attractive the streets of the city; to facilitate travel on the highways. Among other things the author said: "Various attempts have been made to combine ornamentation of the city with illumination. Festoons of incandescent lamps have been strung along the side of the street. Posts with groups of lamps have been used. With none of these methods has serious consideration been given to intrinsic brilliancy, and yet, in most cases, on account of the small units and their nearness together, most satisfactory illumination has been obtained." "The illumination of streets to facilitate travel thereon is, to my mind, much more important than that of obtaining ornamental or spectacular lighting. We should have on all streets in towns and cities sufficient light that we may be able to get about easily." "The writer believes that the tendency of all well lighted streets, except in large cities, is the abandonment of arcs and toward the use of the higher power incandescent lamps."

In the discussion F. W. Willcox said that the solution of incandescent street lighting involved only the matter of the provision of satisfactory posts and attachments at reasonable cost; then incandescent electric lights could be run on both sides of the street, like gas light. He called the attention of fixture manufacturers to this point.

J. E. Woodwell mentioned an installation of incandescent street lights in St. Paul and Minneapolis, which is very satisfactory, but he said that until a simple and inexpensive type of post is designed which will serve the purpose, he thought the introduction of such a system would find its usefulness only in business sections of the city, where it would be installed with a view of advertising the business of mercantile establishments. Mr. W. D'A. Ryan said that in his opinion there is no question that incandescent lamps of from 40 to 60 candlepower are going to do a great deal in the illumination of streets, but in order to approach the same effect of intrinsic brilliancy as given by the arc with incandescent lamps, it would be necessary to expend more energy with the incandescent lamp.

Reliability of Photometric Curves.

The paper on "Check on Reliability of Photometric Curves" was then presented by J. S. Codman of Boston. Mr. Lansingh thought that the problem of calculating illumination through a vertical lamp was comparatively simple, but when that lamp was placed at an angle the problem becomes more complex; if Mr. Codman could make his method applicable to lamps which hang at an angle, so that in the case of a chandelier, with a number of lights at 45 degrees, the illumination could be calculated, not only in a plane passing through the lamp axis, but also between the lamps, the engineer would have something which he needed very urgently.

Reflection from Different Colored Wall Papers.

The next subject was "Coefficients of Diffuse Reflection," by Dr. Louis Bell of Boston. Dr. Bell said that in all cases there is the more or less uncertain factor of wall reflection with which we have to deal, and it therefore seemed desirable to add somewhat to the meager data which are at the disposal of the illuminating engineer by measuring the coefficients of diffuse reflection by wall finishes, chiefly papers, in various colors, both by daylight illumination and by illumination from incandescent lamps.

The material employed in the experiments is chiefly wall paper of various finishes and of various colors, the method adopted being to compare each sample with a piece of standard white cardboard, taken merely for purposes of comparison, using the Munsell photometer. It was found that nearly all the colors, all the strong colors, give somewhat lower coefficients than had been supposed. The absolute coefficient of the standard cardboard was 0.74. The highest efficient obtained with any wall paper was 0.64; that was with a very faint cream, scarcely perceptibly different from white. That gave a coefficient of 0.64 with the incandescent lamp and 0.53 with diffused daylight from a north window and a clear sky, which was the uniform condition under which the daylight measurements were made. Deep greens and deep reds ranged downward from 0.64 to 0.05, the latter figure applying to dark reds and dark greens.

The various results of finishes divided themselves somewhat as follows: Incomparably better than any of the deeply colored finishes come the very light creams and yellows. These have coefficients of the magnitude of 0.4 and 0.6. Next come the medium papers of gray, yellow, bright red, very light red, pink and lilac. The coefficients of these run roughly from 0.20 to 0.40. Finally, last in the line, come some of the very heavy papers, in dark tones, which run down, say, to 0.15 or 0.05, winding up with the deep red and deep greens, which are nearly equally bad. A few experiments were made with striped papers, and the condition between the several stripes of the paper found in practice was a really remarkable similarity. These figures apply, so far as lights are concerned, to light from the north sky on the one hand, and the light from the ordinary incandescent lamp on the other.

Concluding Business.

The next paper was that on "The Metallic Flame Arc Lamp," by Mr. C. E. Stephens of Pittsburg, Pa., which was followed by the paper on "New Lights and New Illuminants from the Central-station Point of View," by Mr. R. S. Hale of Boston, which was read by the secretary. An abstract of Mr. Hale's paper is given on page 110.

A resolution of thanks to the Boston Edison Company, to the governor and to the mayor, to the committee of arrangements and the members and others who prepared papers, was then passed, and the convention stood adjourned.

Convention Notes.

The Pittsburg section was well represented, and New York had a good quota in the convention hall.

The palm for devotion to the cause must be awarded to R. Garland Gentry, who came on from Denver to attend the convention.

The harbor excursion of Wednesday afternoon was an ideal trip on an ideal afternoon and closed the convention's proceedings with just the right sort of recreation.

The Massachusetts gas and electric-light commissioners were present at some of the proceedings and appeared to enjoy the papers which had a bearing upon their official duties.

The various committees did the work assigned to them with excellent results. The society's first convention as a whole was handled as if conducted by veterans of long experience.

There were several ladies in the city as guests of the members, and the committee having charge of their entertainment saw to it that nothing was lacking to make their stay here a memorable event.

President Sharp made an admirable presiding officer. He prepared the way for some interesting inquiries and discussions with leading questions, and facilitated the business of the convention very efficiently.

John Campbell, as chairman of the convention committee, was certainly a hustler. He had charge of the city's preparation for electrical decorations during the week, and his untiring energy was manifested in his success with both fields of effort.

Among well-known electrical men who attended and whose names are not given elsewhere may be mentioned W. H. Atkins of Boston, E. P. Bernard of Boston, C. B. Humphrey of Pittsburg, [illegible] D. March of New York, George R. Stetson of New Bedford, Mass., and Arthur Williams of New York.

Miss Estelle C. Westervelt was Secretary Lansingh's able assistant in the duties of the office. Registration, delivery of papers and badges and other details of the work were attended to with celerity and a commendable degree of system.

The courtesy of the Boston Edison Electric Illuminating Company was thoroughly appreciated. The convention hall was just the right size for the meetings, and the company's contingent among the participants in the proceedings was a large one.

Chairman Campbell found time to pilot a large party over to the electric fountain on the Common Wednesday evening, and the brilliant effects obtained from the illuminations installed at the base of the fountain under his direction were much admired.

Power Distribution Project for Paris.

[From the Paris correspondent of the Western Electrician.]

There has been some talk of late of a project for an extensive power transmission for the city of Paris, using the river Rhone for operating a large hydraulic plant and erecting a 250-mile pole line from the station to Paris, which would be operated at 120,000 volts. Such a project is being considered seriously in electrical circles, as the need is felt for an increased supply of current. In this way the city would have a large amount of electric power which could be delivered to subscribers at a low price. The main idea is to use it for supplying the large subscribers mainly for motors in large factories and elsewhere, also for electric traction. Arrangements can also be made for distributing current to small factories and home workshops in the city. It is not the intention to compete with the city lighting companies in this case.

The present project has been drawn up by three competent engineers, Messrs. Blondel, Harlé and Mähl, and not long since Mr. Harlé, who is one of the members of the construction firm of Sautter, Harlé & Co., presented a report which shows the general lines upon which such a plant could be laid out to advantage. It is proposed to use either the high-voltage direct-current system, such as is now employed, for instance, on the Saint Maurice-Laussane power line in Switzerland, which has been described in the Western Electrician, or the three-phase alternating system. The following is a condensed account of the project, as described in the Harlé report, with special reference to the three-phase distribution:

The hydraulic work would consist of a single dam of great height just below the narrowest part of the gorges of the Rhone, so as to cover these over their entire length and bring the water level up to the point which it reached before the erosion of the gorges. The best point is near Génissat, in the Ain district. The height of the water at the dam will be 69.5 meters, and the dam will have a total height of 72.5 meters, which is exceptional, but can be used, owing to the present favorable conditions, as the dam will be convex on the upper side and will be solidly braced between the sides of the cliffs.

An overflow canal is provided, having a length of 80 meters and a width of eight meters. The offtake canal for the turbine station will branch off from the overflow canal. The hydraulic work comprises a series of basins, one for each pair of generator groups. Water will be admitted by Stoney gates which are operated electrically from a distant point. To each basin is connected a penstock of 2.7 meters diameter, laid in a trench cut in the rock upon a bed of beton.

In the turbine plant there will be 24 main turbines of 10,000 kilowatts each and eight turbines of 500 kilowatts for the exciters operated by separate inlets. There will be two exciters for each group of eight alternators. One of them will be sufficient to give the regular field current and the other is used as a standby.

Each alternator circuit going to the bus-bars is formed of a separate set of cables, placed upon beton supports below the floor of the station. In a special brick construction will be lodged the switch connections, placed upon insulators. All the cables will be laid in a set of underground galleries ending at the starting point of the overhead lines. In the station proper there will be only an exciter switchboard and a second board for the motors of the station. At some distance from the building and on the river bank will be installed the station which is used for the starting point of the overhead line. Here the alternators will be operated from a distance and can be connected on one or the other line. This arrangement will resemble the one used by the Ontario Power Company at Niagara Falls.

Each of the alternators is connected by a three-phase cable to the line station, and it will be operated in an efficient manner from this point, where are placed the instruments and switches. All the main bars will be double, and the connections made by oil switches will enable each alternator to feed either of the two main pole lines through transformers or else to feed the local pole line at 12,000 volts directly.

Each of the main lines will receive high-voltage current from a bank of six single-phase transformers, making two per phase in parallel. The transformers will raise the voltage from 12,000 to 120,000 volts, and perhaps later on to 150,000 volts, and are of the oil type with water cooling. The high-tension end will have no switches, these being only on the low-tension side. In case of an accident to one of the lines the circuit of the alternators which work in parallel on that line will be opened and the line will be thrown out of use. The machines will then be connected to the other line, which will be overloaded until the repairs are finished. In case of accident to a transformer which feeds one of the lines, all the current will be broken on the three phases of that line, transferring successively all the alternators to the second line. The transformer will then be replaced by a reserve transformer, restoring the former connections.

The line station will be built of two stories and will be almost as large as the turbine house, thus needing a great outlay for this purpose. However, this disadvantage will be compensated by the fact that the sub-station at Paris will be a simple transformer post and will give much less expense than for the direct-current project. At the Paris end a bank of transformers will be needed as at the other station, but they can be of a smaller type, lowering the voltage to 12,000 volts. A set of oil switches will give the current distribution to the different feeders.

The three-phase lines will be carried upon iron towers or pylons and they will be erected altogether on private property. This will reduce the number of angles to a minimum and the pylons can be spaced better in a straight line. The cost will be reduced by making the pylons large at the base. The three-phase lines will be two in number, but they will work in parallel, or each one can take all the load for a certain time with a greater loss in case the other line should be out of service.

There are three cables per line, with a section of 300 square millimeters and a tension of 120,000 volts. Each cable is mounted on a heavy insulator placed at the three angles of a triangle and upon stout iron tubes fixed in metallic cross-arms. Such cables are not likely to break, and they will have a considerable sag. Insulators are now made for as high as 120,000 volts three-phase, and even more, according to information obtained by the promoters from America. Self-induction and capacity will not figure here, according to the calculations, using the frequency of 25 cycles.

Another feature of the project relates to the use of the current in Paris. It will be used mainly for industrial purposes and is designed to give very cheap current for factories, traction lines, etc., which will use current on a large scale. Current will be furnished to the heavy consumers by means of sets of mains belonging to the municipality or its concessionaires, or else by private lines, since the latter are made independent by the act of June 15, 1906. This will allow of making a distribution at high tension to subscribers taking above 20 kilowatts by means of a special network, using a primary voltage of 12,000 volts for the large factories and a secondary distribution at 2,000 volts for the smaller subscribers. The mains will be run in districts where groups of subscribers are placed. Such a system is now in favor in England throughout the country and even in London for motor current at 2,000 and 500 volts. The use of high-tension cables at a low cost of copper with few transformer stations is the cause of the low price of such current. Under these conditions we may estimate a cost of $50 per kilowatt distributed, or for 50,000 kilowatts, which is the assumed figure for the start, about $2,500,000. The steam engines now in use in factories, etc., will be kept as a standby, so that this expense will be less. Besides a reserve current can be secured from a neighboring city plant if needed.

In the case of three-phase current the distribution at Paris will start directly from the main transformers of the sub-station. But for the direct-current project the sub-station must be equipped with groups of rotary converters, consisting of direct-current motors coupled to alternators. However, some of the existing sub-stations in the city could have their generators driven by adding direct-current motors. About half the current needed for Paris can be transformed to three-phase current by a large sub-station at Ivry, in the eastern suburbs, and the other half converted into direct current in other sub-stations, some of these placed on the spot, such as for tramway stations, railroads, etc.

Scotland Yard May be Called Up by Telephone at Last.

Although it may hardly seem credible, Scotland Yard, the headquarters of the criminal investigation department in London, has just been connected up to the public telephone system. As the outcome of much pressure and some ridicule, the various London police stations were similarly connected a short time ago, but Scotland Yard has held out until now. Of course, there has all along been an elaborate system of private telephones between the various police stations and with Scotland Yard.

ELEMENTS OF ELECTRICAL ENGINEERING.

By Geo. R. Metcalfe.

XXVIII. Electric Lighting.

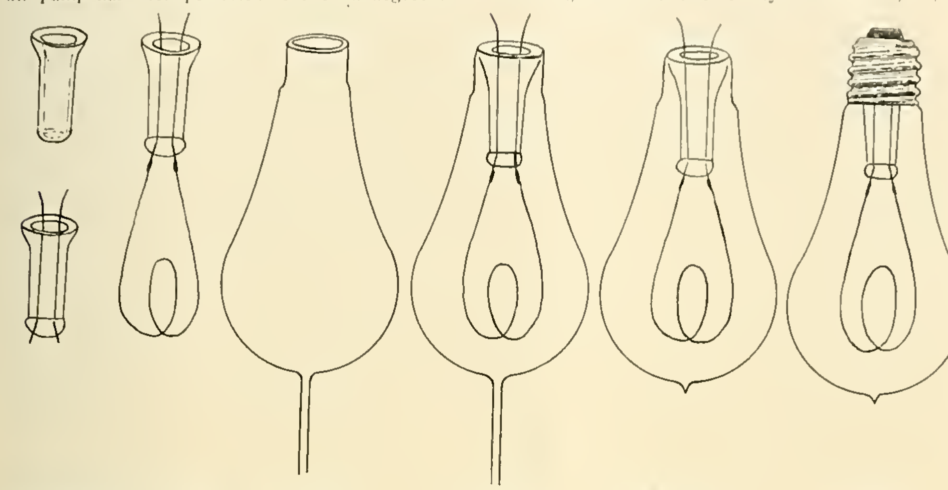
Incandescent Lamps.

After the process of flashing is completed, the filament, with the glass neck to which it is attached, is introduced into a glass bulb, and the neck and bulb are securely sealed. The large end of the bulb has a glass neck projecting from it by means of which the lamp is attached to an air pump, and the air is exhausted from the bulb. A very high degree of exhaustion is necessary in order to avoid consuming the filament, besides diminishing the amount of heat conveyed to the glass, and preventing the destruction of the filament by currents of gas which the heating of the filament would set up in the bulb.

Formerly the Sprengle type of mercury pump was used exclusively for exhausting lamps, and while it did this very effectively it required a great many hours of pumping to produce a sufficiently high vacuum. Within recent years the mechanical air pump has been perfected to such a degree that this work can now be done in a small fraction of the time required by the mercury pumps.

After the lamp has been pretty well exhausted, it is heated by passing current through the filament, and this heating has the effect of driving off any gas which may cling to the surface of the glass or which may be occluded in the filament or the paste at the joints. When the pumping process is completed, the tube on the end of the lamp is sealed off, and the base is attached by means of plaster of paris, thus forming a complete incandescent lamp.

The accompanying illustration shows some of the stages in the manufacture of incandescent lamps.



Glass Stem and Glass Stem with Leading-in Wires. Filament Attached. Bulb with Tube Attached. Ready for Exhausting. Finished Lamp Without Base. Lamp with Base Attached.

STAGES IN THE MANUFACTURE OF AN INCANDESCENT LAMP.

The process of manufacture of incandescent lamps has been so perfected that it is possible to turn out a grade of lamps which will be very nearly uniform, but as it is necessary in burning incandescent lamps in multiple to have all lamps on the same circuit almost absolutely uniform, each lamp must be separately tested for voltage and candlepower.

There are in use, for various purposes, lamps of all kinds of voltages and candlepower, the former ranging from four volts, for small battery lamps, to 220 volts for central-station circuits. They are also made in sizes of from a fraction of a candlepower up to 50 and sometimes 100 candlepower. The great majority of central-station circuits, however, are nominally 110-volt circuits, although practically they vary from 100 to 118 volts, and all incandescent lamps used for central-station distribution must be sorted for voltage, so as not to vary more than one or two volts from the circuit on which they are to be used.

If a lamp is connected to a circuit of higher voltage than that for which it was made, it will burn at a higher efficiency and give a greater candlepower and a more brilliant light than it would at its normal voltage, but it will do this at the expense of its life, which will be greatly reduced. On the other hand, if the lamp is burned at too low a voltage, it will generally have a very long life, but its candlepower will be less than normal, and it will burn with a dull red glow, giving very inferior illumination, which will not be satisfactory to customers.

It is therefore of importance that lamps be burned as close as possible to their proper voltage, and this requires a careful testing and assorting of every lamp as it is manufactured.

Efficiency.

The term efficiency as applied to incandescent lamps means the amount of power consumed per candlepower of light. For example, a 16-candlepower lamp burning on 110-volt circuit takes one-half an ampere of current. The watts consumed are equal to the amperes multiplied by the volts, or $110 \times \frac{1}{2} = 55$ watts; $55 \div 16 = 3.4$, or 3.4 watts per candle. The most economical carbon-filament lamps available at present have an efficiency of 3.1 watts per candlepower, which corresponds to about 1,300° C. temperature of the filament, and if this efficiency is increased, or, in other words, if the filament is burned at a higher temperature than this, it will rapidly disintegrate. It is therefore impracticable to exceed 3.1 watts efficiency with ordinary carbon-filament lamps.

An incandescent lamp burns at its highest efficiency; and consequently at its maximum economy, when new. After having been in use for a short time the lamp begins to deteriorate, because of the very slow but constant deposit of carbon on the interior of the bulb. This not only darkens the lamp, so that it gives less light, but the carbon deposited on the bulb comes from the surface of the filament, which is thus reduced in size and therefore increased in resistance, so that it takes less current and gives a great deal less light.

It is evident, then, that barring accidental breakage of either the bulb or the filament an incandescent lamp of, say, 16 candlepower, when new, would continue to depreciate very slowly at first, and afterward more rapidly, until eventually it would give perhaps only four or five candlepower. For a long time, however, before it reaches its ultimate life, it will be comparatively useless for ordinary lighting purposes.

The useful life of a lamp is generally very much shorter than its possibile ultimate life, and is usually considered about 600 to 800 hours. At the end of this period the lamp will generally drop off three or four candlepower, and it is generally considered that when a lamp has lost 20 per cent. of its initial candlepower it should be replaced by a new one.

To obtain the most economical results, lamps should always be renewed at the end of their useful life, and it is a fairly safe rule to follow to replace a lamp whenever it shows any appreciable deterioration.

The efficiency of a lamp to be used on any particular circuit should be selected with reference to the closeness of regulation of the circuit voltage. The 3.1-watt lamps are not suitable for circuits which show any appreciable voltage variation. If the circuit varies two or three per cent. or more in voltage, then 3½ or even four-watt lamps should be selected, in order to obtain a reasonable length of life.

The reason for this is that the high-efficiency lamp burns at a much higher temperature than the low efficiency lamp, and any slight increase in voltage with the former lamp increases the temperature of the filament to an extent which causes very rapid deterioration, whereas with a lamp of lower efficiency the temperature of the filament is lower, and a moderate increase in its temperature, due to a temporary rise in voltage, would not raise its temperature to a dangerous degree.

In comparing different lamps, the candlepower rating is a more or less ambiguous term, unless the direction from which the light of the lamp is measured is taken into account. In different types of incandescent lamps a great variety of shapes of filaments may be noticed. In some lamps the filament will be a simple U shaped carbon, while in others there will be one or several turns of the filament, forming a spiral coil at the end of the bulb. Between two such lamps the distribution of light will be quite different. The simple U-shaped filament will give practically 16 candlepower at every point in a horizontal plane, while if the mean horizontal candlepower of the spiral-filament lamp be 16, the candlepower measured from the end of the lamp will generally be considerably more.

In order, therefore, to compare lamps of very different shaped filaments, it is necessary to take the mean spherical candlepower, which is the mean value of the light taken from every direction. For purposes of general illumination, the amount of light given off in the upper hemisphere, assuming the lamp to be suspended vertically, is of comparatively little importance. It is the horizontal illumination directly beneath the lamp which is chiefly desired. For this reason, the mean hemispherical candlepower, or all the light given out below the horizontal plane, is the most useful measure for the comparison of different lamps.

Distribution.

Incandescent lamps are used almost entirely for interior lighting, and are only adapted for constant-potential circuits. As the lamps are connected in multiple across the circuit, the greater the number of lamps used, the greater the amount of current which must be carried. In large systems, where many thousands of lamps are distributed over a considerable area, the amount and cost of copper conductors soon become a very expensive factor, and to reduce the cost of copper what is known as the three-wire system of distribution was invented, and will be described later. In this system the voltage of distribution is doubled, which permits a saving of about two-thirds of the copper required for a similar two-wire distribution.

Although an incandescent lamp is not very well adapted for street lighting in series, several methods have been devised for adapting it to series lighting for outdoor illumination in small towns and villages where the expense of arc lighting is not warranted. A few of these series systems have been installed, but they are not generally considered very successful.

Take, for example, a 32-candlepower lamp requiring 100 volts. A series of 20 of these lamps would require a current of only a little more than one ampere at 2,000 volts. Such a current could be carried by a conductor merely large enough to support its own weight, but in case of the accidental breakage or burning out of any one lamp in the series, the whole circuit of lamps would go out unless some provision be made for bridging over the gap of the burned-out lamp. This is accomplished in some cases by the fusing together of the terminal wire in any lamp in which the filament is broken.

Series circuits of this sort are also sometimes operated from constant-potential circuits by means of constant-current transformers. Ordinary incandescent lamps, however, are not usually satisfactory for street illumination, and as the action of the series lamps in short-circuiting themselves when burned out is uncertain, the system as a whole is not to be recommended.

[To be continued.]

Note.—This series of articles, intended to survey, briefly, the whole field of applied electricity for light, power and heat, was begun in the Western Electrician of February 2, 1907.

Illinois Electric Association Next Week.

The annual meeting of the Illinois State Electric Association will be held on August 14th and 15th. The members will meet at Peoria and take the Illinois, the state fish commissioners' boat, for La Salle, where special cars of the Illinois Valley Railway Company will carry them to Starved Rock. Some form of entertainment will be provided there, and the next morning the members will again take the Illinois for the return trip.

The complete programme has not as yet been finished by Secretary Chubbick, but that the meeting will be well worth attending is assured. The trip up the Illinois River to La Salle is a most interesting one and will make an ideal outing, combining the business of the convention with the pleasure of the boat ride.

The Concepts and Terminology of Illuminating Engineering.[1]

By Clayton H. Sharp.

In the infancy of a science the concepts regarding it are necessarily neither very clear nor definite. The terminology of a science always lags far behind the actual state of the science itself. We must have the thing before we have a name for it; we must have the concept before we have a word to express it. An exact terminology, as contrasted with a loose one, is found to be more and more essential in proportion as its concepts develop and as the science itself progresses in exactitude. As long as the treatment of the science is qualitative only, no particular need is felt for an exact terminology. As, however, the science becomes quantitative and involves exact measurements of the quantities entering into it the need for a terminology which is correspondingly precise is felt. For instance, in the earlier days of the science of mechanics no strict differentiation was made between the terms force, work and power. At the present time, however, these concepts and the terminology corresponding thereto are very clearly differentiated. The interrelations of things are not seen in the same way when a science is young as they are when it has, so to speak, reached its maturity.

The simplest and most obvious relations are the ones which first are used, and it is only with advancing knowledge that the utility of the less obvious relations comes to be appreciated. This is true for an applied science as well as for a pure science. In the application of scientific principles and industrial products to the uses of everyday life it usually happens that the practitioner at first proceeds in a purely empirical way. He is likely, however, very soon to find a need for greater exactitude in his work; consequently his terminology, which at first was of the crudest description, becomes more exact and perhaps more complex. His concepts of what he is working with, which at first are inexact and hazy, necessarily become cleared with time, and he finds that the ideas on which he proceeded at first, while they may have been more or less correct, yet are not the ones which are most useful in the more extensive practice which time has brought.

We are led now to ask what is the state or condition of the science of illuminating engineering in regard to its terminology and its concepts. This science is founded on the ancient science of optics. All the optical principles which apply to illuminating engineering have been known for many years. Optics is, in many respects, an exact science. The laws of reflection, refraction, diffraction and polarization have been studied with minute care. The measurement of wave lengths and angles of rotatory polarization as well as the computation of lenses, mirrors and other optical apparatus have been carried to an extraordinary degree of precision. In spite of all this, however, the science of optics has remained in a rudimentary condition in so far as its terminology and concepts relating to light as an output used for purposes of illumination are concerned.

At the present time, in his quantitative work, the illuminating engineer deals chiefly with candlepower in its various aspects and with intensity of illumination. He does not, as a rule, employ any term which expresses directly the quantity of light which is being emitted by the source with which he is dealing. This is surprising, for the quantity of light which he had at his command is of vital importance to him. The distribution of this light he can arrange according to his own wishes by the use of various devices. Now the proper term for the quantity of light is easily found by a consideration of the physical nature of light itself. Light consists in ether waves propagated with a velocity of 300,000 kilometers per second. A source of light is simply a wave-maker. It agitates the ether continually and sends out a constant stream or flow of such waves in all unobstructed directions. If we take any transparent plane on one side of which is a source of light we may think of a continual flow of wave-trains in the ether across this plane. If we surround our source of light by a closed, transparent surface, say an imaginary sphere, the total flow of ether-trains through this surface measures the luminous output of the source. For the sake of uniformity with the usages of other branches of physics, etc., the wave-flow is referred to by using the Latin name for flow, namely, "flux."

We should form a concept, then, of all sources of light, whether primary or secondary, as the starting points of luminous flux, and of all spaces surrounding such sources of light as traversed by this luminous flux. Having formed the concept of luminous flux the following definitions and relations are a direct consequence: The output of any lamp is measured by the total luminous flux which it emits; the brightness of a diffusely reflecting or transmitting surface is proportional to the luminous flux which it emits per unit of area; the reflecting or transmitting power of such a surface is the ratio of the luminous flux which it emits to that which it receives; the intensity of illumination on any surface is the flux which it receives per unit of area. All the above quantities are of vital importance in illuminating engineering, in view of which fact it would be surprising if the concept of luminous flux should not prove itself to be very useful in the everyday work of the illuminating engineer.

It is necessary first to define a unit in terms of which luminous flux is to be measured and to establish its relation to the unit of luminous intensity, the candlepower. This is done in a way analogous to that employed in magnetism and electrostatics; that is, unit flux is defined as the flux emitted by a light of unit intensity, or one candlepower, in a unit solid angle. A unit solid angle is the solid angle subtended at the center of a sphere by a portion of the surface of the sphere bounded by four lines, each equal in length to the radius of the sphere. There are 4π or 12.57 such solid angles in the entire sphere. This being the case, we have approximately the relation that a unit solid angle is the one subtended at a point by a surface one foot square, one foot distant from that point, or by a surface one meter square, one meter distant from the point, or a surface one yard square, one yard distant from the point, etc. If at the apex of such a solid angle a light source of one candlepower be placed, a unit luminous flux will pass through any transverse plane through the solid angle, no matter what the inclination of the plane or its distance from the light. In terms of this unit luminous flux is measured.

The relation between the total luminous flux of a source of light and the mean spherical candlepower of that source is at once seen. If we consider a source of light having an intensity of one candlepower in all directions, its mean spherical candlepower would be one; and since there are 4π solid angles in a sphere surrounding that source the total flux from it will be 4π unit of flux. If the mean spherical candlepower of a source is I_s its total flux will be equal to $4\pi\ I_s$, or Φ equals $4\pi\ I_s$, where Φ represents the total flux and I_s the mean spherical intensity. Thus the total flux is numerically equal to 12.57 times the mean spherical candlepower of the source.

We have next to consider the relations existing between flux of light and intensity of illumination. As we have seen, the flux falling on a plane surface one foot square placed one foot distant from a light of one candlepower is approximately a unit flux. But the illumination on that surface is unit illumination if we measure in English units. If the same plane surface is removed to a distance of two feet from the light, only one-fourth of the total flux falls on it and the illumination is one-fourth as intense. In other words, the intensity of illumination on any surface is measured by the luminous flux per unit of that surface or by the flux density. This relation may be expressed thus:

$E = \frac{\Phi}{s}$. From this relation the familiar inverse square law may at once be deduced.

The above equation becomes of practical importance in computing average illumination results. If, for instance, we know that from a given source or sources of light a certain flux falls upon the plane of reference, we can determine at once the average illumination on this plane by dividing the flux by the area of the plane. Thus the average illumination is determined without direct reference to the candlepower of the sources. Conversely, measurements of illumination on a given plane enable us to determine the flux of light falling on that plane. This is a quantity of great importance, since it leads us to a value for what we may term the net efficiency of the installation, or the efficiency of utilization of the light. By the net efficiency of the installation, or the efficiency of utilization, would then be meant the ration of flux which falls upon the horizontal plane of reference, to the total luminous flux emitted by the lamps in the room.

The procedure for determining the value of the luminous flux from a lamp, either its total flux or the flux within a certain solid angle, is similar to that pursued in determining the mean spherical candlepower and mean hemispherical candlepower, etc. For instance, the well-known Rousseau diagram, so generally employed for the determination of mean spherical candlepower, is really a flux diagram. If the Rousseau diagram extends over 180 degrees polar distance, the total area which it encloses is proportional to the total flux of light from the lamp and the part which is enclosed between any two angles as marked on the axes of the abscissas, is proportional to the flux from the zone or from the solid angle. Consequently, any method which will yield the mean spherical, mean hemispherical, or mean zonular candlepower will give, with practically no modification, the luminous flux corresponding thereto. The Matthews integrating photometer may be calibrated so as to give directly the total luminous flux from the lamp measured by it, or other integrating devices may be employed. By the use of such devices as are at hand today, it would not be at all impossible to rate lamps according to their total luminous flux rather than according to their candlepower. Thus at one stroke the difficulty would be cleared up which arises from the actual difference in performance of incandescent electric lamps, which are rated alike according to our present arbitrary method. Using one of the methods indicated above, it is a matter of no difficulty to determine what the total flux of light will be.

Having pointed out certain reasons why the notion of luminous flux should find extensive application in illuminating engineering work, let us consider for a moment the question of terminology. We have at the present time a name for the unit of luminous intensity. We call that the candle, and we measure luminous intensities in candlepower.

It is usual in this country to express illumination in terms of the candle, and of the foot as the unit of distance. We have no suitable name for this unit of illumination; by some it is called the candle-foot, by others the foot-candle. Some make the plural candle-feet, others make it foot-candles. The name is inappropriate and awkward, since ordinarily, when we place two words in conjunction like this, we mean the product of the two quantities involved, as, for example, in foot-pounds, where we mean the product of the feet by the pounds. The foot-candle or the candle-feet, however, means candles divided by, not feet, but feet squared; consequently the term is doubly inappropriate. It would, therefore, be very desirable, if we are going to adhere to this unit of illumination, to have a suitable name for it. If we use the metric system, a name for the unit of illumination is at once at hand. In this system the candle may be the unit of luminous intensity, but the meter is taken as the unit of length. The illumination produced by one candle at a distance of one meter is called the "lux." On account of the relation existing between the foot and the meter, it happens that the lux is about 10 times the size of the foot-candle. To be more exact, it is 10.8. The use of the lux, however, involves the use of an unaccustomed unit of length, and it is consequently found awkward.

When it comes to the unit of flux of light, as we have seen, the unit of length does not enter. The unit of flux depends only upon the chosen unit for luminous intensity, and consequently we may adopt the name which has already been suggested and used for this purpose, namely, the "lumen." By the lumen we mean the flux of light emitted by a source of one candlepower through a unit solid angle, and, as we have seen, the number of lumens falling on a surface, divided by the area of the surface in square feet, will give the illumination in foot-candles, or the number of lumens falling upon a surface, divided by the area of that surface in square meters, will give the illumination on that surface in lux. It would, therefore, seem to be an obvious thing to do to adopt the lumen as the name for the unit of luminous flux.

We have in this kind of work at least three kinds of efficiency to consider. We have, first, the efficiency of the illuminant as such; second, the efficiency of the illumination installation irrespective of the lamp (this may be called the net efficiency of the installation, or the efficiency of utilization of the light); and, third, the efficiency of the installation, including the lamp (this may be called the gross efficiency of the installation). The efficiency of the lamp, if it be an electric lamp, would properly be determined by its lumens per watt; this term has not come into use, but deserves to do so. Instead of lumens per watt, we speak of watts per candle. Watts per candle measures for a given type of lamp, the specific consumption of that lamp. True specific consumption would be measured by watts per lumen. The term watts per candle, while a very convenient one from the lampmaker's point of view, is not so good a term for the use of the illuminating engineer. It is to be hoped, therefore, that in time lamps will be designated by their efficiencies, and the efficiencies will be expressed in terms of lumens per watt. What we ordinarily at the present day call a 16-candlepower 3.1 watts per candle lamp would, under that system, have a rating of 163 lumens and an efficiency of 3.3 lumens per watt. In the case of gas lamps, the efficiency could be expressed in terms of lumens per cubic foot per hour.

Going next to the net efficiency of the installation, irrespective of the lamp. This is the efficiency which it is the especial province of the illuminating engineer to attend to. Given any illuminants whatever, there is some best way to equip and to arrange them so as to produce a maximum result in illumination. This efficiency may be expressed in terms of the lumens received on the horizontal plane of reference, divided by total lumens emitted by the lamps. The gross efficiency includes the efficiency of the lamps themselves. This is the efficiency with which the user of the installation, the man who pays the bills, is most interested. This efficiency can be expressed in terms of lumens on the plane of reference per watt, or per cubic foot per hour expended in feeding the lamps. But, as the foot-candles multiplied by the square feet gives the luminous flux in lumens, consequently the expression foot-candles per watt per square foot is equivalent numerically to lumens per watt; so that here again the introduction of the notion of luminous flux, and of the term lumen, justifies itself by reducing an expression of unusual complexity to one of very great simplicity.

1 Abstract of the presidential address at the convention of the Illuminating Engineering Society, Boston, July 30, 1907.

QUESTIONS AND ANSWERS.

Difference Between Auto-transformer and Starting Compensator.

H. D., Chicago: What is the difference between an auto-transformer and a starting compensator?

ANSWER.

These names are often used interchangeably, so that the device spoken of in this answer as an auto-transformer may not be what is familiar to the reader as an auto-transformer, but the device

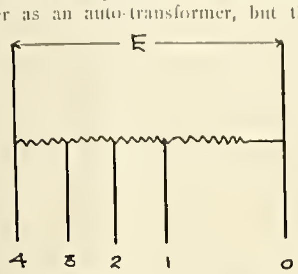


FIG. 1. DIAGRAM OF AUTO-TRANSFORMER.

represented schematically by Fig. 1 is most commonly referred to as an auto-transformer, and that in Fig. 2 as a starting compensator.

The difference between the two devices is the additional coil necessary in the starting compensator, the latter being a transformer with a subdivided secondary graded to give the proper voltage values for starting.

In Fig. 2 (E) represents the line voltage impressed on the primary; the terminals (1) (2) (3) (4) are steps from less than one-half the secondary voltage to full secondary voltage.

In the auto-transformer of Fig. 1 (E) is the line voltage as before and the terminals (1) (2) (3) (4) are steps in the secondary side. The secondary voltage of this device cannot be higher than line voltage. Variation in the working load of motors causes more fluctuation in the line circuit than when the compensator is used, and there are

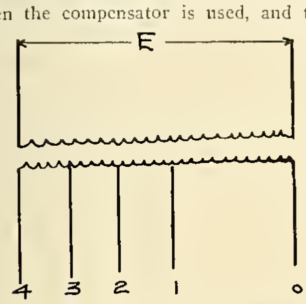


FIG. 2. DIAGRAM OF STARTING COMPENSATOR.

disadvantages in having the line and feed parts of a circuit in metallic contact.

The auto-transformer, however, is a very flexible device and its constant losses are less, which means less heating. These losses are less because the copper losses and iron losses almost cease when the secondary is taking full voltage, there being in that case only a small current flow in the coils.

It might be well to mention that the name compensator is also quite badly overworked in electrical terminology; for instance, there are starting compensators for direct-current motors. These are usually called controllers or starting rheostats.

Repulsion of Electromagnets on Alternating Currents.

C. B. H., Austin, Ill.: How is it that you can connect up a pair of magnets so they will "buck" on alternating current, and why in this arrangement is there such an excessive flow of current?

ANSWER.

Connect two electromagnets, as shown in Fig. 1, to a source of direct current. If the terminals

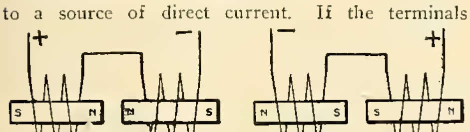


Fig. 1. Fig. 2.

REPULSION OF ELECTROMAGNETS ON ALTERNATING CURRENTS.

and windings are as indicated, poles will be produced as lettered. The two N poles opposed will repel. Now reverse the direction of current supply, leaving all other connections as before (see Fig. 2). When the current in the windings of each is reversed the polarity of each will be reversed; each N pole becomes an S pole and vice versa. Now we have two S poles opposed, and being of similar sign they repel. Thus, there will always be repulsion or "bucking" which ever way the current is flowing through the pair. Arrange to reverse the current supply a number of times a second. Commercial alternating current is such a current. Then if the pair of magnets are connected to the same source of alternating-current supply they will repel or "buck" as the questioner describes.

The flow of alternating current through the windings of an electromagnet is limited by the pure resistance of the wire and by the self-induction of the turns. When the two magnets are in "bucking" relation it may be explained that one magnet tends to demagnetize the other, or that the effect of the turns in one direction neutralizes those in the other, destroying the self-induction, so that only the resistance of the wire limits the current flow.

If the connections of one magnet be reversed from those shown in the diagrams there will always be attraction, since an N pole and an S pole will be adjacent. In this case the magnets are in helping series, so the self-induction of the coils is cumulative and less current will flow.

The Westinghouse Report.

In the recent report of President George Westinghouse and other officers of the Westinghouse Electric and Manufacturing Company some interesting facts are given concerning the business of this great manufacturing company. The company is the possessor of a large number of patents, and licenses under a still greater number have been acquired by agreement with the General Electric Company. These jointly operated patents amount to many thousand in number, and at a conservative estimate aggregate a value of $30,000,000.

The foreign Westinghouse companies—in England, Canada, France, Italy, Russia and Austria—are closely associated with the Westinghouse Electric Company, Ltd., all of the shares of which are owned by the Westinghouse Electric and Manufacturing Company. The British company reports a business of $6,000,000 a year, while the French company, in executing a large contract for the electrification of Italian railways, has organized an Italian company with new works near Genoa. The Russian company, also a French subsidiary, is now engaged on the contract of the $5,000,000 street-railway electrification in St. Petersburg. Tungsten incandescent lamps are the principal production of the works near Vienna, Austria.

The reputation of the Westinghouse engineers has been enhanced by the increasing adoption of the single-phase railway system, which, in the language of Vice-president Herr's report, has been "invented, developed and promoted by this company."

The magnitude of the steam-railroad field promises a large amount of electrification work for years to come. A heavy single-phase electric express passenger locomotive recently built for the severe duty of the Pennsylvania Railroad's New York terminal has been tested with satisfactory results. All during the work of railroad motor and equipment design advances have been made, weights materially reduced and efficiencies increased.

The engineering department has also recently developed a new form of integrating wattmeter, a new line of apparatus for high-voltage direct current, steel mill machinery, generators designed for direct connection to steam turbines, and metallic flame arc lamps.

In the scheme of organization of the company two large departments, those of erection and railway construction, closely co-operate with the engineering, sales and manufacturing departments. The erection department is in charge of setting up the apparatus on the purchaser's premises, while the railway construction department, which is of recent creation, executes such contracts in railway construction where responsibility for the whole equipment has been assumed, the work often being done during the regular operation of the road.

The Pittsburg plant has recently had its available manufacturing space increased about 10 per cent. by the addition of a new building containing 250,000 square feet of floor space. The Sawyer-Man Electric Company, which for some time has been a Westinghouse subsidiary, has undergone a change in name to the Westinghouse Lamp Company. A new factory at Watsessing, N. J., is now manufacturing incandescent lamps with satisfactory results.

Mr. Westinghouse reports that the manufacturing profits and other income of the Westinghouse Electric and Manufacturing Company for April and May, 1907, were $1,377,766. After making all deductions, including depreciation and interest, the surplus was $849,464, which is at the rate of 20 per cent on the capital stock. It has been the policy of the company to limit the capital stock to actual necessities. When the increase of capital stock now authorized has been sold the outstanding capital stock of the company will be $30,000,000. The number of employes on March 31, 1907, was 18,386, an increase of 3,681 since the close of the fiscal year 1906.

Generators of 10,000 kilowatt capacity are under construction.

By a license from the Cooper Hewitt Electric Company the Westinghouse company is entitled to manufacture and sell the mercury-vapor rectifier.

A new form of incandescent lamp, known as the "metallized-filament lamp," is being placed on the market.

Orders taken from April 1, 1906, to March 31, 1907, were valued at $34,175,548.

The subsidiary companies are the Bryant Electric Company, the Perkins Electric Switch Manufacturing Company, the Westinghouse Lamp Company and the R. D. Nuttall Company.

The total assets of the company on March 31st were $72,270,855, while the net manufacturing profits for the year ended March 31st were $4,179,575 and the total income $5,435,910.

The roster of directors and officers is as follows:

Directors—Brayton Ives, chairman, New York; A. N. Brady, New York; N. Willis Bumsted, Boston; George W. Hebard, New York; E. M. Herr, Pittsburg; George C. Smith, Pittsburg; T. W. Siemon, Frank H. Taylor, New York; W. D. Uptegraff, George Westinghouse, Pittsburg; H. H. Westinghouse, New York.

Officers—President, George Westinghouse, Pittsburg; first vice-president, E. M. Herr, Pittsburg; second vice-president, L. A. Osborne, Pittsburg; fourth vice-president, Newcomb Carlton, New York; acting vice-president, G. W. Hebard, New York; W. M. McFarland, acting vice-president, Pittsburg; Charles A. Terry, secretary, New York; T. W. Siemon, treasurer, New York; H. F. Baetz, assistant treasurer, Pittsburg; assistant treasurer, E. St. John, New York; general auditor, James C. Bennett, Pittsburg; assistant auditor, F. E. Craig, Pittsburg; assistant auditor, W. B. Covil, Jr., Pittsburg.

Manufacturing Department—Manager of works, Alex Taylor; assistant managers of works, F. W. Cox, J. H. Zimmerman and R. A. Smart.

Engineering Department—Chief engineer, B. G. Lamme; assistant chief engineer, H. P. Davis; consulting engineer, C. F. Scott.

Sales Department—Manager railway and lighting department, C. S. Cook; manager industrial and power department, S. L. Nicholson; manager detail and supply department, C. B. Humphrey; manager export department, Maurice Coster.

Business Men Take a Hand in Milwaukee M. O. Situation.

Following the movement started by Comptroller Bechtel to discourage the building of the proposed million-dollar municipally owned electric-lighting plant to compete with the present private corporation in Milwaukee, papers have been prepared in a suit to enjoin the city from erecting the plant on the ground that the city needs to invest $1,500,000 in bridges, viaducts, schools and other necessary improvements. To erect the city light plant, as proposed, will mean indefinite deferring of the other improvements, as the city is now too near its bond limit to build both the light plant and the bridges, viaducts and schools.

T. J. Neacy is asking the injunction, which is supported by the three business men's associations.

The city controller has announced that owing to the city's financial condition he will not countersign contracts for the plant. It is said that when the socialists began their agitation for a municipal-light plant for Milwaukee there was considerable public sentiment in favor of the plant, but that now only the socialists favor the plant.

Ratification of the Wireless Convention.

Writing under date of July 27th the London correspondent of the Western Electrician says:

"Although the government has again through the prime minister reiterated its intention of ratifying the Berlin radiotelegraphic convention of 1906 upon the strength of the report of the select committee (carried by a majority of one), strong efforts are being made by the opposite party to bring about a reconsideration of the whole matter. The Times suggests a conference of the colonies with Great Britain before a definite decision is arrived at. Meanwhile the Marconi company is being suspected of again working up a press campaign, and people seem somewhat chary of accepting an article in a daily paper to the effect that German capitalists are negotiating for the purchase of a controlling interest in the Marconi company."

New Lights and New Illuminants from the Central Station's Point of View.[1]

By R. S. Hale.

The new illuminants are devised by engineers and inventors and are a great advance in the art of lighting.

The public in the form of customers of the central-station uses the new illuminant and gets the advantage.

The central station is the intermediary between the inventor and the customer. From most points of view the central station makes and sells electricity rather than light, and if the central station produces and sells its product purely as electricity, then although the result might be important, yet the question of the method of handling the introduction of new illuminants would be of comparatively slight importance to the central station, or rather the central station has but little to do with it. When the central station is concerned with electricity only it looks forward either to having the new illuminants give so much more light that they may cut down the total output of electricity, or, on the other hand, that the new illuminants may so increase the demand for light that the total output of electricity will increase; and if the central station is supplying only electricity and taking no consideration of how it is used—in other words, if the central station pursues a policy of making no lamp renewals whatsoever—then, while the central station is interested in the result it can do but little more than to wait.

If, however, the central station is supplying lamps and including the cost of them in its charge for electricity—in other words, is selling light—then the new illuminant comes before the central-station manager in a very immediate and practical way.

In the first place the new illuminants are an improvement and the word itself means that the new illuminants give a greater ratio between the light received by the customer and the current sold.

The immediate effect may be either that the central station sells the same number of units of electricity and the customer gets more light, or that the customer gets the same amount of light as before and purchases less electricity; and while the immediate effect must lie between these two points, yet the final result is effected by the increase in business, and may be such that even more units of electricity are used than ever before, and of course in such case very much more light.

While it is possible that the new illuminants may permanently cut down the central-station sales of current for light, yet this is very improbable. It is possible, for instance, that an improvement to, say, 50 candlepower per watt would affect the central-station lighting business, and would be as unpleasant to the central-lighting stations as the railroads once were to the stage coaches. However, the final result will be the same whatever the central station does, and in my opinion the final result will actually be a very large increase of business. Any improvement in illuminants will bring in at least some competitive business.

In addition to the competitive field there are great latent possibilities. Many customers will pay $5 a month for a certain number of units of light. They will not pay $10 for double the number of units, but they will pay, say, $10 for triple or quadruple the number of units of light. Hence, while too great an improvement in illuminants may cut down the sales of electricity, there is an intermediate point where the improvement may actually increase the sales, and the improvements that are now apparently coming are, in my opinion, about this point. An improvement from one-third of a candle per watt to one candle per watt, such as is now in sight, will, in my opinion, ultimately increase the sales of electricity, and it will not be until we get to three or four candles per watt that the improvements in illuminants will cut down the sales of electricity.

If the central station is supplying free-lamp renewals and adopts the new illuminants, the immediate effect will be to give the customers more light in proportion to the money they pay; and this may either cause an immediate fall in income followed, possibly, by an increase, or the central station may use its influence so that from the start the sales of current will remain the same or increase, while the light received by the customer shows a much greater increase.

This is the candlepower question. Today, or rather yesterday, the central station supplied a lamp giving 16 candlepower for 50 watts. If, on the introduction of the tungsten and tantalum lamps they give 16 candlepower for 20 watts, the immediate effect would be a very considerable falling off in income, and the falling off in income would be very much greater than the falling off of expense, since every central station has a large amount of fixed expenses that are not affected by the immediate cost of current.

If this were a free country and there were no socialists a central station might wisely risk the temporary loss in income, looking to its future profits to make up for the loss, but if in this country the central station pays no dividends for one or more years this is seldom or never taken into consideration in the future when the question of reducing its prices comes in; hence the central station, or rather the people who have been frugal enough to save the money that built the central station must plan to earn their dividend each year and cannot risk losing it for even a short period.

Another important part of the central station view of the question is on the cost of renewals. If the cost of renewals is small in proportion to the total cost of electricity, then a slight variation in the cost of renewals is not important. For instance, today a central station, such as the Edison Electric Illuminating Company of Boston, supplies both eight and 16-candlepower lamps free. The cost of renewals of the eight-candlepower lamps is slightly more than of the 16-candlepower, but the difference is so slight that it can be disregarded.

One lamp company has just adopted the practice of so proportioning its lamps so that the renewal cost per kilowatt-hour shall be the same for all sizes. Thus it supplies, we will say, a 50-watt lamp whose proper life is 600 hours with a total consumption of 30 units, and if the cost of the lamp is 15 cents, this makes the renewal cost one-half cent per unit. If the 100-watt lamp costs, say, 25 cents, it would then be so proportioned for voltage, etc., that during its economical life it would use 50 units. This practice is good, but unfortunately it does not cover the whole situation, since it is desirable that lighting circuits should be so arranged that small miscellaneous devices, such as cooking devices, fans, etc., should be supplied from the same sockets, and if the total cost of renewals becomes large in proportion to the cost of electricity it is difficult to handle the question of free renewals.

The central station, therefore, much prefers that the new illuminants should be developed along the line of lamps whose renewal cost will be small in proportion to the cost of electricity. If, for instance, the price of electricity should get down to 10 cents a unit on an average and the renewal cost of the new illuminants should become four cents a unit, this would force the central station to give up the policy of free renewals.

This situation has actually arisen today in the case of very large wholesale customers. For very large wholesale customers burning long hours, as, for instance, a department store whose lamps are kept going all day, the cost of electricity gets down in the neighborhood of three or four cents a unit, and for such business the central stations are in general giving up the policy of free renewals. Even in the case of these large customers, however, the fact that they have to pay for the lamps in a separate charge has caused them to use lamps that are not as economical as they should be.

The flaming arc for outdoor lighting gives tremendously more light in proportion to the total cost and maintenance. The maintenance cost, however, is so great that the central station cannot possibly afford to include this in the price of current, so that the central stations have been forced to let the customer buy and maintain his own flaming arcs, and the results have been that the customer would rather pay a much greater total amount in the form of a bill for current than to pay the two charges for current and maintenance and trimming, even if the total of the two was less than the charge for the ordinary arcs alone.

Another part of the question that affects the immediate interests of the central station, but which will finally cancel out, is the question of investment and antiquation. Take for instance the small carbon arc lamp using carbons of five-sixteenths inch diameter. This improves the light something like 25 per cent. as compared with the arc lamp using one-half inch carbons, but its adoption would involve purchasing a full supply of new lamps (since the old lamps using a large carbon cannot be fitted over the small carbons). This would often be spoken of as involving scrapping of old lamps, but the correct point of view is from that of purchasing new lamps. Scrapping the old lamps is merely a book entry, while purchasing the new lamps takes the money out of the pockets of the people who have saved it up.

Another feature that the central station has to consider very carefully in regard to these new illuminants is their great multiplicity. Today, for instance, the Edison Electric Illuminating Company of Boston supplies either free or at a nominal cost over 30 kinds of incandescent lamps, six or eight kinds of arc lamps, and six or eight kinds of Nernst lamps. When the supply of any particular kind of renewal service is reasonably large it can be handled with fairly good satisfaction, but we have the immediate problem before us today, for instance, in regard to the Nernst lamps in our outlying districts. If a customer in a small town, such for instance as Dover or Bellingham, wants one Nernst lamp or one arc lamp, we cannot very well afford to send a man out there especially to trim and maintain one lamp. Hence obviously it is not enough in the case of the new illuminant to say that its cost of maintenance, or renewal cost, is small when it is done in quantities. It is necessary that the new illuminant of a special kind must be quickly adopted in large quantities if it is to be adopted by the central station.

Another question that affects the central station very closely is that of deliveries. Take for instance the Gem lamp. I should say that the central stations were very well satisfied today with this lamp and feel that its cost of renewal is such that they could replace the ordinary carbon with Gems. But unfortunately the factories cannot stop making ordinary lamps and go into making Gem lamps in one or two months, or even one or two years. At first the output of these lamps was five per cent. of the total; today it is something like 25 per cent., and it will be a year or two before it is 100 per cent. While the central station may properly differentiate between different classes of customers, it must not discriminate. The central station, just like the telephone company or the waterworks, may make one price for commercial business and another price for residential business, but it must not differentiate between Brown and Smith whose business and use of current are alike. Hence the question is, "Who shall get the Gem lamps, and who shall use the carbon lamps during the period of transition?" This has been solved in part by making a temporary extra charge for the Gem lamps. For instance, the large companies today that formerly renewed ordinary lamps free still continue this practice, and they also renew Gem lamps, making an extra charge of five cents only as compared with the cost of the lamp of 15 cents and 20 cents.

The Hylo lamp, while not in one sense a new illuminant, yet might properly be considered among them. The Hylo lamp saves the customer a great deal in places where he simply wants a dim light, but it costs the customer considerably more when he is using the full candlepower. Hence, a customer who wants a little light for a considerable number of hours, and a good light for a short number of hours, gets it very much cheaper by the use of the Hylo lamp.

All the new reflectors, such as Holophanes, etc., are in a sense really new illuminants. They result in giving more light where it is needed for the same amount of electricity, or the same light for a less amount of electricity; hence, a good reflector is just as good as an improvement in the efficiency of the lamp, and should have the same final result in the central station's business. In this case, however, it is somewhat simpler to have the customer supply the reflector, and this has resulted in the kind of difficulties that the central stations are having from the new light being handled by the customer so far as reflectors are concerned.

The central station should not adopt an improvement that will result in only five per cent. or 10 per cent. saving if at the end of a year or two it expects to find still another improvement has made the change of the year before a serious net loss on account of the very high depreciation.

The central-station difficulties are what might be called detail questions, but it does not help us in handling these details to expatiate on the great future savings. Wise handling of the transfer by the central station will mean a considerable difference to the public, and this difference will be important, even if the savings by the new illuminants are much more important.

1. Abstract of a paper presented at the convention of the Illuminating Engineering Society, Boston, July 30, 1907. Mr. Hale is assistant general superintendent of the Edison Electric Illuminating Company of Boston.

Underground Construction in Peoria.

The Peoria Gas and Electric Company has sent notice to all electrical contractors that owing to the new underground work to be installed all interior wiring must be so arranged hereafter that it can be supplied from one service, entering the basement at a point nearest the service box of the street mains. The plans call for six miles of subway, built of vitrified duct. The whole output of the station will have to be provided for on account of its position in the underground district. The company is operating the alternating series system of street lights and also has a 500-volt power circuit, which, with the lighting load and the 2,200-volt feeder for the outlying district, makes a large number of ducts to be built. The contract for the conduit work has been let to G. M. Gest of New York.

The high-tension feeders in the lower ducts will not be accessible from the street boxes. No transformers will be located in manholes at the street intersections, but the distribution will be made on the Edison three-wire system at 104-208 volts. In a service box, when a tap is made to serve one building only, a stub will be left, so that when the service to the other building is needed the splice on the main feeder will not have to be disturbed. The neutral will be of bare copper, thoroughly grounded to a large copper plate at each manhole. The contract for the cables will not be let till early in 1908.

The Elements of Inefficiency in Diffused Lighting Systems.[1]

By Preston S. Millar.

Diffused lighting, in the sense here intended, is that form of artificial lighting in which the ceiling and walls constitute the reflecting and diffusing media through which the light is transmitted to the plane whose illumination forms the primary object of the installation. By direct lighting is meant the variety of methods in which the lighting of the ceiling and walls is incidental, and the bulk of the light is directed where needed.

For certain classes of work diffused lighting is credited with features of real or fancied merit. Generally it is characterized by reduced intrinsic brilliancy of light sources and by uniform distribution of illumination, said to be less fatiguing and more pleasing to the eye than direct lighting effects. To secure these advantages, efficiency is sacrificed freely. The extent of this sacrifice depends, of course, upon the nature and the object of the installation, being relatively small where the primary object is the brilliant illumination of ceiling or walls, and large when the primary object is utilitarian, as for example in desk lighting.

In this paper an endeavor is made to consider the elements of inefficiency which inhere in lighting systems of this character, in most instances basing conclusions upon measurements of illumination intensity. No effort is made to arrive at representative quantitative values, since these vary so largely with local conditions that such data would have to be based upon a series of investigations covering a large number of installations.

The first element of inefficiency is the loss of a large proportion of the light in multiple diffuse reflection, which is necessary in this system of lighting. This loss has long been recognized, although but little information is available as to its extent even in specific installations. E. A. Norman's recent paper before the New York section of this society gave about the only reliable data now available on the efficiency of a diffused lighting system as compared with a direct-lighting system.

To obtain material for this discussion temporary equipments for both direct and diffused lighting were installed in a room of which a plan may be found upon page 326 of Vol. I of the Transactions of the Illuminating Engineering Society. The accompanying diagram shows a vertical section of the room and of the lighting fixture. It shows also illumination curves, plotted from tests, of horizontal illumination on the working plane, vertical illumination on the wall, and horizontal illumination (plane inverted) on the ceiling. The tests were made at points about midway between one end of the room and the lighting fixture which was near the center of the room. A sufficient number of lamps were burned in each installation to afford satisfactory illumination for reading. The diffused lighting curve illustrates the excessively brilliant illumination of the ceiling and walls, which was necessary if sufficient light was to be obtained near the center of the room.

In this temporary installation tests were made to determine intensity and efficiency of illumination on a horizontal plane 30 inches above the floor. The average results appear in the following tabulation:

Table I.

	Temporary Installation at Electrical Testing Laboratories. System		Harlem Office of New York Edison Company. System	
	Direct	Diffused	Direct	Diffused
Square feet of floor space	176	176	1221	1221
Number of lamps	4	24	84	184
Type of lamp	All oval anchored filament incandescent electric.			
Average mean horizontal candle power	10.2	19.4	16	16
Average watts per mean horizontal candle power	3.53	5.16	3.10	3.10
Total watts	145	2398	4166	9126
Horizontal illumination, average foot-candles	1.02	3.29	5.44	3.84
Foot-candles per watt per square foot	1.24	0.24	1.60	0.51
Relative effect of installation as a whole, Diff./Dir.	19%		32%	

In order to determine the relative efficiencies of two systems of lighting it is necessary to consider separately the two prime elements upon which lighting efficiency depends. The first of these is the efficiency of the illuminants. In an electric lamp this is measured properly by the lumens[2] per watt. The second element which goes to make up lighting efficiency is the efficiency with which the light is utilized—that is, the proportion of the total flux of light which is effective on the plane considered.

So there are three expressions of efficiency, all of which are useful, and none of which should be neglected. These are:

A. Efficiency of illuminants ... Lumens per watt

B. Efficiency of light utilization . . . . . Ratio $\frac{\text{Lumens applied}}{\text{Lumens generated}}$

C. Efficiency of lighting installation as a whole. . . Foot candles per watt per square foot, or lumens applied per watt.

If the illuminating engineer determines the average intensity of illumination on the plane which he selects as the criterion he can obtain the "lumens applied" by multiplying the average intensity of the illumination throughout the plane investigated by the area of that plane, expressing the intensity in foot-candles and the area in square feet.

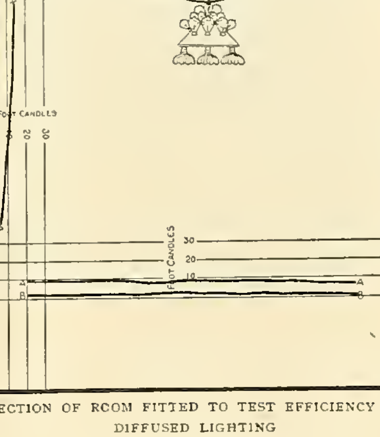
A study of this character has been made in connection with the two installations referred to in Table I. The results appear in the following table:

Table II.

	Temporary Installation at Electrical Testing Laboratories. System		Harlem Office of New York Edison Company. System	
	Direct	Diffused	Direct	Diffused
Total flux of light, lumens	424	4824	13938	30532
Flux on working plane, lumens	180	579	6642	4689
Efficiency of light utilization	42.3%	12.0%	47.7%	15.4%
Efficiency of illuminants, (lumens per watt)	2.92	2.01	3.34	3.34
Relative eff. of systems; Diffused/Direct	28 per cent.		32 per cent.	
Sacrificed to secure diffusion	72 per cent.		68 per cent.	

If the horizontal plane is made the sole criterion, it appears that the efficiency of the diffused lighting system in the temporary installation is only 28 per cent. of that of the direct-lighting system. This figure is independent of the efficiency of the lamps installed and offers the correct basis of comparison. The loss of light in these two diffused lighting systems, due to multiple diffuse reflection, amounted to about 70 per cent.

The second factor of inefficiency is the necessity for providing everywhere on the working plane an illumination which must approximate the highest intensity required at any point covered by the installation. With light which may be subjected to effective control, the necessary illumination is produced where the maximum is required, and efficiency is gained by permitting the intensity to approach a minimum at points where the high intensity is neither required nor desirable. Furthermore, in systems of diffused lighting the body and near-by objects obstruct no inconsiderable proportion of the light which would otherwise be effective.



SECTION OF ROOM FITTED TO TEST EFFICIENCY OF DIFFUSED LIGHTING

The third factor is the ineffectiveness of rays falling at small inclinations upon the surface to be illuminated. With properly located light sources to provide direct lighting the proportion of light falling upon the working plane at sharply inclined angles is reduced to a minimum—with diffused lighting this proportion is necessarily large at whatever angle the working plane may be placed.

The fourth factor is the craving of the eye for higher intensities upon the working plane when surrounding objects are brilliantly illuminated. At the time when it was desired to investigate this question no suitable permanent installation was available. Consequently recourse was had to the makeshift installation which has been described. At various times individuals were brought into this room for purposes of experiment. Each was asked to seat himself in any position and location desired, the object being to secure conditions under which he could read with greatest ease and comfort. He was asked to hold a section of white newspaper at the angle which seemed to him best. The test plate of an illumination photometer was then placed immediately beneath the paper and parallel to it in such a manner that the paper could be removed and the intensity of the illumination which had been produced upon it could be measured without other change in conditions, the reader remaining in his seat. While the location was being selected the illumination was kept at a low intensity, only one two candle power lamp being operated. With the direct lighting system the illumination was then raised and manipulated until an intensity suited to the individual's taste was secured. The paper was then removed and the illumination intensity measured. Immediately afterward the illumination was reduced to the first condition with only a two candlepower lamp burning, and after a short interval the diffused lighting system was tried, other conditions remaining the same. This was manipulated from the switchboard until the desired intensity had been produced and measured.

The investigation was not at all exhaustive, being calculated merely to establish the existence of certain effects.

Considering the average of 10 observers, 65 per cent. higher intensity of illumination was required for reading with the diffused-lighting system than was desired when the direct-lighting system was used. Incidentally, it is of interest to note the extent to which observers differed with respect to the illumination intensity which was found to be satisfactory. This is brought out in the following table:

Table III.

	Direct Lighting	Diffused Lighting
Average Intensity	2.73	4.45
Average difference from mean, amount	.46	.99
Average difference from mean, per cent.	17	22
Maximum variation above mean, per cent	37	42
Maximum variation below mean, per cent.	31.5	42
Variation, highest above lowest, per cent.	100	142

It was found that if a placard was viewed at a distance of eight or 10 feet, 30 times as much light was required to enable an observer to read it as well with the diffused lighting as with the direct-lighting arrangement. In this test large portions of the walls were within the angle of vision and exercised a powerful influence upon the eyes of the observer with both lighting systems. With the direct-lighting system the walls were relatively dark, influencing the pupillary action of the eye so that a low intensity upon the placard appeared satisfactory. With the diffused-lighting system they were brilliantly illuminated and so affected the eye that a very intense illumination was required upon the placard.

From the foregoing the writer has drawn the following conclusions: In diffused-lighting systems of the class considered, where the illumination of a working plane is one of the prime objects, a large proportion of the light is lost; that which is not lost becomes less effective; brilliant illumination is produced where it is useless and even undesirable; and conditions are established which create a demand for an unduly high intensity of illumination on objects viewed.

These effects are present in varying degree in all systems in which control of any large proportion of the light is lost. Among such are cove lighting, lighting with skylight effects, tube lighting, and all systems in which the brilliancy of the light source is reduced by diffusing surfaces used without any directing adjuncts. Lighting with large sources is more liable to these effects than lighting with small sources.

The facts indicate the need for devoting as much care to securing suitable minimum intensities as is generally expended in striving for maximum values. In certain classes of lighting where more light is asked for the requirements may be served by reducing the intensity of illumination on unimportant objects which are unnecessarily well illuminated. By taking advantage of opportunities to minimize intensities at unimportant places efficiency is gained, and, in the opinion of many, good lighting as well.

1. Abstract of a paper presented at the convention of the Illuminating Engineering Society, Boston, July 30, 1907. The author is connected with the Electrical Testing Laboratories, New York city.

2. The Standardization Committee of the American Institute of Electrical Engineers has accepted the term "mean spherical candlepower per watt" as a measure of efficiency, but this is only a compromise, since obviously the efficiency of a lamp as a light producer is the ratio of the light produced to the energy input. The lumen is the unit of light flux. It is the flux of light distributed through unit solid angle. In this country it is the mean spherical candlepower $\times 4\pi$. There can be no reason for continued timidity regarding the use of this most useful unit. Without considering the flux of light it is difficult to obtain a true appreciation of lighting efficiency.

BOOK TABLE.

American Street Railway Investments. New York: McGraw Publishing Company. 1907. Pp. (9⅜ by 12¾ inches) 453, with 44 maps. Price, $5.

A reference book of value to capitalists and investors, and others interested in street and interurban railway properties, is the annual "American Street Railway Investments," the "Red Book," of which the 1907 issue has just appeared. It presents the financial statistics of the street-railway companies of the United States, Canada, Cuba and American insular possessions. The classification is by states and towns, and in each case an estimate is given of the population which the road serves. Besides a brief history of the company, there is a concise statement of the capital stock, funded debt, extent of plant and equipment, and the towns, parks and amusement resorts reached. In many instances the statistics include the operating reports and balance sheets during several years past. Under each company heading are listed the names of the officers and directors and the location of the general offices where they may be addressed. The lines of the larger and more important systems are mapped. Several pages are devoted to a comparison of the gross receipts for the last two years of the principal companies reporting. It is interesting to note that the increase of the gross receipts during 1906 over those of 1905 for the 381 companies listed amounts to almost $46,000,000.

Electrons.

The following extracts are taken from Dr. Samuel Sheldon's presidential address on "The Properties of Electrons" at the convention of the American Institute of Electrical Engineers at Niagara Falls, N. Y., June 25, 1907:

Electrons, which are called corpuscles by some physicists, are the smallest particles of matter that have been isolated. They are considered by some (Larmor) to be constituted of ether. Their shape is unknown, but it is frequently assumed as spherical. At ordinary velocities the mass of an electron is $6.3 \; 10^{-28}$ grammes; at rest, its mass may be zero; and at velocities approaching closely to that of light it becomes nearly infinite. Each electron carries an invariable negative electric charge of $1.1 \; 10^{-19}$ [$= e$] coulombs, $= 1.1 \; 10^{-20}$ [$= e_m$] electromagnetic units, $= 3.4 \; 10^{-10}$ [$= e_s$] electrostatic units. Some writers use the term to designate as well particles carrying positive charges and having other properties. Such use is not common nor desirable.

Electrons in a free condition are present in metallic conductors, in gases, especially at low pressures, and to a limited degree in ordinary solid dielectrics. They are not present in free ether or space. Combined with other electrons and with an unknown something or condition that gives under certain conditions evidences of positive electrification, electrons are present in all matter. Their properties are in nowise dependent upon the properties of the matter with which they are associated, and they are considered to be indestructible by any agent within the command of man. Every electron is in some manner entangled with the luminiferous ether.

The ether is a fluid plenum or continuum, endowed with the properties of inertia and rotational elasticity, and is the medium through which all forces are exerted. It fills all space between electrons and the bounds of the universe; it is supposed by some to penetrate the electrons, and (Lorentz) remains stagnant during the passage of electrons through it.

Each electron, when isolated and at rest, produces at every point in the ether an elementary electrostatic field, corresponding in direction and intensity to its charge. All electrostatic fields are due to the resultant superpositions of such elementary fields.

* * * *

The Ion.—An important part is played in the phenomena of electrophysics by atomic aggregates of electrons that exhibit an external electrical field. When an aggregate or system of aggregates with an excess of positive or negative electrification is subjected to the influence of an auxilary electric field it tends to move in the same or opposite direction to that of the lines of force of this auxiliary field, according to the sign of its excess of electrification. It may then be termed an ion, positive or negative according to the sign of its excess of electrification. In the various physical states of matter are present the following:

NEGATIVE IONS.

1. Isolated and free electrons.
2. One or more electrons acting as a nucleus for a cluster of molecules, the cluster roughly estimated in some cases as containing 30 molecules.
3. Atoms of electronegative elements the instability of whose aggregate has been reduced by the addition of one or more electrons.

POSITIVE IONS.

1. Atoms of electropositive elements, the instability of whose aggregate has been reduced by the subtraction of one or more electrons.
2. Molecular clusters from which an electron has been removed.

Negative ions may or may not be associated with ordinary matter. Positive ions are always found associated with it.

The lines of force of the electric field of an isolated ion are directed radially toward it as a center. In a molecule, while practically all the lines of force start from its electropositive atoms and terminate upon its electronegative atoms, thus being electrostatically nearly saturated, the field distribution is different for different planes passed through its molecular center. The molecule does not, therefore, suffer translation when placed in an auxiliary electric field, but rotates and orients itself. The orientation of a system of molecules produces a polarization of the substance containing the system.

Free electrons exist in gases at pressures under 10 millimeters of mercury, especially when subjected to ionizing agencies; in conducting solids; in the β rays from radium, and in conducting flames.

Clusters exist in all conducting gases under pressures greater than 10 millimeters of mercury; sometimes in gases at lower pressures, and possibly in liquids and solids.

Electronized or de-electronized atoms, or both, exist in all conducting gases at all pressures; both exist in liquid electrolytes; in solid conductors, and possibly in solid dielectrics.

* * * *

Metallic Conduction of Electricity.—Investigations concerning the nature of the process of electric conduction in metals have led to the conclusion that in the metals are to be found molecules and atoms of the metallic element, positive ions and free electrons. The molecules and atoms are not free to migrate from one part of the metal to another, but have a limited freedom of movement about a mean position. The electrons are not constrained to any particular part of the metal, but are free to move from one part to another, such movement being accompanied by collisions and changes in the direction of movement, in a manner similar to that accompanying the movement of molecules in a gas, considered from the standpoint of the kinetic theory of gases. The positive ions have been supposed by some to change their positions, by others not. The number of free electrons per cubic centimeter of metal is very large, being of the order of a billion billions. The mean free path of an electron scarcely exceeds one-millionth of a centimeter in any case. The number per cubic centimeter and the length of free path is different with different metals. In an ordinary metal at a uniform absolute temperature of T degrees all the particles of the metal are in motion, collisions are constantly occurring and the directions of the motion are such as result from chance. According to the doctrine of the equipartition of energy the mean kinetic energies of the molecules of the atoms, of the positive ions and of the electrons are equal to each other and dependent upon the absolute temperature. Inasmuch as the masses of the electrons are much smaller than those of the other particles, the velocities of the electrons must be much greater.

* * * *

Solid Dielectrics.—Solid dielectrics probably contain some free electrons, although the number per unit volume is small compared with that in metals. To free electrons is due the conductivity of solid insulators that remains after surface leakage has been prevented. Free atomic ions are probably absent, since conduction through their mediation would result in a transport of matter with accompanying differences in the chemical and physical character of the surface layers of the dielectric when kept between conductors having a maintained difference of potential. Such transport has not been observed. If the atomic ions of a dielectric are not possessed of freedom of migration, the maintenance of a mean position of equilibrium must be due to the attractions and repulsions of unlike and like charged particles. If a distinction is to be drawn between atomic ions devoid of freedom of migration and molecular aggregates of atoms, then the latter are probably also present.

* * * *

Luminescence.—At all temperatures above absolute zero all bodies radiate energy. If the nature of the body be not changed by this radiation, that is, if it continues to radiate in the same manner, as long as its temperature is maintained constant by the addition of heat, the process is termed pure temperature radiation. If, on the other hand, the body changes because of the radiation and does not continue indefinitely to yield the same radiation, although its temperature is kept constant, the process is termed luminescence. The cause of some of the radiation in the latter case does not lie in the temperature of the system but in some other source of energy. According as the extra supplied energy accompanies either chemical transformations, exposure to light, or the passage of electric currents, the processes are respectively termed chemico, photo and electro-luminescence. The total radiation from a body of this class is made up of two parts—that due to its temperature and that due to the extra energy. If the intensity of radiation of a body within any region of wave-lengths is greater than that of a black body at the same temperature, luminescence must be present. This is frequently (Drude) taken as a criterion for the detection of luminescence. The frequencies of luminescent radiations are more or less restricted, being often evidenced by bright-line spectral distributions. The electrons which yield these radiations are supposed to vibrate harmonically under conditions that are not yet understood. That their movements are not governed simply by chance seems to follow from the character of the spectra. Although change in the character of the material as a consequence of its yielding luminescent radiation may not be capable of detection by chemical analysis, yet the atomic and molecular systems are nevertheless doubtless undergoing constant changes, due to the loss or gain of electrons. The entrance of an electron into a system, or its ejection, must without doubt occasion complex harmonic disturbances of many or all the electrons in the system.

If luminescent radiation be confined chiefly to wave-lengths of the visible spectrum the luminous efficiency of the body becomes high. Herein rests the economic significance of the efforts being made to advance the art of lighting by means of vacuum tube and flaming arc lamps.

A very interesting example of luminescent radiation is that which is yielded by photogenic bacteria, which are frequently found in sea-water and upon meats and fish that have been directly or indirectly infected by sea-water. They are the sources of light known as the phosphorescence of the sea. Some cases of phosphorescence in animals and in plants are explained as an infection with them. Gorham has shown that the light which they give is the result of chemical transformations accompanying metabolism inside the cells of their bodies. When fed with substances such as asparagin or glycocoll they are able to grow and reproduce but not to give light. In Gorham's summary occurs the following:

"We therefore conclude that for light production there must be present, over and above the requirements for growth, the oxygen of the air, sodium or magnesium, and certain organic acids derived from the decomposition of the carbon and nitrogen constituent of the food.

"The chemical energy resulting from the union of the sodium or magnesium with these organic acids, in the presence of oxygen, or from the later combustion of the products of that union, is set free in the form of light."

The brightness of these bacteria considered as sources of light is very small. Lode's measurements show an intensity of emission of 0.00069 candle per square meter. This is too small to stimulate the color sense. The bacillus lucifer of Molisch, however, is much brighter, gives a continuous spectrum in the green, blue and violet, and is able to stimulate the color sense.

Conclusion.—Although much is known concerning the size and mass of the electron, its electric and magnetic effects when in motion, and its radiation effects during acceleration, little more is known concerning its structure than that (Larmor) it is the intrinsic strain-form alone that constitutes the electron; and it is a fundamental postulate that the form can move from one portion to another of the stagnant ether somewhat after the manner that a knot can slip along a cord.

Traffic in Chicago Freight Tunnels.

The freight tunnels underlying Chicago streets have reached a total length of over 50 miles, and in them a considerable amount of mail matter, merchandise and such material as coal and earth from building excavations is electrically transported.

Interesting light is thrown on the magnitude of the operations of the system in the quarterly report of the Illinois Tunnel Company made public this week. The man in the street can form no idea of the vast organization that permits almost 1,000 daily trains to be operated, carrying 1,100 tons of mail to and from the various railroad depots and connecting with the sub-basement in the general postoffice. Besides there are the ordinary freight trains with their loads of merchandise for the big wholesale and retail stores.

The tunnels run as far south as Eighteenth Street; to the west they touch Green Street and to the north Indiana, and are being extended to Chicago Avenue.

The report for the quarter ended June 30th shows that the tunnel company made 26,662 trips in April, 27,485 in May and 27,992 in June, an aggregate of 82,139 trips for the three months with 2,516,420 packages of mail.

Under the old system of hauling mail by wagons the time required was much longer and the service was far from perfect. Then it required 953 wagons to do the work that is now done by the tunnel company in their cars.

Most of the large business houses are already connected with the tunnel, and when the railroads are ready the big mercantile houses will move all their freight through the tunnels.

"It is almost impossible to congest the tunnels," says General Manager Collins, as there are 137 loops which facilitate the free movement of trains.

Streets Illuminated by Porch Lights.

As a result of controversy over street lighting in Clay Center, Kan., the City Council has adopted a novel scheme for lighting the residence streets and at the same time increasing the house-lighting load on the municipal plant. The Topeka (Kan.) Journal explains the situation as follows:

"The City Council met a few days ago and adopted a long resolution offering to furnish free from the city plant one incandescent front-porch light to every user who will agree to install and use three or more incandescent lights in his house. The same resolution instructed the city engineer to cease the work of putting up poles and wires for arc lights in the streets.

"The idea of the City Council is that the streets will be sufficiently lighted from the incandescent lights on the front porches of all the houses. This is a brand-new system of street lighting."

Electric Freight Line in Germany.

The German government railway authorities have decided to build an electric railway from the Essen coal and iron district across the semi-mountainous Eifel region, to the Saar and Lorraine districts. Negotiations have been begun with one of the great electrical companies of Berlin for the equipment of the road. The object is to secure the cheapest transportation for heavy freight from Lorraine, which produces enormous quantities of low-grade iron ore, the shipment of which to the furnaces of the lower Rhine by steam is too costly, while Lorraine draws vast quantities of coal, which comes from Essen. The project is based on plans utilizing streams in the Eifel region.

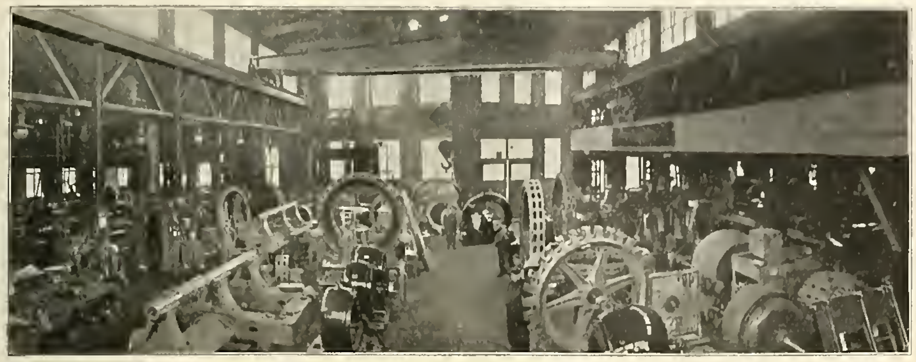
The New Warren Electric Manufacturing Company.

The Warren Electric Manufacturing Company of Sandusky, Ohio, due to unfortunate experiments with a steam turbine it expected to place on the market, went into the hands of a receiver on October 25, 1905, and the business was sold out by the court at public sale to the highest bidder March 6, 1907. The purchaser was the "Warren Electric Manufacturing Company" of Sandusky, Ohio, a corporation incorporated for $175,000, all paid in.

As a result the new company has plenty of working capital and already has installed several modern machine tools, besides having many more ordered which will be delivered within the next few days.

The old company manufactured alternators only, of the inductor type, and of the comparatively smaller sizes, whereas the present company manufactures both inductor and revolving-field alternators up to 750 kilowatts. The accompanying view of the shop shows several of the large-size machines in course of construction. The company also is about to place on the market a full line of alternating-current and direct-current motors which will have some novel features that will interest users of this type of apparatus.

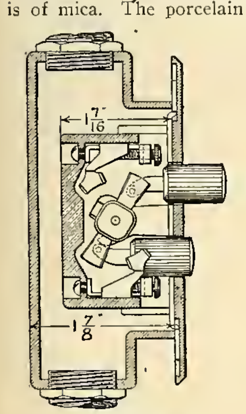
The officers of the present company are: President, Millard H. Nason, who is also vice-president of the Brilliant Electric Company, Cleveland, Ohio, and is well known in the electrical field; vice-president and general manager, Norman L. Hayden, who for 10 years was president of the Hayden & Derby Manufacturing Company, New York, also founder and manager of the N. L. Hayden Manufacturing Company, Columbus, Ohio, in which he is still a large stockholder; secretary, Frank Warren, who for a term of years was sales manager of the Warren Electric Manufacturing Company, and today is one of the leading salesmen of alternating apparatus.



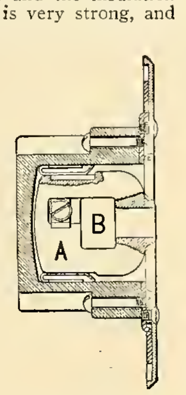
SHOP OF WARREN ELECTRIC MANUFACTURING COMPANY.

Shallow Push-button Switches.

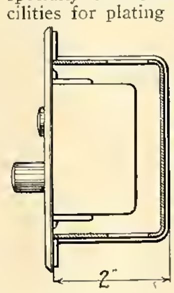
In calling attention to its specialties the Machen & Mayer Electrical Manufacturing Company of Philadelphia says that the M. & M. shallowest flush push-button switch is shallower than any other on the market. The blades and brushes are of phosphor-bronze, which resists the action of the arc better than any other metal, and the insulation is of mica. The porcelain base is very strong, and all unnecessary holes in the porcelain, tending to weaken it, have been avoided. The switch mechanism is simple, and there are no large friction surfaces. The driving spring has only to overcome the friction of the contacts, which accounts for the easy push. All parts are mechanically strong, and the switch has a locked action.



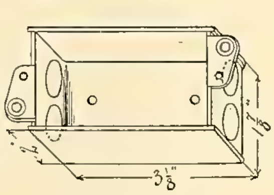
Switch in Iron Box for Conduit.



Flush Receptacle and Plug $1\frac{5}{8}$ inches deep.



Switch in Wall Case 2 inches deep.



Steel Wall Case.

SHALLOW PUSH-BUTTON SWITCHES.

These switches will break 15 amperes at 250 volts, it is said. They are made single and double-pole, three-way and four-way. The bases are 1 7-16 inches deep, and not only do the switches fit into a very shallow partition, but in every case they allow considerably more room for wiring in the wall box. This advantage will be appreciated by contractors who have had difficulty in getting a standard switch in a wall box if there were any splices or cables running into the box, and in some cases have had to use wooden mats.

The company manufactures M. & M. wall cases with knock-out holes for use with its switches, and these wall cases, as shown in a cut, are two inches deep, and still allow ample room for wiring.

Iron conduit boxes two inches deep are manufactured for use with M. & M. specialties. The switches and plugs fit any standard boxes, however. The M. & M. flush receptacles and plugs are simple in construction, and are in accordance with the underwriters' latest requirements, as are also the switches. The plugs are mechanically very strong and can be thrown against the floor without breaking. They have a large hole (B) in them suitable to take a knot in reinforced or ordinary lamp cord, and it is impossible to short-circuit them. The face plates are made both solid and of stamped sheet brass with two doors opening outward. When the plug is in the doors may be closed flush with the face plates. The stamped plates are in every way equal to the solid plates, but are slightly cheaper.

The receptacles are 1⅝ inches deep and will fit any standard box as well as the M. & M. wall cases and conduit boxes. The company makes a specialty of the finish of its face plates, as its facilities for plating are of the best. Lines of rotary, flush and snap switches, automatic door switches, pendant switches and several other patents are being developed which will be on the market shortly.

Hydrate Theory Questioned.

Several papers of considerable interest in connection with recent theories bearing on some fundamental physical phenomena were read at a recent meeting of the Faraday Society of London. "The Thermo-chemistry of Electrolytes in Relation to the Hydrate Theory of Ionization" was the subject of a discussion by Mr. W. R. Bousfield, M. A., K. C., and Dr. T. Martin Lowry, in which it was pointed out that, contrary to the usual assumption that the process of ionization of a neutral salt in aqueous solution is usually attended with a development of heat, the decomposition of potassium chloride into molecular potassium and molecular chlorine involves an absorption of 105,600 calories, and that a further absorption must accompany the decomposition of the molecules into atoms. The authors give a scheme whereby the work done in charging the ions, or in separating ions already charged, may be calculated on the assumption that the ions behave as charged conductors immersed in a fluid dielectric.

Regarding the influence of non-electrolytes and electrolytes on the solubility of gases in water, Dr. James C. Philip, M. A., Ph. D., D. Sc., supported the view according to which the diminished power of a solution to dissolve hydrogen and oxygen as compared with pure water is due mainly to the hydration of the solute and the consequent diminution of the "free" solvent.

Other communications on the general subject of hydrates were given by Dr. George Senter and Dr. Alex Findlay.

Prof. W. A. Tilden, F. R. S., observed that it appeared to be the metal only which detained the water of crystallization, and that in cases such as ammonia dissolved in water, where ammonia was also present, the hydrate theory could not be adopted, and that there is, in fact, no single theory at present able to explain all the phenomena observed.

Combined Bed Lamp and Portable Fixture.

The accompanying illustrations show a new combination bed lamp and portable fixture manufactured by Louis E. Hall, 740 Monadnock Building, Chicago, called the "Lehall-Radiant." This device is unique in that it can be clamped to the bed directly back of the reader, and close to the reading matter or attached to a brass stand and used as a portable lamp for desks, tables, pianos, etc.

FIXTURE USED AS A DESK LIGHT.

LAMP FIXTURE ATTACHED TO BEDSTEAD.

A ball-and-socket joint between the clamp and lamp socket permits the adjustment to any angle. The reflector has a frosted inner surface which distributes the light evenly and without any shadows. The lighting and extinguishing is done by pulling the little chain.

This lamp is well adapted for use at the piano; it can be placed just above the music, the lamp socket inverted and the light thrown clearly upon the pages, while the eyes are protected entirely from the direct rays. Upon a desk, table or pulpit this lamp is also useful. Ornamental shades are provided when desired. For travelers the lamp is made in compact form, packed in a box 4 by 5 by 8 inches, convenient to carry in a grip. Special clamping devices are made for clamping the lamp on wooden beds, Morris chairs, couches, etc. All parts are interchangeable. The lamp is made of brass throughout, and can be supplied in the polished or brush finish.

Indiana Telephone Items.

The Home Telephone Company of Worthington has purchased the Bell telephone plant there.

The Citizens' Telephone Company of Kokomo has imposed a charge of five cents for the use of rural lines, which is unprecedented there. The charge has occasioned opposition among the business men. Petitions are being signed demanding that unless the company rescinds its action subscribers will order their telephones taken out. The company's franchise contains no restrictions against the additional charge.

An Independent telephone company has been organized by citizens in Waterloo. Quarters have been secured for an exchange and the work of constructing the plant will soon begin. D. W. Strauss, manager of the Home Telephone Company of Auburn, is one of the promoters.

The City Council of Mt. Vernon has passed an ordinance requiring the Cumberland Telephone and Telegraph Company to remove the poles and wires from the streets of that city within the next 30 days. This action is the result of the refusal of the company to apply for and receive a franchise to operate in the city. S.

Telephone News from the Northwest.

The strike which has been on at Billings, Mont., between the union and the Rocky Mountain Bell Telephone Company has been settled on private terms. A boycott was started, which induced a number of local subscribers to take out their instruments.

The state board of assessment of South Dakota has increased valuations on telephone and telegraph lines, the former increase amounting to $223,000. Local exchanges which are revenue producers received the bulk of this increase, while country exchanges were reduced in most cases.

The Farmers' Telephone Company of Rockwell, Iowa, has been incorporated with a capitalization of $20,000 by J. H. Brown, W. A. Storer and others.

The Short Line Telephone Company of McCallsburg, Iowa, has amended its articles of incorporation, increasing the capital stock from $5,000 to $10,000 and making the place of business Nevada, Iowa.

The Standard Telephone Company is rebuilding and repairing its toll lines. The exchange at Postville, Iowa, is to be repaired and improved and the Decorah exchange will be rebuilt at a cost of $10,000.

The Colfax Telephone Company of Colfax, Iowa, has amended its articles of incorporation, making the capital stock $25,000.

R. M. Dutcher of Plainview, Neb., has bought the telephone exchange at Britt, Iowa, from the Western Electric Telephone Company, as well as the rural lines in connection.

The Mutual Telephone Company of Billings, Mont., is rushing work on the construction of an exchange building, and expects to have it completed by November 1st. The new exchange will be of the automatic type.

The Michigan State Telephone Company will install a central-energy system for its exchange at Iron Mountain, Mich., at a cost of about $16,000.

Operators of the Rocky Mountain Bell Telephone Company at Great Falls, Mont., have struck, alleging discrimination against certain union operators who struck in March. They demand the discharge of two non-union girls.

The linemen of Butte, Mont., rejected a compromise proposition from the Rocky Mountain Bell Telephone Company for a settlement of the differences between the company and its linemen, the offer being a raise of 25 cents a day, which is about half that was asked for. R.

Northwestern Ohio Bell Employes in Convention.

A meeting of the chief operators and service inspectors of the Central Union Telephone Company in Northwestern Ohio was recently held at the Boody House in Toledo. About 110 employes were present, representing 40 towns. The purpose of the meeting, as stated by District Superintendent A. J. Mellen, was to give the operators a chance to become acquainted with one another, and to discuss with the traffic officials the different operating problems which come up from time to time. A. S. R. Smith of Columbus acted as chairman, and papers were read, bearing the following-named titles:

"Service Testing," A. P. Allen, Indianapolis, Ind.; "Selection and Training of Student Operators," Miss Elizabeth Ryan, Toledo; "Supervision and Handling of Operators," A. G. Abbott, Youngstown, Ohio; "The Duties and Function of a Service Inspector," L. M. Smith, Dayton; "The Handling of a Long-distance Call," A. R. Titus, Columbus.

The Central Union company acted as host of the occasion, and luncheon was served at the Boody House. Many prominent telephone people from Ohio, Michigan and Indiana were in attendance at the meeting.

GENERAL TELEPHONE NEWS

The new building being erected for the Central Union Telephone Company at Columbus, Ohio, is fast nearing completion. It is expected that the company will be located in its new quarters by October. The apparatus for the local switchboard has arrived and is now being installed. The East Side exchange will be capable of taking care of 9,000 telephones, of which about 3,000 will be connected at the time. It will be ready for service before the end of the year.

CORRESPONDENCE.

Continental Europe.

Paris, July 23.—One of the leading electric-lighting companies of Paris, the Compagnie Continentale Edison, lately published its annual report for the preceding year ending December 1, 1906. This is the last period in which the company is assured of the operation of the part of the city circuits allotted to it by the preceding contract. The municipality, in fact, awarded the company the concession in 1888 for the district covered by a certain number of lighting mains. Other lighting companies are now operating in different districts under similar concessions, each having its own district which it supplies from a separate station. The Compagnie Edison uses the direct-current system and has a large station in the central part of the city. The contract which it made with the municipality expired on April 8th of this year. The report issued prior to that date states that owing to the uncertain state of affairs which prevails as to the future electric-lighting operations the company did not take measures to increase its generating plant or underground lines beyond what was absolutely necessary for supplying the subscribers, as such material might have to be turned over to the city in case of an unfavorable decision. Accordingly, the company decided to install a new supply of converters to the capacity of 500 kilowatts in the station and to take the extra current needed from the station of the Societe d'Electricite. Without going into the details of the report I may say that the number of kilowatt-hours supplied to subscribers in 1906 was 7,440,641, which is an increase of about five per cent. over the preceding year. This increase is necessarily small, owing to the fact that the company did not wish to extend its operations as above stated. The net profits for the year, deducting all expenses, are in round numbers $346,000.

One of the recent meetings of the Civil Engineers' Society was of especial interest, owing to the fact that President Fallieres was present, accompanied by the minister of commerce. After the official speeches appropriate to the occasion two papers of considerable value were read, both of them treating of electrical engineering questions. M. Janet, who is at the head of the Electrical Engineers' College, read a paper upon recent progress in radio-telegraphy. A second paper, upon the hydraulic plants in the Mediterranean region, was presented by M. Marchena, one of the leading engineers of the French Thomson-Houston Company.

The government railroad department in Italy expects to make a considerable increase in its line very shortly, and for this purpose has applied for bids for various kinds of materials. Among these may be cited a four-ton electric crane.

A number of concessions for hydraulic power have been granted in Italy within a recent period. Among the most important is one granted to the Marsiglia heirs for a supply to be taken from the river Toce at the locality of Formazza. Here will be constructed hydraulic work, including a canal, and a hydraulic plant of 10,000 horsepower will be erected. Water from the Reno stream is to be utilized at Pistoia for a power plant. The concession granted to L. Vivarelli has a duration of 30 years. A new company known as the Eridano company of Cremona has secured the rights for 30 years from the administration of Parma for a supply from the torrent of the Ceno. A network of power lines is to run from the new station and it will cover an extensive area in the Parma province. Current will be used for tramways and electric railroads as well as lighting.

Among the financial operations recently carried out in Paris I may mention that the Societe Generale Francaise des Tramways has increased its capital stock from $8,400,000 to $10,000,000. One of the principal gas-engine companies, the Societe des Moteurs Gnome, makes an increase in like manner from $160,000 to $200,000. At Lille the company known as the Northern Electric Power Company decided to increase its capital stock from $300,000 to $900,000. A. de C.

Great Britain.

London, July 27.—After a good deal of adverse criticism from political opponents the proposal of the highways committee of the London County Council to adopt as an experiment the G. B. surface-contact system of electric traction for the Mile End Road has been passed. During the discussion the chairman of the highways committee said that he was advised that the cost of electrical energy would be five per cent. greater with this system than with the conduit system. Since the system is in operation only at Lincoln, in England, naturally a good deal of attention has been focussed upon this installation. As a matter of fact, not one accident has been reported at Lincoln since the road was opened in February, 1906. The only serious trouble experienced was last Christmas, when the traffic was dislocated by a heavy fall of snow. At the commencement some "live" studs were found occasionally, but the cause of these was located and has since been removed.

A very outspoken report has been issued by the London County Council upon tenders received for the manufacture of two 5,000-kilowatt three-phase steam turbo-generators for the second portion of the Greenwich tramway power station. Seven firms sent in bids and the ultimate choice lay between the British Westinghouse Company and Williams & Robinson. In such cases usually little more is done than to make the bare announcement of the recommended tender, but on this occasion elaborate reasons are given for the acceptance of the tender of Williams & Robinson, the price being $215,975.

The London County Council has decided to send a deputation to the prime minister urging him to appoint a traffic board for London. Meanwhile circumstances have forced the railway and omnibus companies to form such an authority for their own purposes. At a meeting of the managers of all the London tube and other railways, as well as the motor omnibus proprietors, it was decided to form a traffic conference which shall deal with all questions of policy, including fares. The first step has been to reduce the stage distances so as to bring about a remunerative system of fares. The position of the motor bus companies today is a sufficient answer to those who a couple of years ago were endeavoring to raise a scare with the object of depreciating the value of all tramway undertakings in the United Kingdom. We now learn that the costs per car-mile are about 36 cents, whereas the receipts are only amounting to between 22 and 25 cents per car-mile.

A somewhat serious condition of affairs is in sight in Dublin, where, owing to the general labor strike, the supply of coal is running perilously short at the electric power station. In fact, as a precautionary measure all the tramway motormen and conductors have been warned that they may be discharged at the end of next week, owing to the lack of electric power, due to shortness of coal.

As a result of much pressure the corporation of the city of London has at last consented to allow the electric supply companies to give a demonstration of public street lighting with modern flame arcs. This demonstration will be carried out by the two competitive electric companies from October until March. An experiment will be made with lamps suspended across streets by steel ropes attached to brackets on the walls of buildings. G.

Dominion of Canada.

Ottawa, August 3.—Chatham, Ont., will extend its electric-lighting plant at a cost of $15,000.

The public demonstration at Amherst, Nova Scotia, in honor of the opening of the maritime power plant, was attended by a large party of prominent men. Electric energy is generated at the mouth of the mine from the refuse coal.

The difficulty between the city of Ottawa and the Ottawa and Hull Power Company, by which the city was threatened to have its supply of electricity for the municipal plant shut off entirely, has been adjusted and a 10-year contract will be entered into. The Ottawa Electric Company being the city's competitor in electric lighting has, it is understood, intimated its willingness to sell out to the city at a price to be determined upon by arbitration. The condition precedent to such negotiations, however, is that the basis thereof, or the minimum price, shall be the par value of the company's stock. The capitalization is $1,000,000 and the bond issue $500,000.

The Shawinigan Water and Power Company of Quebec Province has acquired the controlling interest in the North Shore Power Company. The Shawinigan company, which has steadily been strengthening its position, has by the latest deal secured the control of the electrical business of the city of Three Rivers, Que., which is growing rapidly as a manufacturing center. The Shawinigan company will install modern electrical machinery in the plant of the North Shore company. A. V. W.

New York.

New York City, August 3.—A bill providing for the appointment of a public-service commission for the state of Connecticut in accordance with the recommendations of Governor Woodruff has recently passed the Senate unanimously, and finally was carried in the House after a long debate by a vote of 141 to 55.

A controversy is now being waged by the city against the use of overhead high-voltage wires which were recently strung by the New York Central Railroad in connection with its extensive electrification. A preliminary report was rendered by Prof. George F. Sever, consulting engineer to the city, and Charles F. Lacombe, chief engineer of light and power, appeared for the department. In this report it was stated that the stringing of the wires overhead was "dangerous," and Commissioner O'Brien ordered the investigators to make a more thorough examination and report to the commissioner as quickly as possible. The railroad company maintains that the city has no authority over the property of a private company. The company is entirely willing to remedy any inconvenience to the public which the department may deem necessary, but is positive that the present system is "permanent." The cost of this system is stated as about $300,000, and it would cost a much larger sum to make the change to underground, which would delay the work several months. The rail road company, through its counsel, has also taken issue with the corporation counsel as to the city's authority over the wires through its commissioner of water supply, gas and electricity. The final report is expected to reach the commissioner within two weeks, when action will be immediately begun.

The Edison Electric Illumination Company of Brooklyn on Tuesday entertained the electrical contractors of that borough. Special trolley cars were chartered and the party started for Brighton Beach about 5:30 p. m. from the borough hall. A photograph was taken at the beach and then the party was served with a banquet at the hotel. Vice-President W. W. Freeman of the Edison company congratulated the contractors upon their growth in numbers and in prosperity, and dwelt upon the advantages to be obtained by co-operation between the electrical contractors and the company. Among the speakers were James R. Strong, president of the National Electrical Contractors' Association; E. J. Theimer, president of the Long Island Contractors' Association, and C. A. Christensen, president of the Independent Contractors' Association, all of whom spoke in behalf of the contractors, while W. F. Wells and P. R. Atkinson, officials of the Edison Company, spoke briefly on matters of mutual interest. J. C. Forsythe, representing the New York Board of Fire Underwriters, was also present and made a short address. E. H. S.

Ohio.

Toledo, August 3.—Through electric cars may be running from Toledo to Columbus within a year. A scheme is under consideration contemplating the amalgamation of the Columbus, Urbana and Western, with lines from Columbus to Magnetic Springs, the Magnetic Springs and Northern, between Delaware and Larue, and the Toledo Urban and Interurban, now in operation from Toledo to Findlay. The plan is then to extend the last road from Findlay to Larue, by way of Kenton, the gap to be filled being 39 miles. It is stated that most of the right-of-way has been secured.

The Lake Shore Electric Railway, running between Toledo and Genoa, is unable to agree with property owners along its right-of-way as to the value of land along the route. The present line uses the highway, but recent legislation requires that interurbans shall pass over private right-of-way after the expiration of their present franchises. Having but 11 years of life remaining, this company has been trying to arrange with the farmers to purchase a private right-of-way, but has found the prices named in many cases so excessive that a change of route may be determined upon at the expiration of the present franchise.

The contract has been awarded for the construction of the Indiana, Columbus and Eastern electric line between Columbus and Springfield, a distance of 49 miles.

The Mahoning and Shenango Railway Company has followed the Fort Smith (Ark.) idea in notices posted in Youngstown, Ohio, giving motormen the privilege of appearing on duty clad in shirtwaists. Conductors will still be compelled to wear coats because of the necessity of pockets while collecting money and handling tickets.

An order for the foreclosure and sale of the Toledo, Ann Arbor and Detroit line has been made by the courts, and it is said that purchasers are in sight and the system will finally be completed. Already about $500,000 has been expended since this trolley project was promoted, seven years ago. Twice has business been suspended during construction. Already the right-of-way has been graded almost from Toledo to Ann Arbor, bridges and culverts constructed, and the ties and rails laid between Toledo and Petersburg, a distance of 20 miles. Ten miles of poles are set, and a $20,000 power house erected at Petersburg. It is said there is no question that the line will now be completed and put in operation.

The Lake Shore Electric enjoyed a prosperous month during July, the average daily gain in passenger earnings being about $235 a day.

The Licking County Light and Power Company recently held its annual meeting at Newark, Ohio. The company has had a prosperous year, during which the plant has been almost completely reconstructed. H. L. S.

Indiana.

Indianapolis, August 3.—Beginning with August 1st, the Fort Wayne and Wabash Valley Traction Company will carry express matter for the United States Express Company between Fort Wayne and Lafayette. It is also announced that the United States Express Company will begin operation over the traction companies out of Marion and Kokomo.

The Osburn Engineering Company is surveying a route for an interurban road connecting Rockport and Owensboro with the proposed Ohio River bridge near Rockport, and on the Kentucky side from Owensboro to the bridge site. When this bridge is completed it will afford a link between the interurban roads of Indiana and Kentucky.

A complaint has been filed with the Indiana Railroad Commission by the Farmland Stone Company, asking that the commission compel the Big Four Railroad to deliver cars of coal to the Indiana Union Traction Company at Winchester for transfer to the stone company's quarry near Maxwell, reached by the Union Traction Company. This petition opens up an important question for the commission to solve, namely, whether a steam road can be compelled to interchange traffic with an interurban line. It is argued that the Legislature intended to give the commission power to decide and compel such interchange of traffic when and wherever deemed expedient by the commission.

The United States Steel Corporation, in order to secure a traction franchise to operate in Gary, is proposing to adopt the referendum method to secure what the Town Board has denied to it. G. N. Gavitt and associates of Hammond succeeded in obtaining a street-railway franchise in Gary by bidding lower than the steel men. The corporation, however, has dug up an old Indiana law which provides that a referendum may be obtained through a petition signed by a sufficient number of the voters.

The Indiana and Michigan Electric Company, recently formed by the merging of several power companies operating on the St. Joseph River, has filed a mortgage in favor of the New York Trust Company for $7,000,000. The new company was formed to control the power dams of the St. Joseph River and build other dams between Elkhart, Ind., and Berrien Springs, Mich.

An election will be held in Hagerstown to vote on the purchase of the electric-lighting and power system there, which is now owned by Pittsburg (Pa.) capitalists and local citizens, who offer to sell the plant to the town. S. S.

Illinois.

Peoria, August 3.—The electrical workers of Peoria are on a strike for an eight-hour day and a scale of $3, which only one firm, the Central Electric Company, has granted. The agreement signed some time ago is to take effect September 1st, when the electrical workers will also become members of the Building Trades' Council. Heretofore there has been no scale or limit to the day's work, shops working both 10 and eight hours.

Following modern railroad organization, the Illinois Traction Company announces the appointment of Dr. S. C. Glidden of Danville as chief surgeon of its new hospital system which is patterned after that of the Wabash Railroad. The traction company has arrangements with hospitals and has engaged local surgeons in each of the important towns on its lines.

W. D. Boyce of Ottawa, who owns the hydraulic power plant at Marseilles and operates his large paper mill there with the power, has engaged a firm of Chicago engineers to design the new power house that he will build there. The plan is to transmit power to Ottawa, Morris and Streator.

The Greenfield Electric Light and Power Company has let a contract for building 12 miles of pole line between Greenville and White Hall, besides rebuilding all the other lines of the company.

It is expected that A. Y. Collins, proprietor of a coal mine a mile and a half from Greenfield, will ask for an electric-light and railway franchise. The plant will be located at the mine, and the electric railway will be used for delivering coal.

Right-of-way is being secured for a new electric railway from Iowa City, Iowa, through Fort Madison, Iowa, to Carthage, Beardstown and Springfield, Ill. W. R. Sturgeon and W. R. Tempe of Fort Madison are interested.

The Taylorville Utilities Company, capitalized at $100,000, will furnish light, heat and power.

The Vivax Storage Battery Company has been incorporated with a capital of $100,000 to manufacture electrical devices at Chicago. The incorporators are Arthur B. Pease, M. L. Goodrich and Louis Pierson.

The Illinois Traction system has met with some trouble in securing the right-of-way for its Springfield-Jacksonville line near Springfield. The owners have demanded unreasonable prices, and despite the three new surveys the difficulty has not been avoided. The line will be built from Jacksonville to Berlin at once, and if a reasonable entrance can be secured it will be continued to Springfield.

The Peoria Terminal Railway has purchased a 40-acre tract of land at South Bartonville which it will use as a coal dump and transfer yard for the Deering Coal Company. The Deering company, at a cost of $500,000, will erect a modern dumping, screening and transfer plant. The coal company controls 48 mines in the state and the coal will come here for screening and then be reshipped.

The Moline and Watertown Railway obtained a grant from the company that laid out the village of East Moline, but when the village was incorporated its officers demanded that the company take out a franchise for which it was to pay $10,000 and the sum of $1,000 a year for 10 consecutive years to light the streets and to give bond to extend its line to Geneseo. This the company refused to do and was prevented from running its cars through the village for a week, though later a truce was fixed up to let the company operate. The car company then applied for a writ to prevent further trouble. After hearing the argument Judge Wright took the matter under advisement. V. N.

Northwestern States.

Minneapolis, August 3.—The completion of the Fort Dodge, Des Moines and Southern interurban has been delayed somewhat by bad weather, but it is now expected to be able to have the line in operation by September 1st between Fort Dodge and Des Moines. The line will be the longest electric line in the state.

Considerable interest is shown in the projected interurban line from Fort Dodge to Spirit Lake, Iowa, by the farmers along the route, and some of them have invested in stock in the project. The estimated cost to build and equip the road is $10,000 a mile. Power is to be secured for operation by damming the Des Moines River near Fort Dodge.

The Minnesota State Agricultural Society has contracted with the Minneapolis General Electric Company for light for lighting the state fair grounds, and will not install an electric-light plant. It will take 600 horsepower to light the grounds, and current will be furnished from the company's new plant at Taylor's Falls, Minn. The General Electric Company also expects to be able to show to the State Agricultural College a saving over its present method of lighting.

The Wausau Street Railway Company of Wausau, Wis., has voted to increase the capital stock of the company from $120,000 to $400,000, and has extensive improvements in view.

The Duluth-Superior Traction Company will soon extend its lines to Superior, Wis., to the suburb of Allouez.

The Minneapolis General Electric Company has served notice on the city of Minneapolis that it will not comply with a portion of the ordinance recently passed by the City Council, fixing rates for furnishing electricity to its patrons. The company declares that the rates fixed would prove confiscatory, and would not yield any profit whatsoever.

George Fowlie and George Breckon have leased the Sherman electric-light plant at White Sulphur Springs, Mont., and will operate it.

The city of Rice Lake, Wis., will vote on August 19th on the question of leasing the waterpower of the Rice Lake Milling and Water Power Company for 10 years at $2,500 per annum, the power to produce 250 horsepower, and with the privilege of buying at periods of one, two, three or four years.

The franchise of the Britt Light and Power Company of Britt, Iowa, has been renewed for a period of 25 years, by action of the council.

Yegen Bros. of Billings, Mont., propose to install an electric-light plant at once.

The Chippewa Valley Electric Light and Power Company is making extensive repairs to the plant at Eau Claire, Wis., the entire machinery being overhauled.

An addition is under construction to the power plant of the Wilmot (S. D.) electric-light and waterworks station. It will cost about $2,000.

The Chippewa Valley Electric Light and Power Company was the only bidder for furnishing light for the city of Menomonie, Wis., for a seven-year contract, offering all-night lights of 2,000 candlepower at $75 per year, or $70 if more than 50 are used. The present price paid is $86.87.

The La Crosse Water Power Company of La Crosse, Wis., which is developing a large waterpower plant near La Crosse, Wis., will build an interurban line to Winona, Minn., where the local line has already been acquired. R.

Pacific Slope.

San Francisco, July 31.—The situation in this city is becoming less abnormal every week, and now, that there is an honest mayor in office and the Board of Supervisors has been replaced by men in whom the citizens can place confidence, there is hope of a speedy improvement in all lines of business, including the various branches of electrical industries.

Although few contracts have been closed of late for large electric power installations, there is a good deal of inquiry, and several new hydro-electric projects are coming to the front.

Vice-President Kruttschnitt of the United Railroads says: "We are soon to build upon the Oakland Estuary on a block of land we bought for the purpose, one of the finest electric power plants in the United States. It will occupy the whole block, which is about 400 feet square. It will be quite a showy building, and high, because we shall have big coal bunkers there and mechanical stoking machinery for supplying the furnaces with fuel. The plans for this electric power house have been finished, and Electrical Engineer Babcock has started East to submit them to Mr. Harriman." The specifications call for two 5,000-kilowatt generating units, each consisting of a polyphase generator of high voltage direct-connected to a steam turbine engine. Salt water from the estuary will be used for condensing purposes. This station in Oakland, Cal., will supply current to several sub-stations, whence direct current at 600 volts will be supplied to the company's local car lines.

The Department of Electricity of San Francisco will, on August 1st, begin construction of underground conduits for electric wires for the use of the fire-alarm and police telegraph systems, extending on Market Street from Second Street, to East Street near the Ferry Depot. The central station is still in a temporary wooden structure erected hastily after the fire, and W. R. Hewitt, chief of the Department of Electricity, has made strenuous endeavors to awaken the Board of Supervisors to the necessity of appropriating a sum sufficient to erect a proper station building.

The Heroult Smelter Company's new electric smelter at Heroult, Cal., is said to have proven to be a great success. The company has solved the problem of smelting iron ore by electricity, and the method has superior features. There are millions of tons of ore in sight to work on.

C. H. Glenn and his fellow directors in the Snow Mountain Electric Company are losing no time in carrying out the new enterprise which has its headquarters at Willows, Cal. All of the first issue of stock of the company has been sold, and active construction work will be commenced soon. The erection of a long flume will be commenced as soon as the company's mill begins to saw the lumber. Work will be pushed to completion, and inside of a year the company will be furnishing power in Glenn and Colusa counties.

The City Trustees of Palo Alto, Cal., have granted the California Gas and Electric Corporation a permit to erect a line of poles and string its wires on Hawthorne from its main line on Middlefield Road to the Interurban street-railway power house at High Street.

To furnish light and power to small and isolated users is the plan of J. A. Belloli, who has applied for a franchise to put up poles and string wires along the county roads of Santa Clara County, Cal. His idea is to buy the power in large quantities from the Pacific Gas and Electric Company, taking his supply at some convenient point from the high-tension service of the company. Through his lines he will distribute the power to small users from Milpitas to Alviso.

The Central California Traction Company has recently been short of electric power, which the American River Electric Company had contracted to furnish. The floods during the spring carried away some of the work at the company's plant, and the consequence is that the power company is not able at this time to generate the required amount of current to operate the car line and also to supply the other consumers. Within 10 days the American River Company will have its auxiliary steam station completed on Banner Island in Stockton, and then it will not be entirely dependent on its waterpower plant near Placerville. Electric car lines in and around Stockton, Cal., are operated by the traction company.

Advices from Boise, Idaho, say that the Telluride Power Company (L. L. Nunn, president) has secured the Bear Lake reservoir site and will impound the flood waters. These will be used for the irrigation of some 30,000 acres of land, but the principal feature of the enterprise is the generation of power, which will be taken southward for use in Utah. The project is on a gigantic scale. Four hundred cars of pipe are arriving. This is hauled to the scene of operations, five miles from the railway, by traction engines. The pipe is eight feet in diameter. Five miles of this pipe will be laid down the canyon, securing a head of about 500 feet for the pressure pipe supplying the waterwheels. This plant will cost about $2,000,000, and is the greatest undertaking of the kind in the state.

The Truckee River General Electric Company is erecting its pole-line extension to Minden and Gardnerville, Nev. Materials have been delivered at Carson for the completion of the power and light line to the valley towns, and the finishing of the transmission line will be rushed as rapidly as possible. The company purposes to furnish electric power within a few weeks for a number of industrial plants that are ready for operation in this territory.

The City Council of Rosalia, Wash., has granted six months' extension on time for completion of the electric-light and power plant. It is understood that the Spokane and Inland, W. E. Zimmerman, chief of electrical department, will make every effort to complete the system with all possible haste, and it is understood that there is a possibility of a temporary plant being installed for service during the winter months.

The City Council of North Bend, Ore., has granted a franchise to Seymour H. Bell for construction of gas and electric plants in the city of North Bend.

Contracts have been awarded to the United States Steel Company for a number of steel towers, which are to be erected by the United States government and utilized in the transmission of wireless messages in connection with the wireless-telegraph service in Alaska. Each tower will be 176 feet in height. It is said to be the intention to establish, in time, a chain of such towers in connection with wireless-telegraph plants along the Atlantic and Pacific coast and the Gulf of Mexico. A.

Insulated joints have been inserted in several pipe lines in Cambridge by the Massachusetts Metropolitan Water and Sewerage Board, as an experiment for checking electrolysis.

PERSONAL.

L. Hase, who has been manager of the electric-light plant at Mantorville, Minn., has gone to Redwood Falls, Minn., to take a similar position.

J. H. White, for two years manager of the Winona (Minn.) Railway and Light Company, has gone to New York for a month, after which he will look for a new location.

John C. Henderson, who has been associated with several important engineering works about Louisville, Jeffersonville and New Albany, died in the latter city on July 23d, aged 63 years.

Mr. A. S. Hibbard, vice-president and general manager of the Chicago Telephone Company, is in Europe, enjoying a vacation that has been well earned. Mr. Hibbard is not expected back in Chicago before the end of October.

Frank J. McNulty, president of the International Brotherhood of Electrical Workers, was a member of the committee that visited European countries in carrying out the investigations of the National Civic Federation regarding municipal ownership. His signature is affixed to the report returned to the federation.

Prof. Charles Henry Benjamin will be the new dean of the Schools of Engineering of Purdue University, to succeed Prof. W. F. M. Goss, who resigned to accept a similar appointment at the University of Illinois. Professor Benjamin comes to Purdue from the chair of mechanical engineering at the Case School of Applied Science at Cleveland, Ohio. He brings an unusually successful experience and valuable equipment as teacher, investigator, author and engineer, and will undoubtedly prove a worthy occupant of the chair so long and eminently filled by Professor Goss.

ELECTRIC LIGHTING.

The Lawton (Okla.) Lighting Company has been incorporated for $100,000. C. S. Stevenson of Lawton, Okla., and J. E. and D. E. Stevenson of Ansonia, Ohio, are the incorporators.

The Massachusetts gas and electric-light commissioners have held a hearing on the Marlboro Electric Company's petition for authority to issue additional stock amounting to $170,000. President Arnold of the company explained that the proceeds from the stock would be used to pay the company's floating debt and for permanent additions to and extensions of its plant.

ELECTRIC RAILWAYS.

The Oklahoma City Street Railway Company will make extensive improvements. Several new lines will be built and new cars will be added.

The Northwestern Elevated Railroad, Chicago, placed an order for 40 new coaches with the American Car and Foundry Company. They are to be used in the service on the Evanston extension.

The Muskogee (Ind. Ter.) Electric Traction Company has granted a steam railroad a 10-year lease to use its lines from Muskogee to Hyde Park to operate sand and gravel trains for the construction of a roadbed which will be of concrete. The operation of these trains will be in connection with the regular street-railway service.

One man was killed and 16 injured as the result of the supposed failure of the brakes of a special car on the Bloomington, Pontiac and Joliet (Ill.) Electric Railway, allowing the special, with General Manager James Hessin acting as motorman, to telescope the regular car ahead. The accident occurred seven miles north of Pontiac on August 4th.

Louis Brennan's monorail, which has attracted considerable attention across the Atlantic, may be exhibited at the Toronto Exhibition this year if the plans of the exhibition directors are successful. Mr. Brennan has been asked to bring a model of his invention from London, and it is said that if possible a mile and a half of cable will be run from the exhibition grounds.

PUBLICATIONS.

The Hine eliminator, which serves as a steam separator or oil extractor, is the subject of a special catalogue, which may be obtained from James L. Robertson & Sons, New York.

A new catalogue of the Gould Storage Battery Company describes the couple type batteries (recently described in the Western Electrician), in which the feature is the placing of the plates end to end, and a pair only in each jar.

Small purchasers of cement will appreciate the directions of proper mixtures and tests applicable to their purposes, which are being sent out by the American Conduit Company, manufacturer of bituminized fiber conduit, New York.

Crocker-Wheeler Company's Bulletin No. 87 explains the advantages of the latest developments of motor drive with multi-point control for printing machinery. Motors are designed for the operation of cylinder and job presses and type-setting machinery. Bulletins 76, 77, 81 and 88 of the same company relate, respectively, to hoisting motors, alternating-current generators, direct-current motors and polyphase induction motors.

General Electric Company's Bulletin No. 4521 describes a line of adjustable water-tight floor outlet boxes. The boxes, which are of substantial construction, are intended for use in the floors of offices or other places where bracket or ceiling outlets are not desirable.

The Ohio Brass Company's monthly bulletin for August contains a number of pages of general interest besides the advertising matter devoted to the company's products. An illustrated article describes an example of the latest methods of catenary construction using both line-brackets and spans.

The Trumbull Electric Manufacturing Company, Plainville, Conn., has published a new bulletin of its type "A" switches, which is said to represent the most complete line of any one type of switches ever published. Four-pole and New Code fused switches with high fingers for fuses, both on the hinge and handle end, and a complete line of switches for alternating current from 15 to 2,000 amperes are listed. The bulletin is sent to all interested on request.

General Electric Company's bulletins for June, numbered 4516 and 4518, relate to the MR circuit-breakers and electric hoists, respectively. Electric hoists have come to be extensively adopted on account of the increased efficiency, compactness and durability inherent in motor-driven machinery. The circuit-breakers are for automatically breaking the main-control circuit in case of excessive overloads on short circuits and can also be used as a hand-operated main-circuit switch. The arc is extinguished in an extension arc chute at the top of the casing, practically concealing the arc, so that the breaker can be placed in any convenient position in the car vestibule.

The Ward Leonard Electric Company of 15 Swain Street, Bronxville, N. Y., has issued a catalogue covering Ward Leonard self-starters, showing the ALS type, comprising a self-closing switch, a self-starting rheostat provided with no-voltage and overload release and protective interlock, preventing the automatic closure of the self-closing switch, except when the rheostat is in its initial position. The device is controlled by two push buttons. The company also shows its AS type self-starting rheostat with plain no-voltage release for use in connection with Ward Leonard self-closing main line switch or float switch, etc. In either case it is simply necessary to close the circuit and the machine does the rest. This catalogue is complete with specifications covering the features of design.

SOCIETIES AND SCHOOLS.

The proceedings of the American Public Works Association's convention held at Atlanta, Ga., during September of last year have been issued in book form.

The Nebraska Electrical Association, composed of central-station men of the state, was organized at Lincoln last month. Membership is by companies and any employe may represent his company at the annual meetings. The officers are: President, T. H. Fritts, Grand Island; vice-president, R. D. Russell, Fairbury; secretary, William Bradford, Lincoln; treasurer, E. V. Capps, Blair; executive committee, E. A. Bullock, H. J. Schwingel and J. E. Crawford.

MISCELLANEOUS.

Eye diagnosis by the light of the mercury-vapor lamp, according to Associated Press dispatches from Paris, makes it possible to view the vessels at the back of the retina. A Paris physician, Dr. Fortin, has found that the light from a mercury-vapor lamp passing through two sheets of blue glass and reflected into the eye by a large lens reveals the internal surface better than the ordinary white or yellow light.

The electrical show to be held at the Madison Square Garden next month will have a novel scheme of sharing the box-office receipts with the exhibitors pro rata so that extra tickets bought by exhibitors in hundred lots may cost less than seven cents apiece. An exhibit of some interest will be an arc lamp said to be of 2,000,000 candlepower, placed on a tower in the center of the garden. Recently Mr. Scott of the Scott Electric Company, the inventor of the light, made a successful test with a 300,000-candlepower lamp, and decided, it is said, that the candlepower could be successfully raised to 2,000,000.

A complete electric power equipment, consisting of two 300-kilowatt Allis-Chalmers generators, direct-connected to Reliance engines, a 110-kilowatt generator direct-connected to a high-speed engine, a five-panel switchboard, 24 five-horsepower variable-speed induction motors and a number of constant-speed machines for distribution throughout the plant, was recently sold to the Diamond Match Company for its branch factory at Oshkosh, Wis., all of the apparatus being three-phase, 60-cycle, 440 volts. The unusual feature in connection with this installation is the fact that the match machines, which have always heretofore been group-driven, in this new plant will each be driven by a five-horsepower induction motor, 24 machines comprising the initial installation.

Successful experiments in the telegraphic transmission of photographs from Munich to Berlin (about 320 miles) were carried out last week by Professor Stern. For the purpose the German government had loaned a direct wire. The apparatus was operated without a hitch. The photographs were received over the wire faultlessly developed.

TRADE NEWS.

Mr. F. B. Duncan, formerly general superintendent of the Northern Electrical Company, and since then manager of the Akron Electrical Manufacturing Company, has resigned from the latter company to organize with Mr. H. C. Hale, the firm of Hale & Duncan, contracting and designing engineers, with offices in the Schofield Building, Cleveland, Ohio. Mr. Hale, who resigned as manager of the Mineral Ridge Manufacturing Company, to enter the new firm, was for many years mechanical engineer and designer of mining machinery for the Webster, Camp & Lane Company and the Wellman-Seaver-Morgan Company, and since then manager of the Mineral Ridge Company. In the new firm these gentlemen will give their principal attention to the electrical equipment of mines, and especially the electrical operation of hoisting apparatus. Mr. Duncan will continue to devote much of his attention to the field of motor-driven machine tools, in which he has done much good work.

BUSINESS.

The Westinghouse Electric and Manufacturing Company of East Pittsburg has received, through G. & O. Braniff & Co., agents for the former company in Mexico, an order for one of the electrical equipments of the Vera Cruz tramways, built by the Vera Cruz Light, Power and Tramway Company. Vera Cruz is the second city in Mexico to be electrified.

S. J. Rosenthal of Mobile, Ala., writes under date of July 29th: "I have bought the electrical engineering and supply business of the Singer Electric Company, and will from this day forward conduct the said business under my name. I have assumed the liabilities of the Singer Electric Company and will collect moneys due it."

The Chase-Shawmut Company of Newburyport, Mass., has recently placed upon the market a newly approved stage pocket, reconstructed to comply with new rules by the National Board of Fire Underwriters, which requires pockets to be fused on switchboard. In placing this article upon the market, the Chase-Shawmut Company has taken into careful consideration the rough usage received by articles of this nature in street-railway park theaters, etc., and sincerely believes that this simple, safe and durable pocket will fulfill all requirements.

The J. B. Galloway Company of Clarendon, Ark., makes a specialty of oak pins and brackets of all sizes. The company also makes yellow-locust pins for use on telephone and telegraph lines. It is said that these pins are equal to black locust in durability, and the Galloway company solicits inquiries from users of pins.

Locke Etheridge, Chicago sales manager of the Avery Scale Company of Milwaukee, has now on permanent exhibition at the Chicago office a full size Avery automatic scale in actual operation. The Avery Scale Company is one of the oldest companies manufacturing scales in the world, and recently established itself in automatic scale manufacture at North Milwaukee, Wis. It has a completely equipped factory and is energetically pushing its automatic weighing machines in the United States. The Avery scale is a fine piece of machinery and appeals to every central-station manager interested in accurate coal measurement. The machine operates automatically to the ounce and weighs coal automatically and with great accuracy.

ILLUSTRATED ELECTRICAL PATENT RECORD.

Issued (United States Patent Office) July 30, 1907.

861,249. Electrically Heated Sad-iron. William J. Barr, Cleveland, Ohio. Application filed December 17, 1906.

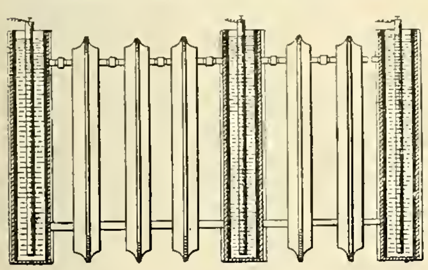
For electrically heated irons, a resilient bracket is provided for relieving the mechanical strain on the conductor terminals at the iron.

861,275. Insulator for Electric Wires. Constantine Gallagher, Richmond, Va. Application filed June 14, 1904.

A curved groove in the insulator permits a loose wire to be inserted easily, but grips the wire tightly when it is in tension.

861,280. Electric Smelting. Paul L. T. Héroult, La Praz, France, assignor to the Societe Electro-Metallurgique Francaise, Froges, France. Application filed April 25, 1906.

The process consists in maintaining a column of carbon between the electrodes and through which the molten material passes, and varying the length of this column to obtain saturation of the metal with carbon or production of silicon by increasing the heat.



NO. 861,282.—ELECTROLYTIC RECTIFIER.

861,281. Electrolytic Alternating-current Rectifier. Arthur S. Hickley, Manasquan, N. J. Application filed February 7, 1907.

The inventor seeks to remedy an inherent defect in electrolytic rectifying devices, which, during operation, undergo considerable rise in temperature and so become inefficient, by providing exposed radiating surfaces projecting from the body and extending beyond the receptacle for conducting heat from the electrolyte and the electrodes.

861,282. Electrolytic Alternating-current Rectifier. Arthur S. Hickley, Manasquan, N. J. Application filed April 16, 1907.

Features of construction include the use of receptacles forming hollow electrodes connected together to allow the electrolyte to circulate through the electrodes, and separate electrical connections between the electrodes and power supply. (See cut.)

861,288. Trolley Wheel. Edward H. Johnson, Cleveland, Ohio. Application filed October 8, 1906.

The wheel consists of two concentric parts held by rib-and-groove joint.

861,310. Electrothermal Switch. James G. Nolen, Chicago, Ill., assignor to Frank B. Cook, Chicago, Ill. Application filed July 6, 1903.

When electrically or otherwise heated, an expansible medium operates, by means of a diaphragm, to control a circuit switch.

861,315. Fuse. Ralph S. Peirce, Hinsdale, Ill., assignor to the Peirce Specialty Company, Chicago, Ill. Application filed June 12, 1905.

Details of construction of an enclosed fuse are given.

861,319. Apparatus for Electrolytic Reduction of Metals from Ores or Salts. Charles E. Robertson, St. Louis, Mo. Application filed July 30, 1906.

An electrolytic furnace is provided with an interior lining of conducting material. A disk continually rotated in alinement with the upper end of the furnace receptacle is provided on its upper face with conducting bars which carry carbons of tubular form projecting through the disk into a receptacle. Electric current is passed between the conductor bars and the interior lining of receptacle.

861,322. Train-order Check System. William R. Scott, Berkeley, Cal., assignor of one-half to E. M. Cutting, Fruitvale, Cal. Application filed February 25, 1907.

Electrically controlled means operable by the order-holder maintains the signal in danger position when the holder is removed from the cabinet.

861,325. Device for Cleaning Overhead Trolley Wires. John L. Snitker and Wilmer S. Carl, Cincinnati, Ohio. Application filed August 29, 1906.

The scraper consists of a bent rod whose bend is adapted to touch the trolley wire at two points.

861,340. Telephone Apparatus. Charles S. Winston, Chicago, Ill., assignor to the Kellogg Switchboard and Supply Company, Chicago, Ill. Application filed January 3, 1905.

A trunk circuit between central offices is described.

861,343. Incandescent Lamp Socket. James J. Wood, Fort Wayne, Ind. Application filed August 22, 1906.

The threaded shell is fastened only by a swivel so that it is free to rotate unless locked by insertion of a key. The socket is designed to prevent the unauthorized removal of the lamp. Unless the key is inserted the lamp turns freely, but will not unscrew from the shell.

861,349. Apparatus for Treating the Scalp. Robert E. Beaubien, Chicago, Ill., assignor to Herbert F. Hanson, Chicago, Ill. Application filed April 9, 1906.

A revoluble electrode extends through the walls of a vacuum-cupping device.

861,357. Device for Locating Defects in Telephone and Telegraph Lines. Gideon G. Buttler, Oklahoma, Okla., assignor of one-half to A. D. Marble, Oklahoma, Okla. Application filed September 11, 1906.

A compactly arranged testing set contains transmitter, receiver, induction coil, generator, switches, jacks and other apparatus.

861,365. Rheostat. Frederick G. Jahn, New York, N. Y., assignor to the International Postal Supply Company of New York, Brooklyn, N. Y. Application filed December 8, 1904.

The circuit closer may be manually operated in both directions. An automatic circuit-breaking mechanism has the movable contact idly mounted and adapted to be moved in one direction by its own direct push and in the other direction by a projection on the circuit closer.

861,394. Electric Chain-welding Machine. Hanson Robinson, Hanover, Pa., assignor to the American Electric Chain Company, Newark, N. J. Application filed June 9, 1906.

Mechanical details of the machine, for preparing the blank links and holding them during welding, are described.

861,445. Electric-light Hood. Charles J. Eichhorn, Newark, N. J., assignor to the Tea Tray Company of Newark, N. J. Application filed July 25, 1906.

The hollow hood is in two parts and encloses the socket.

861,458. Connector. Edwin T. Greenfield, Kiamesha, N. Y. Application filed October 24, 1906.

For fastening conduit to a junction box, a hollow metallic sleeve is arranged to be clamped by a screw.

861,459. Telephone Attachment. Henry Gross, New York, N. Y. Application filed May 9, 1906.

The mouth-piece may be slid to one side, at the same time closing the transmitter opening.

861,468. Contact Device with a Swinging Plug for Electrical Circuits. Wilhelm Kreinsen, Burbach-on-the-Saar, Germany. Application filed June 11, 1906.

New features of construction permit the plug to be automatically released without damaging any part in the event of a violent pull taking place.

861,510. Cigar Lighter. Charles E. Gervais, New York, N. Y. Application filed May 31, 1904.

The wick is ignited by a spark from a kick coil and battery.

861,560. Electrical Keyboard Heater and Tone Preserver for Pianos and Organs. Rose R. Turner and John C. Bernitt, Spokane, Wash. Application filed March 7, 1906.

The heater consists of one layer of coiled resisting wire on top of the keyboard and another layer under the keys.

861,587. Sectional Electrical Switchboard. William D. Graves, Wheeling, W. Va. Application filed July 11, 1906.

The units consist of short bars having a straight body portion and a downward bend near one end. When linked by clamping screws, a continuous conductor is formed.

861,602. Photographic Printing Apparatus. Hervey H. McIntire, South Bend, Ind. Application filed February 2, 1903.

A motor in the case operates mechanism to expose the sensitive paper through the negative to the light which, after a predetermined time, is automatically extinguished.

861,611. Time-limit Circuit-breaker. William M. Scott, Philadelphia, Pa. Application filed January 31, 1907.

In the tripping mechanism of a circuit-breaker, a sucker associated with the movable tripping member has an element with a sand-blast roughened surface.

861,617. Third-rail Ice-cutting and Cleaning Machine for Electric Railways. George A. Spice, Chicago, Ill. Application filed April 6, 1906.

An insulated cutter head is held against the third rail and rotated by gearing from the axle.

861,654. Cover-attaching Means for Electrical Floor Boxes. William F. Irish, Denville, N. J. Application filed March 15, 1906.

The plug is inserted and engaged by a rotary movement.

861,679. Magnetic Switch. Jacob L. Schureman, Chicago, Ill. Application filed May 22, 1905.

Separate opening and closing magnets are provided. The circuit is broken in the presence of a magnetic field, serving to blow out any arc.

861,692. Switch Socket for Electric Lamps. Ernst Anderson, Chicago, Ill. Application filed November 15, 1906.

The socket is in two parts, capable of relative rotation. Each member carries one of a pair of engaging contacts, so that the circuit is opened or closed by twisting the sleeve.

861,715. Electric Indicator for Trains. Harry G. Dyer, Gloucester, N. J. Application filed February 11, 1907.

The system requires that a number of signal rails be laid close to the track and arranged in sections, to be engaged by contact shoes carried by the locomotive.

861,718. Switchboard for Use in Telegraph and Telephone Offices. Wilbur H. Gabel, Hazel, S. D. Application filed October 26, 1903.

An arrangement of binding posts, contact buttons and a switch arm for making various connections of instruments is described.

861,744. Electric Muffle Furnace. Albert L. Marsh, Lake Bluff, Ill., assignor to the Hoskins Company, Chicago, Ill. Application filed February 18, 1907.

A muffle removably insertible into the housing is composed of refractory material with an electrical resistance element having terminals adapted to be received by friction sockets.

861,759. Railroad Signaling Device. Elmer G. McGath, Lancaster, Ohio. Application filed April 11, 1907.

A contact plate on the locomotive strikes a semaphore arm and at the same time exhibits an electric signal in the cab.

861,761. Fire-alarm System. Newman M. Ogle, Walbrook, London, England. Application filed February 23, 1907.

The system combines a thermopile, a fuse, a current-register provided with a needle and contact-points, all included in a main circuit. In a secondary circuit connected to the contact-points are a battery, a call-bell and a polarized relay. The needle is automatically placed in contact with the points when the fuse is destroyed by heat.

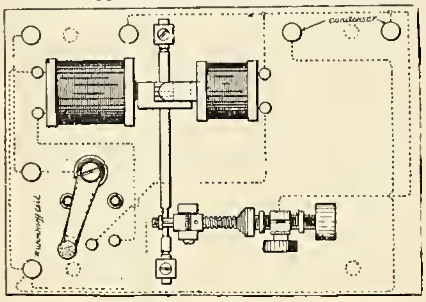
861,772. Signal-controlling Mechanism. Valentine I. Smart, Chicago, Ill., assignor to the Union Switch and Signal Company, Swissvale, Pa. Application filed July 13, 1906.

The circuits controlling the semaphores are so arranged that the co-operation of two operators is required to set any semaphore.

861,782. Process of Separating Ore. Henry H. Wait, Chicago, Ill., assignor to the International Separator Company, Chicago, Ill. Application filed March 20, 1905.

The process of separating mica from molybdenite consists in impregnating the mixture of such ores with a solution of an iron salt, exposing the impregnated ore to the air and finally subjecting the mixture to the action of an intense magnetic field, so that mica is attracted and removed.

861,783. Interrupter for Electric Circuits. Reinhold H. Wappler and Charles F. Fayer, New York, N. Y. Application filed January 28, 1907.



NO. 861,783.—INTERRUPTER.

A vibrating interruptor, whose movement is electrically maintained, is described. (See cut.)

861,790. Controller. Thorsten von Zweigbergk, Preston, England. Application filed November 28, 1906.

A controller for a hoisting motor has raised positions adapted to govern the motor and lowering positions to reverse the motor and establish a resistance shunt about the armature.

861,800. Switch for Electric Circuits. Herbert S. Brown, New York, N. Y. Application filed May 12, 1906.

In the switch a yielding spring-retracted device is combined with a resilient contact, a complementary contact and means to cause the contacts to interlock.

861,806. Electrode for Secondary Batteries. Louis Chronik, New York, N. Y. Application filed January 2, 1907.

A new detail of construction is the frame having spaced cross-bars, and sets of plate sections filling the space between the cross-bars, each plate section having a supporting bar and strips secured at one end to the supporting bar, the strips of one set of plate sections being arranged between the strips of the other plate section, and each of the strips having diagonally extending ridges running in opposite directions.

861,808. Telephone System. Henry P. Clausen, Chicago, Ill., assignor to the American Electric Telephone Company, Chicago, Ill. Original application filed April 26, 1901. Divided and this application filed November 20, 1901.

A cord circuit for connecting common battery and magneto lines is described.

861,809. Telephone Switchboard Apparatus. Henry P. Clausen, Chicago, Ill., assignor to the American Electric Telephone Company, Chicago, Ill. Application filed November 21, 1903.

A central-energy multiple switchboard telephone system is provided with operators' cord-circuits having normally short-circuited impedance coils, together with spring jacks adapted to be connected with the cord-circuits in the establishment of connection between different subscribers, each spring jack having an outer contact constituting a part of both the talking and busy test circuits.

861,811. Electrical Water Heater. Edward J. Condon, New York, N. Y., assignor of one-third to Eleazer I. Rains and one-third to George W. Ruppert, New York, N. Y. Application filed November 1, 1906.

The heater comprises a heating element which is supplied with current by an automatic circuit closer included within the water connections and adaptable to be moved by the water to close the circuit.

861,812. Cable Terminal. Frank B. Cook, Chicago, Ill. Application filed February 23, 1907.

An enclosure terminal comprises two similar porcelain halves on which fanning strips are formed as parts. Posts extend through the walls for connecting the aerial lines to the cable conductors.

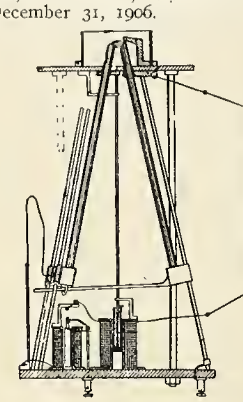
861,813. Junction Box. Frank B. Cook, Chicago, Ill. Application filed March 2, 1907.

The box is described as comprising two cylindrical sheet-metal tubes, one extending through the other, and baving ends connected. A removable lid fits over the outer tube, and the cable through the enclosure between the tubes.

861,851. Electrical Heater for Hot-water Bags. Charles Van Dyke Hill, St. Louis, Mo. Application filed September 15, 1906.

A resistance wire is loosely coiled in a shell, seated in the bag-stopper, and arranged to be heated by completing electrical connections.

861,856. Electric Arc Lamp. Hendricus J. J. Jaburg, Jr., Amsterdam, Netherlands. Application filed December 31, 1906.



NO. 861,856.—ARC LAMP.

The feed mechanism of an arc lamp burning the carbons in a manner similar to that used in a certain class of flaming arc lamps is described. (See cut.)

861,887. Hanger for Electrical Cables. Ralph S. Peirce, Chicago, Ill. Application filed February 27, 1905.

The marlin or other cord is formed into a closed loop by a non-corrosive, non-abrasive metallic clip which rests on the messenger.

861,921. Ignition System for Explosive Engines. Richard Varley, Englewood, N. J., assignor to the Autocoil Company. Application filed November 3, 1906.

Details of a sparking commutator are described.

861,931. Dynamo-electric Variable-speed and Reversing Gearing. Martin Albrecht, Friedberg, Germany, assignor to Feltten & Guilleaume-Lahmeyerwerke Actien-Gesellschaft, Frankfort-on-the-Main, Germany. Application filed February 13, 1907.

Two elements are adapted to turn about a common axis, while a dynamo and an electric motor, whose armatures are included in an electric circuit, are connected to the turning elements.

861,940. Electric Lamp Socket. Reuben B. Benjamin, Chicago, Ill., assignor to the Benjamin Electric Manufacturing Company, Chicago, Ill. Application filed July 14, 1904.

The insulating base consists of a single piece to which the lamp-receiving receptacle is attached.

861,941. Electric Lamp Socket. Reuben B. Benjamin, Chicago, Ill., assignor to the Benjamin Electric Manufacturing Company, Chicago, Ill. Application filed July 14, 1904.

A lamp cluster has a number of concentrically arranged lamp openings, and a number of one-piece insulating bases, carrying lamp receptacles, secured to the inner face of the casing registering with the lamp openings.

861,942. Electric Lamp Socket. Reuben B. Benjamin, Chicago, Ill., assignor to the Benjamin Electric Manufacturing Company, Chicago, Ill. Application filed October 17, 1904.

A socket is described, which has the terminal contacts entirely enclosed in a protective casing.

861,950. Process for the Insulation of Electric Wires and Cables. Frederic M. Chaplet, Laval, France, assignor to La Compagnie Francaise de l'Amiante du Cap, Paris, France. Application filed May 4, 1905.

The process consists in insulating wires by superimposing to the desired thickness thin layers of fibrous material, applying the layers parallel to the conductor, and separately smoothing each layer as it is applied.

861,956. Trolley Pole Attachment. Patrick F. Duross, New York, N. Y. Application filed December 22, 1905.

Check pieces are mounted to rock on the spindle of the wheel, each being provided with a guide finger projecting beyond the wheel.

861,958. Electric Signal. Martin A. Ewing and Joseph H. Ewing, Gallatin, Tenn. Application filed January 12, 1906.

An arm is arranged to be engaged by a projecting member on the locomotive, and is designed to be held by a number of holders mounted on a revoluble member.

861,965. Safety Fuse. Carl Gehrke, St. Louis, Mo. Application filed January 16, 1907.

In an enclosed fuse, screw plugs received in the metal terminal rings, grip the ends of the fuse-wire.

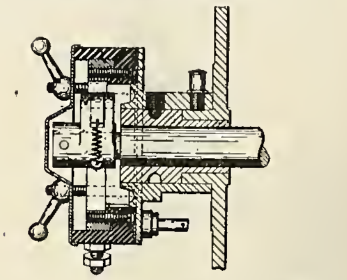
861,980. Secondary Electric Clock. Robert L. Hight, Decatur, Ill. Application filed March 29, 1906.

In a time-piece designed to be operated from a master-clock, a magnet energized by impulses from the master-pendulum, transmits power to a ratchet-wheel in the secondary clock.

862,026. Automatic Alarm. Charles W. Smith, Fredericksburg, Ohio. Application filed December 14, 1906.

A float closes the circuit of an alarm bell.

862,041. Circuit Maker and Breaker. John Wilkinson, Syracuse, N. Y., assignor to the H. H. Franklin Manufacturing Company, Syracuse, N. Y. Application filed April 15, 1907.



NO. 862,041.—CIRCUIT MAKER AND BREAKER.

Mounted in a ring of insulating material, the wearing faces of the contact-pieces and bearing-members are arranged in the same curved line forming a substantially continuous metallic path. (See cut.)

862,072. Switchboard Construction. Theodore A. Hammond and William P. Hammond, Passaic, N. J., assignors to the H. R. and K. Manufacturing Company, New York, N. Y. Application filed November 18, 1903.

For telegraph connections, a single wire circuit switchboard consists of a number of jacks, so arranged as to make either a patching or a looping connection at any individual jack.

862,080. Electric Haulage System. Nils D. Levin, Chicago, Ill., assignor to the Goodman Manufacturing Company, Chicago, Ill. Application filed November 7, 1904.

The driving gear of an electric rack-rail haulage system is described.

862,082. Wire Clamp. Oliver E. Lewis, Ulysses, Neb., assignor of one-half to Joseph B. Simpson, Washington, D. C. Application filed June 19, 1906.

The clamp provides a curved path for the wire, so that when taut it is firmly gripped.

862,084. Relay and Sounder. George W. Lorimer, Piqua, Ohio, assignor to the Lorimer Automatic Telephone Company, Augusta, Me. Application filed July 22, 1902.

A sheet-metal frame supports the electromagnet, its armature and other parts and consists of a sheet-metal base, standards and ears formed in standards for supporting the armature lever and the adjusting screw.

862,101. Hair-drying Comb. Paul E. Oswald, Los Angeles, Cal., assignor to Herbert N. Wayne, Los Angeles, Cal. Application filed April 16, 1907.

Resistance material in the back of the comb heats the air which is blown through the ends of the hollow teeth from a bulb in the handle.

PATENTS THAT HAVE EXPIRED.

Following is a list of electrical patents (issued by the United States Patent Office) that expired August 5, 1907:

433,445. Registering System for Telephone Exchanges. J. C. Clark, Morristown, N. J.
433,485. Multiple Signal System. B. J. Noyes, Boston, Mass.
433,486. Multiple Signal Apparatus. B. J. Noyes, Boston, Mass.
433,504. Multiple Signal Apparatus. J. C. Wilson and B. J. Noyes, Boston, Mass.
433,544. Electric Railway. A. A. Shobe and W. Embley, Jerseyville, Ill.
433,554. Electric Release for Target Traps. L. L. True, Bismarck, N. D.
433,557. Dynamo-electric Machine. C. F. Winkler, Troy, N. Y.
433,584. Electric Fire Alarm and Night Call. C. J. Vining, Cleveland, Ohio.
433,619. Electrical Communication. J. L. Cutler, Piketon, Ohio.
433,636. Multiple Switchboard System. E. P. Warner, Chicago, Ill.
433,637. Electrical Measuring Instrument. E. Weston, Newark, N. J.
433,671. Electric Soldering Iron. C. E. Carpenter, Minneapolis, Minn.
433,700. Alternating-current Electromagnetic Motor. N. Tesla, New York, N. Y.
433,701. Alternating-current Motor. N. Tesla, New York, N. Y.
433,702. Electrical Transformer or Induction Device. N. Tesla, New York, N. Y.
433,703. Electromagnetic Motor. N. Tesla, New York, N. Y.
433,706. Electric-circuit Coupling for Railway Trains. W. P. Widdifield, Uxbridge, Ontario, Canada, and A. H. Bowman, Allentown, Pa.
433,744. Electric-current Controller. M. O. Sargent, Malden, Mass.
433,839. Trolley for Electric Street Cars. F. C. Wheeler, St. Joseph, Mo.
433,904. Electric-motor Mechanism. S. E. Mower and G. J. Spencer, New Haven, Conn.
433,917. Method of Manufacturing Electric Conductors. E. P. Warner, Chicago, Ill.
433,918. Electric-railway Conduit System. M. Wheless, Nashville, Tenn.
433,920. Joint for Electric Conductors. G. L. Wiley, Arlington, N. J., and E. G. Acheson, Pittsburg, Pa.
433,921 and 433,922. Joint for Electric Conductors. G. L. Wiley, Arlington, N. J.

WESTERN ELECTRICIAN

EVERY SATURDAY

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Interurban Traction Lines near Rome, Italy.

By A. de Courcy.

A system of interurban lines which is to be ranked among the most extensive in Italy was installed not long since between Rome and a number of the small towns in the neighborhood. It is now operating very successfully and carries a good traffic, being well patronized by the supporting population and also by tourists. The present lines have a total length of about 25 miles.

The system comprises three separate lines or sections, as may be seen by the map on the next page. First of these is the Rome-Grotta Ferrata section, which forms the main line running from the city. It starts at Rome from the square in front of the railroad depot, passing by the Church of St. John Lateran and goes out by a special gate which is pierced in the ancient walls of the city near the gate of St. John. Outside of the city it follows the new Appian way for 1.2 miles, the Via Tuscolana, and after running across the open country it crosses the railroad line of Rome-Albano upon an iron bridge. Passing then along the Aqueduct of Claudius, it crosses the Rome-Naples railroad line, then rejoins the Via Tuscolana and reaches the point of Villa Senni.

From the city to Villa Senni the road rises in a slow and constant grade with an almost straight path. But from this point it commences the ascent of the Alban Mountains, and in order to avoid going up a too steep slope it makes a wide turn, which includes many curves and grades. It finally arrives at Bivio, which is the terminal point of the main line, and there it joins on to the second section.

The second line lies between the town of Frascati and Genzano and is about 11 miles in length. From Frascati it first follows the provincial route, and after crossing Grotta Ferrata it passes along the communal road, crossing the bridge of Squarciarelli. After descending the valley of the Marino and passing along Lake Albano it arrives at the town of Genzano, the terminal point. The third section branches off this line at the Squarciarelli bridge and runs to the town of Rocca di Papa. It is a short line of about two miles length. It runs up a heavy grade and finally reaches an altitude of 527 meters, or 477 meters above the level of Rome. From the terminus a cable incline, which is building, will take passengers up to an altitude of 627 meters.

From the city terminal to St. John Place the track is formed of Phenix rails weighing 43 kilogrammes per meter, but where the line is laid in the flat country of the Campagna it is built of light Vignole rails weighing 28 kilogrammes per meter. The Frascati-Genzano line uses Phenix rails of 48 kilogrammes. In all cases the gauge of the line is 1.44 meters and the minimum curves 25 meters radius. The line is laid in single track, with turnouts of 90 meters length. On the whole system the overhead trolley is used with rail return.

Current is furnished by the large hydro-electric plant of Tivoli, belonging to the Anglo-Romana Company. The main part of the road as far as the Via delle Cave is supplied by the sub-station of this company, located at Porta Pia, by means of an underground feeder which ends at St. John's gate and brings current at 550 volts. As to the remainder of the system it is fed by three sub-stations installed at Ciampino, San Giuseppe and Albano. These latter stations receive current at 10,000 volts and 42 cycles from the Tivoli station, and a set of rotary-converter groups delivers direct current at 650 volts.

The trolley line is formed of a double overhead wire of 9.25 millimeters, supported generally upon brackets fixed on wooden poles. In the villages rosettes are used upon the houses. One of the sub-stations near the city, that of Ciampino, besides being connected directly upon the trolley line, also supplies it by means of a feeder line from a booster which runs for a distance of 5.5 miles. The current given by this station has a pressure of 650 volts.

The high-tension line coming from the Tivoli hydraulic plant is divided into three sections. Of these the main section, which ends at the Ciampino sub-station, is about 21 miles in length. Starting from the hydraulic plant, which is situated at the foot of the Tivoli hill, it crosses the plain of the Campagna and can transport 700 kilowatts in the shape of three-phase current, working at 10,000 volts and 42 cycles. This line is made up of six five-millimeter copper wires, forming two separate lines which are operated in parallel usually, but one of them can be used alone if need be. A shorter line is used to connect the Ciampino sub-station with the San Giuseppe sub-station. It has three wires only upon a length of 3.7 miles. A similar high-tension overhead line runs from the latter point to the Albano sub-station.

Special precautions had to be taken to avoid accidents due to lightning, as the storms in this region are frequent and very violent. Where the line leaves the generating plant of Tivoli it passes first through a set of Wirt lightning arresters of the ball type, which stop the smaller discharges. Larger discharges are stopped by arresters placed entirely outside the station building, using a series of horn lightning arresters with liquid resistances. The same arrangement is used at the entrance of the line into the Ciampino station.

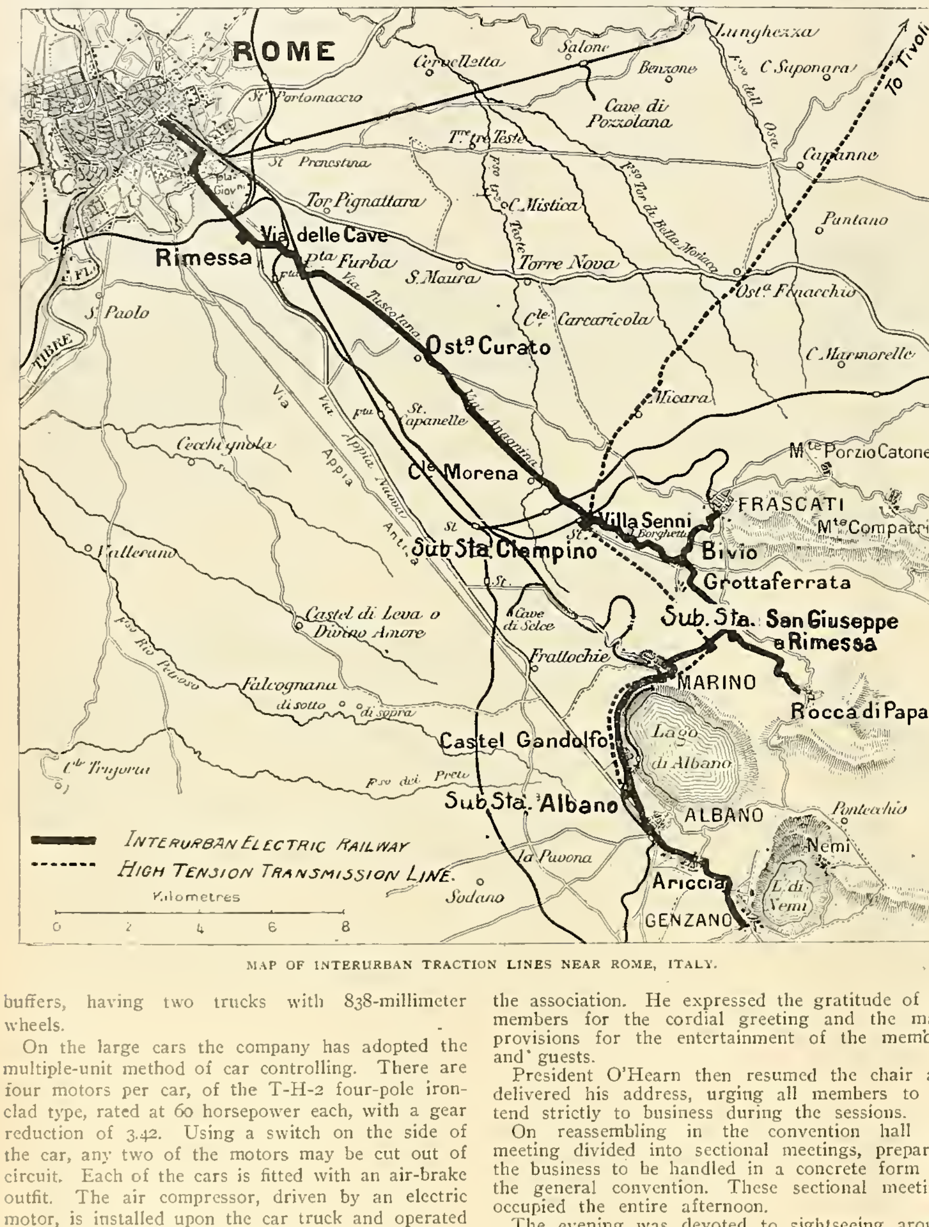
At Ciampino there are two main groups of motor-generators for delivering direct current for the line. Each of these is made up of a synchronous motor of the Thomson-Houston 10-pole type, designed to give 250 kilowatts at 516 revolutions per

Terminus in Rome, near City Walls, at Square of St. John Lateran. Terminus at Frascati.
Bridge over Steam Railroad. Single-deck Cars at Castle Gandolfo.

INTERURBAN TRACTION LINES NEAR ROME, ITALY.

minute and receiving current at 8,500 volts. Direct coupled with it is a six-pole railway generator of 200 kilowatts which delivers 650-volt current. In parallel with the bus-bars is connected a storage battery of the Union type having 500 ampere-hours capacity. The trolley line is fed first by a direct connection with a feeder near the sub-station and also by a second feeder farther along, which is boosted by a group consisting of a direct-current motor coupled to a 150-ampere generator delivering up to 300 volts. There are two of these booster sets in the sub-station. As to the two other sub-stations, they have an outfit of two motor-generators of 125 kilowatts each, using a storage battery of 325 Union cells.

Rolling stock comprises 12 double-decked cars, including eight motor cars and four trailers having a capacity of 82 passengers each; also 16 cars of the ordinary type, eight motor cars and eight trailers holding 35 passengers each. The double-decked cars are specially designed for the interurban service and are 11.8 meters long between buffers, having two trucks with 838-millimeter wheels.



MAP OF INTERURBAN TRACTION LINES NEAR ROME, ITALY.

On the large cars the company has adopted the multiple-unit method of car controlling. There are four motors per car, of the T-H-2 four-pole iron-clad type, rated at 60 horsepower each, with a gear reduction of 3.42. Using a switch on the side of the car, any two of the motors may be cut out of circuit. Each of the cars is fitted with an air-brake outfit. The air compressor, driven by an electric motor, is installed upon the car truck and operated by an electric governor.

In order to give greater security when traversing the country during the night the cars are equipped with two arc projectors which are placed upon the upper deck. The smaller cars are of the usual type, with rigid axles, and have two of the above-mentioned motors.

Under the present conditions of the line the service is somewhat difficult to carry out properly. As operated at present it comprises trains leaving Rome every hour and proceeding either to Frascati or to Genzano. Besides there is a special service between the two latter towns. As to the new section running to Rocca di Papa, it uses ordinary cars over a length of 1.8 miles, but to reach the town of Rocca di Papa, which lies at an altitude of 627 meters, passengers will be taken by the cable road, as the grade is too steep to allow of using the ordinary electric road.

The lines were equipped by the Mediterranean Thomson-Houston Company with apparatus built at the Paris factory of the French company. Mr. Garfield, chief engineer of the latter company, kindly supplied the writer with the foregoing information.

International Association of Municipal Electricians.

The twelfth annual convention of the International Association of Municipal Electricians was called to order by President T. C. O'Hearn in the City Hall of Norfolk, Va., at 10 a. m. on August 7th. President O'Hearn called upon Councilman J. S. Barron to assume the charge of the opening exercises. An address of welcome made by Acting Mayor D. S. Burwell assured the delegates of a generous entertainment. In the course of his speech the acting mayor gave a brief history of the development of the city, assuring the delegates and guests of the pleasure it gave the citizens to entertain them.

Mr. J. B. Yeakle of Baltimore responded for the association. He expressed the gratitude of the members for the cordial greeting and the many provisions for the entertainment of the members and guests.

President O'Hearn then resumed the chair and delivered his address, urging all members to attend strictly to business during the sessions.

On reassembling in the convention hall the meeting divided into sectional meetings, preparing the business to be handled in a concrete form for the general convention. These sectional meetings occupied the entire afternoon.

The evening was devoted to sightseeing around the city.

The first business of Thursday, August 8th, was the report of Mr. A. S. Hatch, chairman of the Electric Light Department, who said Mr. A. L. Pierce of Wallingford, Conn., would read a paper on "Operation of a Municipal Electric-light Plant," the main feature of which was that a municipal plant to be successful must be conducted in the same manner as a private corporation; i. e., the superintendent must be in absolute control, with the elimination of political influences.

C. S. Downs of Altoona, Pa., read his paper on "Luminometer Methods of Testing Street Arc Lamps," believing this method to be the fairest yet devised for both the companies and the public. The discussion of these two papers consumed all the time of the morning.

The afternoon was given up to a trip by steamer around the bay through Hampton Roads, landing the party at the Jamestown Exposition grounds, and thence by trolley cars to Ocean View, where the salt-water bathing was greatly enjoyed. In the evening all went to the Ocean View Hotel, where a banquet was served.

On Friday morning the meeting was called to order at 10 o'clock by the president. Mr. J. B. Yeakle explained the value of volt and ammeter tests for insulation of lines, describing some very unique methods used in the Baltimore office.

The paper by Adam Bosch of Newark, N. J., "Modern Fire-alarm Central Office," was read. It was a description of the central office recently installed by his city.

Walter M. Petty, borough electrician of Rutherford, N. J., presented his paper, "Modern Application of Storage Batteries." The author advocated a large-capacity cell connected to the circuits in multiple, rather than the greater number of smaller ones in series for each circuit.

The question, "What efforts, if any, do the various cities use to control street railways?" provoked a lively discussion, developing the fact that very little was done to control the companies.

The election of officers resulted as follows:

President—R. A. Smith, Norfolk, Va.

First vice-president—J. B. Yeakle, Baltimore, Md.

Second vice-president—B. A. Blakey, Montgomery, Ala.

Third vice-president—C. F. Gall, Louisville.

Fourth vice-president—C. S. Downs, Altoona, Pa.

Secretary—Frank P. Foster, Corning, N. Y.

Treasurer—C. E. Diehl, Harrisburg, Pa.

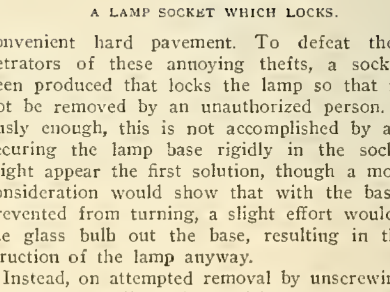
Executive committee—L. Gascoigne, T. C. O'Hearn, Cambridge; W. Y. Ellett, Elmira; Elmer G. Loomis, Allegheny; William S. Devlin, Newcastle; Clarence R. George, Houston; William Crane, Erie; Jerry Murphy, Cleveland; James Grant, New Haven.

Finance committee—A. L. W. Kittredge, New Haven; Oliver M. Schafer, Trenton.

There was a spirited contest between the cities of Detroit, Mich., and Niagara Falls, N. Y., for the next convention, Detroit being finally selected for the meeting in 1908. The meeting then adjourned and the delegates and guests were taken in automobiles around the city on a sight-seeing trip. All left declaring that Norfolk people were the embodiment of hospitality.

A Lamp Socket Which Locks.

Incandescent electric lamps in public places, such as electric signs and store fronts, frequently suffer from petty thieves and small boys who delight in the loud report which results from impact with a convenient hard pavement. To defeat the perpetrators of these annoying thefts, a socket has been produced that locks the lamp so that it cannot be removed by an unauthorized person. Curiously enough, this is not accomplished by actually securing the lamp base rigidly in the socket, as might appear the first solution, though a moment's consideration would show that with the base thus prevented from turning, a slight effort would twist the glass bulb out the base, resulting in the destruction of the lamp anyway.



A LAMP SOCKET WHICH LOCKS.

Instead, on attempted removal by unscrewing, the lamp turns easily and promisingly for ten or fifteen turns or until the uninitiated would-be remover begins to notice that the lamp is no farther out of the socket than when he commenced his efforts. The internal threaded cup which carries the lamp is free to turn on a swivel, so that unless its movement is arrested during the twisting operation, it turns with the lamp-base, from which it does not unscrew. A key (H) is arranged to be inserted in the side of the socket, which locks the cup against rotation while the lamp is being inserted or unscrewed.

The inventor of this thief-proof socket describes a form of construction which has certain important practical advantages. It may be strongly, lightly and cheaply made and involves the minimum of alteration of the ordinary standard socket, utilizing most of the parts without change. No change in the exterior shell is necessary except cutting the hole for receiving the lateral key shell. The screw-socket or cup is not liable to be strained or distorted if the lamp be too forcibly screwed in; no distortion or wear of the parts can affect the conductive contact with the switch in the closed position; and the lock admits of the use of a small key entering through a keyhole so small as to practically preclude tampering with the lock.

While the invention has been illustrated in the accompanying drawing as applied to the ordinary Edison socket, the invention is not limited to this application, but is applicable to any socket with which the lamp is connected by screwing into place, or by any other means requiring a rotative movement.

The new socket is the invention of Mr. J. J. Wood, the well-known engineer of the Fort Wayne Electric Works.

The Ohio Convention of Next Week.

To the Ohio Electric Light Association is due the credit for issuing perhaps the most attractively printed and bound programme ever distributed for an electrical convention. This is the programme for the thirteenth annual convention of the association at Toledo on August 20th to 22d. The copy of the programme which has been sent to the Western Electrician consists of a souvenir booklet or book of 80 pages, handsomely printed and illustrated and bound in limp green leather, gold stamped, and backed with watered green silk. The book contains portraits of the officers of the association and pictures of Toledo, as well as lists of the names of officers and members, a brief history of the association, information about the association and about Toledo, as well as the programme itself.

W. P. Engle, President. C. C. Collins, Vice-President. D. L. Gaskill, Secretary and Treasurer. W. E. Russell, Chairman of Executive Committee.

OFFICERS OF THE OHIO ELECTRIC LIGHT ASSOCIATION.

The pictures herewith given are reproduced from the souvenir programme. It may be mentioned that Bacon & Huber of Toledo are the architects of the proposed new interurban electric-railway station illustrated.

The events on the programme may be epitomized as follows:

Monday, August 19th—Committee meetings at 5 p. m.; theater party at Casino in the evening.

Tuesday, 10 a. m.—President's address; papers on "Factory Lighting," by A. P. Biggs of Detroit Edison Company and J. Kermode, Cleveland Illuminating Company; report of committee on uniform accounting, by F. E. Crawford of the Library Bureau, Cleveland, and D. W. Low, Alliance (Ohio) Gas and Electric Company.

Tuesday, 2 p. m.—Paper on "Luminous Arcs from Central-station Viewpoint," by H. P. Grabbill, Ashland (Ohio) Gas and Electric Company; report on electric heating devices, by M. E. Turner of Cleveland Illuminating Company; executive session.

Tuesday afternoon—Ladies' prize contest. At 4 p. m. all hands will take cars to Toledo Beach for supper, after which there will be dancing.

Wednesday morning—"Co-operative Commercialism in the Electrical Field," by J. Robert Crouse of Cleveland; "The Best Form of Power for Stations of 500 Kilowatts Capacity or Less," Professor F. C. Caldwell of Ohio State University, Columbus.

Wednesday morning—Ladies' card party.

Wednesday afternoon—Report of committee on high-efficiency lighting units, by C. C. Collins, Railway and Light Company, and A. N. Cope, Public Service Company, Columbus; papers on soliciting business, by Frank Maunsell of Railway and Light Company of Toledo, J. D. Kenyon of the Sheldon School of Chicago and A. S. Miller of Dayton (Ohio) Lighting Company; report on cost determination, by M. E. Turner of Cleveland and F. M. Tait of Dayton; executive session.

Wednesday afternoon—Ladies' prize contest.

Wednesday evening—Steamboat trip on Lake Erie.

Thursday morning—Papers on the best way to meet gas and gasoline competition, by F. H. Golding of Dayton, Samuel Rust of Greenville, W. E. Russell of Massillon, Arthur Pomeroy of Cleveland, E. T. Selig of Mt. Vernon and W. C. Anderson of Canton; report of secretary and treasurer; election of officers; question box; executive session.

Thursday morning—Ladies' prize contest.

Thursday afternoon—Visiting places of interest.

Twenty-seven prizes, donated by electrical concerns, will be awarded to ladies winning in card parties, guessing contests, bowling matches, etc.

The officers of the association are: President, W. P. Engle, Defiance; vice president, C. C. Collins, Columbus; secretary and treasurer, D. L. Gaskill, Greenville; executive committee, W. E. Russell of Massillon, M. E. Turner of Cleveland, D. W. Low of Alliance, E. H. Beil of Youngstown, F. M. Tait of Dayton; Advisory committee, Samuel Scovil of Cleveland, W. E. Miller of Mt. Gilead, D. L. Gaskill of Greenville.

The dues range from $5 to $20 a year for active members (central station men) and $5 for associates. The association has had a very prosperous year, and a most successful convention is assured. The sessions will be held at the New Boody House.

The Ohio Electric Light Association was organized in 1895. At a meeting of the National Electric Light Association held in Cleveland, Ohio, several representatives from Ohio discussed the necessity of a state association and decided to take measures to ascertain the sentiment of the Ohio stations upon the advisability of forming such an organization. Mr. Samuel Scovil of Cleveland was appointed to ascertain the sentiment of the representative electric stations, and, after addressing 60 of the representative Ohio stations, he received favorable answers from 47. The result was a meeting held at the Neil House in Columbus, Ohio, on May 21, 1895. At this meeting the association adopted a constitution and by-laws and expressed, in clear, forcible terms, the object of the association in the following language:

"Its object shall be to foster and promote the common interests of its members and to advance scientific and practical knowledge in all matters relating to electric-light and power companies; also to establish cordial and beneficial relations with kindred associations, and between the manufacturers of electrical machinery and appliances and the members of this association. It may render such assistance and advice to its members as may not be inconsistent with the purposes above expressed."

From this meeting the growth has been continuous and the interest manifested has increased each year. Twelve conventions have been held, each of which has been an improvement over the preceding convention, and from these meetings the stations of Ohio have received great and lasting benefit.

The places of the convention have been as follows: Piqua, Springfield, Cincinnati, twice at Sandusky, Cleveland, Toledo, twice at Columbus and three times at Put-in-Bay.

In addition to the educational and social benefits of the organization, the Ohio Electric Light Association has done much toward giving individual assistance to its members. It maintains its organization throughout the year, and problems requiring solution are answered through the office of the association whenever asked.

It maintains an advisory committee, whose business it is to look after legislation and by every honorable means seek to promote the interests and welfare of the electric-lighting industry.

It also maintains committees upon various branches of the lighting industry to experiment and report at each convention the progress and the desirability of such branches for the preceding year. These reports and the discussions that grow therefrom afford one of the interesting features of the convention.

PROPOSED INTERURBAN ELECTRIC-RAILWAY STATION TO BE ERECTED IN TOLEDO.

Notes of Wiring Inspection Progress in Illinois.

At Kankakee, Ill., a new electrical inspector has been appointed, and he has already established an up-to-date standard for wiring. He is a graduate engineer, and, in addition to supervising the wiring, carries on a general promoting and engineering business, covering out-of-town projects. Only approved fittings are used, and the inspector will endeavor to improve the character of workmanship connected with the installation of them. The lighting company is also maintaining an inspection department for its own protection. All series arc lamps have been removed from the interior of buildings and are now used for street lighting only. Where meters are removed the service is not permitted to be restored until wiring is overhauled and placed in good order. The present city administration will back the inspector in every legitimate demand for changes.

Paxton has adopted an up-to-date electrical inspection ordinance, and a competent inspector has been appointed to administer it. The inspector is an electrical contractor, but so far the arrangement has worked all right, and the business district is being gradually overhauled or rewired.

Urbana has had an electrical inspection ordinance for about a year, and it has resulted in greatly improving the standard for wiring. The new work now being installed is, with a few minor exceptions, in full compliance with Code requirements. This ordinance was adopted largely as a result of the example set by Champaign. The inspector also looks after plumbing and is engaged in the hardware business, but is in no way connected with the electrical industry except as inspector and is entirely disinterested.

At East St. Louis the plan proposed by the Underwriters' Electrical Bureau, some time ago, is being carried out. By this plan the chief of the Fire Department delegates the duties of electrical inspector to an electrician, leaving the chief free to look after the department in general. The lighting company is interested in safe wiring and has endeavored to protect prospective customers in every way possible by making inspections for wire capacity, etc. It has made considerable improvement in its outside wiring, and further alterations may be expected, including some underground work. High-tension arc circuits have been abandoned except for street lighting, and the 500-volt direct-current stationary-motor circuit is being gradually cut out, and power customers transferred to a three-phase system of lower potential. Transformer secondaries on distributing systems are being grounded at the neutral point, and this protection will be extended to all secondaries.

At Alton several attempts have been made to prevail upon the City Council to adopt an electrical inspection ordinance. The Fire Department is short-handed, and it may be possible to arrange for the appointment of an inspector whose services would be available for fire duty in case of necessity. This would increase the effectiveness of the department without adding materially to the annual expenses, as most, if not all, of the salary could be provided for through the collection of inspection fees.

Galesburg has a municipal street-lighting system, and several efforts have been made to prevail upon the City Council to adopt an electrical inspection ordinance authorizing the city electrician in charge of the plant to regulate the wiring. This request was about to be granted, when the city electrician notified the council that if other duties were imposed upon him he would expect more pay, and the matter was immediately dropped.

The Luminometer Method of Inspecting Street Arc Lamps.[1]

By C. S. Downs.

The question of inspecting street arc lamps and the compiling of specifications that would leave no chance for misinterpretation, yet at the same time give all prospective bidders an equal chance in preparing their bids was the puzzle which confronted me when the time came to prepare new specifications for lighting the streets of the city of Altoona.

The city of Altoona was fortunate in that we had two competing companies as bidders, one furnishing alternating-current and the other direct-current arc lamps. The old specification and the one that gave rise to no end of complaints was simply the old time-worn phrase, "shall be of 2,000 candlepower" but with the word "nominal" tacked on, which, like the tail of a kite, helped to balance as well as to raise and lower it as occasion seemed to demand. I have had to explain the meaning of the word "nominal" many, many times.

I found it very hard to construct in volts, amperes and watts a table that would give an equally fair deal to plants furnishing direct-current arcs and those furnishing alternating-current arcs, for a direct-current lamp of 6.6 amperes and 77 volts consumes 508 watts and the alternating-current lamp at 7.5 amperes and 72 volts consumes 482 watts, so it is seen that the power consumed is all in favor of the alternating-current plants.

Another thing to be considered was the growing tendency of arc-lamp makers to decrease the amount of power consumed in the lamps, but at the same time give the same amount of light, thus effecting considerable saving to the electric companies. This would be considered when they bid, and to hold them to a certain amperage, etc., would probably cause a higher price. Therefore a specification requiring a certain amperage, etc., was not considered advisable.

Tests by the photometer were considered, but found to be unsuitable for street work. Taking the amperage and voltage at the lamp was out of the question; first, on account of the extreme danger in working about the lamp in the darkness, and secondly, it was found that after a lamp had been tested for its amperage and found O. K., it would be discovered that the globe was dirty, thus rendering the light poor.

The average citizen does not care at all whether a lamp consumes one watt or a hundred; it is the light that he wants, and the lamp that gives the most, be it electric, gas or oil, is the best. Light is what he wants to buy, not current.

The luminometer or type-reading photometer is an instrument for determining the relative illuminating values of various sources of illumination. The instrument consists of a printed card enclosed in a mahogany box, so that only the light from the particular lamp under test can illuminate it. An eye screen is provided to keep the observer's eyes at a fixed distance from the card. The comparative illuminating value is determined by the ability of the tester to distinguish the type.

There are several methods of making comparative tests with the instrument, one being with a card showing several sizes of type and another showing but one. In making tests where it is desired to determine which of two or more lamps give the best light at some particular distance, the observers, as many as convenient, make readings at these distances and determine the smallest size of type which can be read from each of the lamps. This method will determine which of the lights under test gives the strongest illumination, but no proportionate result can be obtained. Cards should be changed often enough to prevent memorizing.

The second method of test, and the one we have adopted, permits comparative results being obtained from time to time, and consists in the use of cards on which is printed but one size of type, viz., pica or 12-point. The observer takes a position distant from the lamp and from which it is impossible to read the card. He then gradually approaches the lamp until he reaches the farthest point at which the card can be read under the most favorable condition, which I have found to be when the arc has traveled to a point on the carbon nearest the observer, is drawing its longest arc and is just about to feed. The observer then approaches the lamp gradually until the card can be read clearly under all conditions, except the point where the side rods intervene. The difference between the maximum and minimum is therefore the illuminating value of the lamp.

In preparing specifications a number of readings should be obtained. I have found repeated tests on the same type of lamps, made at different times and by different groups of observers, have checked remarkably close. It is suggested that the person selected to make the tests should have his eyes tested by a competent oculist to determine the per cent. of normal vision, as two persons rarely have the same power of sight.

Where possible, measuring instruments should be connected with the lamp under test in order to determine whether they are under normal running condition, although I found very few instances where a poor light was caused by the lamp not receiving the proper amount of current. In nine cases out of ten the depreciation was caused by dirty inner or outer globes, the loss of illumination being sometimes as much as 40 per cent. A small drop in current causes such a great loss of light that the electric companies are loath to have it occur as a rule on account of the large number of complaints.

I have prepared a copy of the table of the lamps tested to determine a fair average distance, the extremely high and low ones being discarded as being unfair to both sides. The distance was found to be 134 feet, but the odd feet were dropped, and 130 feet found to be a fair distance for a good clear reading, provided the globes were kept clean and the amperage maintained.

[Mr. Downs' table shows the result of luminometer tests of four alternating and seven direct-current arc street lamps taken in November, 1906, and June, 1907. The lamps were in varying condition of efficiency and the weather also varied. The minimum reading given in the table was 76 feet and the maximum 191 feet. The averages range from 84 feet to 171 feet. The average for direct-current lamps was 125 feet and for the alternating-current lamps 130 feet, but the latter seem to have been in rather better condition.]

I have found in my experience that the luminometer is fair to both sides. One of the superintendents did not believe that the distance could be averaged and called me out of bed one dark, rainy night to make some tests at random. All the lamps that were in fair condition came up to the specifications.

A clause, stipulating that a light will be furnished by which printed type of a certain size may be distinctly read at a certain number of feet distant from the lamp, should be in every specification for street arc lighting, and I believe it would prove more satisfactory to both the contractor and the buyer.

[1] Abstract of a paper presented at the convention of the International Association of Municipal Electricians at Norfolk, Va., August [illegible], 1907. Mr. Downs is municipal officer at Altoona, Pa.

Clearance Between Passing Street Cars.

One point brought up during the rehabilitation of the Chicago street railways is the standard clearance between passing cars on tracks in the center of the streets. This space has been fixed, tentatively at least, at 8½ inches, with the larger cars which are to be used. A man would be crushed if caught between cars passing at this distance apart, and the subject has attracted some attention in the daily papers. The chairman of the Board of Supervising Engineers, Mr. B. J. Arnold, is reported by the Chicago Daily Tribune as explaining the situation in these words:

"Of course, it would be better and safer if it were possible to allow a clearance of, say, 40 inches between all passing street cars. It would require fully that space, if not more, to make it safe for any large man to get between them. Most of the streets in this city are 66 feet wide, with a roadway of 38 feet. Storekeepers must have room to transact business, and they could not load or unload their teams if on these 66-foot streets the space between the car tracks was such as to give a larger clearance than 8½ inches. Give us wider streets and we'll make a wider clearance.

"If on the wider streets the space were made greater the public would get the fatal idea that it is safe to stand between passing cars in any street. The result would be that a great many people would be crushed. In the interest of safety, therefore, as well as for other reasons, the board decided in relaying the tracks to have a minimum or standard track center of 9 feet 8½ inches. [See Western Electrician of August 3d, page 85.] That ruling will widen all present tracks that are laid with centers of nine feet or nine feet six inches. The new cars are all to be nine feet wide, so the space between the passing cars will be 8½ inches."

Patapsco River Dam with Power Plant Inside.

The Patapsco Electric and Manufacturing Company, Ilchester, Md., recently completed its new dam and power plant, which, as will be seen from the following description furnished by the consulting engineers, Messrs. Newton and Painter, and by the Allis-Chalmers Company of Milwaukee, whose generators are here installed, has many unique features. The power plant is placed inside of the dam, with the waste water passing over the top of it. The dam is situated on the Patapsco River about 1½ miles below the company's other plant, or about three miles from Ellicott City and five miles from the western limits of Baltimore.

The part of the dam used as a power house is 108 feet long, 14 feet high and 27 feet wide, except at the buttresses, where it is 18 feet. The power equipment consists of two 32-inch horizontal turbine waterwheels running at 240 revolutions per minute, each direct connected to a 300-kilowatt 11,000-volt three-phase 60-cycle alternating-current generator. The voltage is unusual, but the transmission lines cover such a large territory that it was decided to use 11,000-volt generators in place of stepping the current up.

PATAPSCO RIVER DAM WITH POWER PLANT INSIDE.

The turbines are fitted with governors, so arranged that either will control both wheels when the generators are run in multiple. The generators have 125-volt belted exciters.

Located at the end of the power house is the switchboard, which is 10 feet 8 inches long and 8 feet 3 inches high, standing 12 feet from the wall and enclosed by grille work on each end. It is fitted with three voltmeters, two of which are connected directly with two phases (at bus-bars) and the other through plugs, so that the other phase of either generator can be read. A synchroscope is placed under the voltmeters, all of which are mounted on swinging brackets attached to the end of the board. As the exciters are arranged to be operated in multiple, a regulator is used for controlling the voltage of the generators. Three ammeters have been provided for each generator so that it can be told at a glance if either phase is overloaded.

Polyphase indicating wattmeters have been provided, one for the street service and the other to indicate the total output; also two polyphase recording wattmeters, one for street service and the other for the commercial circuits. A polyphase curve-drawing wattmeter is further used for recording the total output of the plant. The leads to the generators and commercial and street feeders are fitted with distant-control oil circuit-breakers with disconnecting switches. The breakers for generators have time-limit relays, so in case of trouble on the outside feeders they will not be thrown before the others.

The dam has a length of 220 feet and is 40 feet 9 inches wide at its base. Its height from the normal tail waters to the spillway is 26 feet 6 inches. At each end the buttresses and deck of the dam rise 10 feet above the spillway so as to allow for floods. The spillway is 168 feet long and arranged with anchor bolts so that in case it should be found desirable planks can be bolted to it sufficient to add two feet. The dam is built of reinforced concrete and the "deck" is supported by 19 buttresses 18 inches thick, which are spaced 12 feet centers. The deck of the dam is 18 inches thick at the bottom and tapers to 10 inches at the top.

The part of the dam used for housing the plant is fitted with a false ceiling hung five feet from the inside so as to protect the apparatus from any water that might seep through the deck. The ceiling slopes until it reaches the vertical sides forming the power house. The side next to the tail waters is fitted with windows. These windows furnish plenty of light, even when the water is flowing over the dam two feet deep. The part of the dam not protected by the false ceiling is comparatively dry, as very little water gathers on the inside of the deck, and what does collect there follows down the concrete deck until it reaches the drain at the bottom. If it were not for this moisture it would not occur to a person that he was standing under water.

HYDRO-ELECTRIC POWER PLANT INSIDE PATAPSCO RIVER DAM.

The water for operating the turbines is taken through the deck five feet six inches below the crest of the spillway, which helps to keep the trash racks clear of driftwood, etc. Each trash rack is 10 feet 6 inches and the flumes to turbines seven feet in diameter. Two waste gates are placed near the bottom of the dam, the water passing under the floor.

The waste water going over the dam is carried on the incline of the spillway to within 16 feet of the tail water. This incline causes the water to fall about 10 feet from the side of the dam, and as the river bed is quite rocky at this point the bottom is not pitted to any great extent.

The dam backs the water up three-quarters of a mile, with an average width of about 500 feet, to the tail waters of a cotton mill located at Ilchester.

The plant will supply current for both power and lighting. At present Ellicott City, Catonsville, Irvington, Carroll, Halethrop, Arbutus, St. Denis, Elkbridge and a part of West Baltimore are being supplied from the other plant, the territory covered being about six by 10 miles. There is quite a large day load, as about 250 horsepower in motors is supplied at different points. As soon as the new plant is in operation it is intended to extend the lines to West Arlington and Mount Washington, about 14 miles.

Mr. Victor G. Bloede is president and general manager and Otto Wonder superintendent of the company.

Further developments of the Rhine Falls at Schaffhausen, Germany, have been prevented by the decision of the councilors of the city.

Progress and Value of Tree Planting.

Reports from all parts of the country show that the last season has undoubtedly been characterized by a more extensive planting of forest trees than any previous year in the history of the United States. The work is progressing very favorably in every state in the Union. It has been most extensive in California, in the great Middle West and in the New England States. But even in the South, where planting has been more or less limited, because of existing natural forests, the scope of the work has greatly broadened.

The trees planted have been mainly hardwoods. Several large nurserymen, however, report greater sales of conifers for forest planting than they have ever made before. In the Middle West catalpa, black locust, Osage orange, and Russian mulberry were the favorite trees; in the North and Northeast preference was given to white pine, chestnut, larch and spruce; in the South the native conifers held the lead; and in California, where the immense annual planting area has been increased to at least five times its former size, eucalyptus had practically a monopoly.

Throughout the entire Middle West it is known that where the catalpa will succeed no other tree will pay so well. Good soil and moisture conditions are, however, essential for success with this tree.

Osage orange has been known to produce as high as 2,640 first-class posts and 2,272 second-class posts per acre, and it is well understood that no posts are better than those of Osage orange. Land producing such a forest as this could hardly be put to a better use, since timber is the easiest of all crops to raise, and from now on will never go begging for a market.

Red cedar in plantations 25 years old has reached a value of $200.54 per acre. European larch used for fence posts or telephone poles reaches an average value of $200 to $300. White pine plantations 40 years old have exceeded a value of $300 per acre, and it is known that the eucalyptus, even when grown for fuel alone, can compete as to profits with oranges.

It does not take a lifetime to get results. Catalpa often reaches a post size in from eight to 10 years, and will give service as a post for from 15 to 40 years. Osage orange, which reaches post size in from 12 to 15 years, usually lasts longer than catalpa. Black locust, though badly affected by the borer in some regions, grows about as fast as the catalpa, and has almost the same post value, while it has the great advantage over catalpa of being able to thrive on poor land. European larch reaches a size suitable for telephone posts in 25 years. When treated with preservative it will then last from 15 to 25 years.

In every region of the United States there is at least one forest tree, and generally there are several forest trees, which can be planted with a complete assurance of commercial success if the plantation is properly established and given proper care. The government has made a careful study of most of the forest plantations in the United States. Its publications on tree planting may be had free of charge upon application to the Forest Service, United States Department of Agriculture, Washington, D. C. The studies on which they were based were made especially for the benefit of farmers and other land owners, and to prevent the waste of thousands of dollars annually lost by planting the wrong forest trees or by improper care of plantations.

From the manner in which our natural timber has been cut it is clear that each region will have to be made as nearly self supporting in timber growth as possible. The lesson of the past is that the right forest trees grown in the right way will bring a good profit.

Municipal Electrical Inspection.

R. A. Smith, superintendent of electrical affairs of Norfolk, read a short paper on "Municipal Electrical Inspection and Records" at the recent convention of the Municipal Electricians. He said no city should depend entirely upon insurance inspectors for protection against defective electrical wiring. The city should have a board or committee of electrical affairs, empowered to supervise electrical construction, and also a municipal electrician. An ordinance should require permits for all electrical installations and or for alterations, with heavy penalty for moving or interfering with such installations after the inspector has passed upon them.

The electrical department's blank forms should include a blank application for permission to make installations by contractors, a blank for second notice from contractor when date can be set for inspection, a blank for the central-station company asking permission to make connections and a report blank to go back to the central station when permit is withheld.

Records should be kept by the card system, with a card for every electrical installation.

Three sets of files should be used; one to receive applications for inspection of work, one to receive applications for connecting buildings, and another for pending applications, such as work held for future notice of inspection, work with defect notices thereon, etc.

Upon receipt of an application for inspection, the clerk should stamp the time of day, date, etc., thereon, and place it on the receiving file accordingly, each application being placed on file in the order in which it is received. When the inspector comes for a bunch of applications he should be given those that are ready, and in the order of their dates and time of day as nearly as possible, giving due consideration to routes and taking all that may be ready on the route. On finding an installation defective, he should make out a slip with duplicate directed to the electrical contractor, stating definitely what the defects are.

On returning to his office, the inspector should file his duplicate defect notice, together with application of contractor on the pending file. This application should not be taken up again until contractor has remedied defect, O. K.'d slip, sent the slip to the inspector's office, and the case has taken its turn with other applications on file.

Electrical Openings in India.

William H. Michael, United States consul-general at Calcutta, enumerates the following openings in India for electrical engineering.

"The little city of Poona is situated 45 miles from Bombay at an elevation of 1,800 feet above sea level. It is a week-end resort for many of the well-to-do citizens of Bombay, who have fine cottage homes there, or have reserved suites of rooms at the hotels and boarding houses. The latest scheme for improvement at Poona is an extensive electrical system. A Bombay firm has made a start with a scheme to provide Poona with electric power for street lighting, power and street railways. The supply at first is to be confined to the municipal limits of Poona, and this area enlarged as the demand requires. It is proposed to supply the energy from a central station and to lay underground mains, or to erect overhead wires, as may be approved by the local government. All the streets to be supplied are under control of the municipal government, but it is already understood that there will be no opposition by the government to the proposed scheme.

"No country stands as well in India as America in regard to all kinds of electrical machinery and supplies, as well as to methods in the use of them. American electrical engineers are here considered the best in the world, and I would modestly suggest that they pay some attention to the Poona proposition.

"The extensive electrical works in Kashmir, under the direction of American electrical engineers, are making rapid progress toward completion. The power is derived from the Jhelum River, below Baramulla. The big flume, capable of carrying 20,000 horsepower, is completed, and the turbines to furnish 5,000 horsepower are being installed. Electrical power for mills and other purposes will be conveyed to Serinagur, many miles away. The scheme for extending the power is a large one, and great commercial results are confidently expected. The comfort and convenience that will necessarily follow to a large territory occupied by millions of people would be hard to describe. The items of lighting and operating electric fans alone are worth the expenditure on this great enterprise."

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DEPARTMENTS.

DATES AHEAD.

Ohio Electric Light Association (annual convention), New Boody Hotel, Toledo, August 20th to 22d.

Michigan Electric Association (annual convention), Battle Creek, Mich., August 20th, 21st and 22d.

Canadian Independent Telephone Association (annual meeting), Toronto, September 4th.

Canadian Electrical Show, Power Building, Montreal, September 2d to 14th.

Colorado Light, Power and Railway Association (annual meeting), S[illegible] Hotel, Denver, Colo., September 18th, 19th and 20th.

Central Electric Railway Association (regular meeting), Columbus, Ohio, September 26th.

To BEAUTIFY CHICAGO is the aim of a comprehensive list of improvements recommended, after careful consideration, by the Hamilton Club. And what stands the very first on the list? Why, this: "The substitution of electric power for steam on all locomotives employed in suburban traffic, and, so far as possible, the elimination of all steam locomotives within the city limits." This is an excellent recommendation, and one which should appeal to all good citizens. The numerous steam locomotives drawing suburban trains on the Illinois Central and other railroads, with their billows of sooty smoke, showers of cinders and nerve-distracting noise, are an unmitigated nuisance and should be abated. We heartily wish success to the Hamilton Club in its effort to correct this, among other abuses.

But we do not see any reference in the club's list of recommendations, 27 in number, to the lighting of the streets, although there is a demand for more artistic lamp posts. This is a rather conspicuous omission, for the streets of Chicago, outside the central business district, are in general poorly and insufficiently lighted, hundreds of miles of them having only open-flame gas lamps. Better and more abundant street lighting is really an urgent necessity in Chicago, and it is rather curious that the point escaped the civic improvement committee of the Hamilton Club. Nevertheless the club is to be heartily congratulated for its efforts looking toward the abolition of the smoke nuisance, the suppression of unnecessary noise and many other improvements. The upward path is a long and difficult one; but with an aroused civic pride an appeal to the old "Chicago spirit," much can be done.

AN INSTRUCTIVE SURVEY of the present status of electric lighting is made in the paper of Prof. Dr. G. Klingenberg of Berlin, given in full elsewhere in this issue. The paper is entitled "Electric Lighting in Germany" and was prepared for the recent convention of the National Electric Light Association in Washington. As indicated, it relates particularly to the present-day development of the art in Germany, but it is nevertheless important to electrical men in other countries, owing to the advanced position of Germany in the creation and adoption of the new high-efficiency electric lamps and to the standing of the author.

The writer gives an interesting account of the reasons actuating German engineers in adopting the 220-volt network and the 220-volt incandescent lamp in contradistinction to American practice, where the 110-volt standard has remained unshaken from the first. He admits that the appearance of the new metallic-filament lamps—the tungsten lamp and others—is embarrassing to the advocates of the 220-volt lamp, but he nevertheless continues to favor that voltage of distribution, believing that 220-volt metallic lamps will be forthcoming in due season, and that the possible reduction in generating and distribution expenses is greater than the loss in lamp efficiency. Probably most American engineers will disagree with Dr. Klingenberg on this point, but nevertheless his reasoning will be followed with close attention.

Naturally the author gives much attention to the metallic-filament lamps, and he recites the characteristics of these illuminants in an instructive manner, giving some interesting results of tests. One of his conclusions is that the new lamps will not have an unfavorable influence on the business of the central station, because they give more light for the same current, but will have precisely the opposite effect in encouraging the use of larger lamp units and more light. This is a confirmation of the previously expressed opinion of the Western Electrician, and we believe, with the present author, that the cheaper light will bring many customers to the central station who are now hanging back.

One particularly interesting portion of the paper has to do with the effect of the new metallic-filament lamps on arc lighting. Dr. Klingenberg believes that the small arc lamp will be forced out of the running by the new incandescents, and in this he is very likely right. There is a growing belief in this country that the metallic-filament lamp in large units is destined to play a conspicuous part in future street lighting. This belief was voiced by Mr. W. H. Blood, Jr., of Boston, who said, in a paper read at the illuminating engineers' convention in Boston last month, that the apparent tendency, except in large cities, is in the direction of abandoning the arcs and substituting high-power incandescents to obtain well-lighted streets. But the German authority goes much farther than this and makes the bold statement that "Any source of light of less power than 500 candlepower will be a metal-filament lamp." This is perhaps too radical a statement. For one thing it seems to leave the Nernst lamp out of the calculation altogether. But it well indicates the decisive view of the matter taken by engineers whose views are entitled to respect.

Dr. Klingenberg mentions the use of very powerful flame-arc lamps (20 amperes, 5,000 candlepower) for outdoor lighting in Berlin. These lamps are placed 59 feet above the street level on poles, and the result is reported to be satisfactory. The author is apparently under the impression that the "tower system" is still favored in the United States for street lighting, and he points out that the flame arc is particularly well adapted for tower lighting. However, this system has been abandoned in this country, except in a few localities, and the use of a more powerful lamp will not serve to remove its disadvantages.

The paper is a most interesting one and possesses real value as a contribution to the literature of the art.

DESPITE the bitter opposition of the Marconi Company, it seems to be at last decided beyond peradventure that the British government is to ratify the radio-telegraphic convention of the Berlin Wireless Conference. A last stand was made in the House of Commons on July 30th, when Sir E. Sassoon rose to move the adjournment of the House in order to call attention to a definite matter of urgent public importance—the report of the select committee on the radio-telegraphic convention, and the declared intention of his majesty's government to proceed to ratification without affording the House an opportunity of discussing the subject. A discussion of an hour and a half ensued. Sir E. Sassoon opposed the ratification of the convention, and so did Mr. Gwynn of Galway, who said that the Irish people were exceedingly proud of the fact that Mr. Marconi is half Irish and grateful because the operations of the Marconi Company are doing something for Connemara. The West of Ireland should play an important part as a "jumping-off" station for wireless telegraphy, but Mr. Gwynn declared that the Irish people saw their part in the industry endangered by the precipitate action of the government. Among other things this speaker said that to his mind the strongest objection to the convention was the stereotyping of wave lengths. Both speakers were strong partisans of the Marconi Company.

But Mr. Haldane of the War Office, who spoke for the government, was unmoved. He said the question was whether the government had done right in entering into an international convention whereby each nation should put into its licenses a clause compelling those who obtained those licenses to accept messages from other systems. Surely it was more in the interests of humanity, to go no further, that there should be the utmost freedom of intercommunication than that there should be the restrictive system which existed at the present time. The convention was confined to communication between shore and ship, not between ship and ship, or between land station and land station; that communication was untouched. The government had thought the matter out carefully and had entered into a convention which they believed to be a good one, and unless the House carried the motion they proposed to proceed forthwith to ratify it. The motion for the adjournment of the House was then negatived.

Thus ends the prolonged fight to prevent the ratification of the wireless convention by Great Britain. It is probable that the other countries will ratify the undertaking (if they have not already done so) with little delay.

Electrical Stimulation of Plant Growth.

[From the London correspondent of the Western Electrician.]

Considerable interest has been aroused by the fact becoming common knowledge that the Botanical Society has afforded a Mr. Thwaite facilities for conducting some experiments in stimulating plant growth by electrical methods, and many a fantastic article has appeared in the daily papers in which imagination is given full vent. The Botanical Society has placed a glass house at the disposal of the experimenter, whose equipment when completed will include a suction gas producer in conjunction with an Otto-Lenoir-cycle gas engine working a dynamo. This latter supplies the necessary energy for the arc lamps, which are an integral portion of the equipment.

The aim, of course, is a near imitation of natural forces, and Mr. Thwaite lays down the following essentials: (1) An ample supply of violet in chemically active rays from powerful arc lights; (2) a supply of electric current for atmospheric and root electrification; (3) an atmosphere containing moisture and CO_2 in the proportion common to the most fertile countries at about 70° or 80° F.; (4) an ideal fertilizing agent; (5) an ample supply of water for the roots.

These conditions it is Mr. Thwaite's intention to try to bring about artificially. The scheme of the experimental plant includes the conversion of the fuel before combustion into a gaseous condition and the separation of any nitrogenous matter before transformation. The water-jacketed cylinder of the gas engine is made use of to heat the glass house, the circulating pipes being carried through the glass house. The exhaust gases after purification are led through earthenware pipes which have outlets which insure uniform distribution under the plants. An electrostatic machine, also driven by the gas engine, discharges electricity into the air, while finally very slowly traveling arc lights, whose rays are concentrated into glass water troughs, shed their strong beams of light upon the growing plants.

The experimenter admits that the economical question has still to be decided, but with the results obtained by Sir William Siemens to encourage him he is not without hope. The Botanical Society is to be congratulated upon giving facilities for these experiments. G.

Chicago Railways Company Acquires North and West Side Lines.

Judge Grosscup has entered an order by which the receivers of the Chicago Union Traction properties are directed to make a lease of these properties to the Chicago Railways Company. Possession of the North and West Side lines is to be given to the new company at once. The lease is to be for 20 years—the life of the ordinance—or until such time as it may happen the properties be sold and the ownership pass to the purchaser, which may be the Chicago Railways Company or some other corporation. The receivers will be continued in office, but they will have no control over the management of the lines. Authority is given the tenant, the Chicago Railways Company, to collect all fares and rents and other income of the properties; also to act with the same power the receivers have exercised. On the Chicago Railways Company is imposed the duty to make all improvements demanded by the city ordinance and to carry out to the letter the plan of rehabilitation of the lines therein provided for. The Chicago Railways Company is given authority to issue bonds for the purpose of this rehabilitation. These bonds are to be a first mortgage on the properties, occupying in law a similar position to receiver's certificates issued for the purpose of maintaining and improving the property in the court's care. No more of these bonds shall be issued than are certified by the board of supervising engineers as necessary to do the work, but whatever money the engineers demand shall be provided.

This order would seem to remove the last obstacle to the rehabilitation of the entire street-railway system of Chicago under the direction of the Board of Supervising Engineers.

Preparation of Copper-magnesium Alloy.

It is said to be possible to obtain sound copper castings of high electrical conductivity by adding an ounce of stick magnesium to each 50 pounds of copper. A mixture in these proportions can be most easily made by first preparing an amalgam of magnesium and copper in the following manner: Melt 45 pounds of pure copper under a good layer of charcoal, and when at a good red heat add five pounds of pure stick magnesium, and stir well with a plumbago rod. The magnesium must be forced under the surface of the melted copper, or it will float on the surface and burn. Pour the amalgam out into small strip ingots, which are easily cut. To add two ounces of magnesium to 100 pounds of copper, melt the copper and add 20 ounces of the amalgam.

Widespread Strike of Telegraph Operators.

After the recent San Francisco strike of telegraph operators had apparently been settled and the operators had returned to their keys under a thirty day agreement pending the arbitration of their differences, trouble broke out in the Los Angeles office of the Western Union Telegraph Company and a great strike has spread over the country, tying up business and press messages and threatening to interfere with railroad orders.

At 5:30 p. m. Wednesday, August 7th, the operating force of the Los Angeles office walked out following the refusal of the company officials to reinstate a discharged union telegrapher who, it was asserted, had retorted to the remark over the wire of a non-union operator at Oakland. Dramatically on the stroke of 12 midnight, August 8th, the night force of the Western Union's Chicago office left their keys when they saw that the company required them to handle business from Los Angeles, where non-union men were working. None of the 785 of the day force reported for work the following day, Friday. That evening at 6 o'clock the 400 operators of the Postal Company, whose Chicago office is almost across the street from that of the Western Union, joined their striking brethren, cutting off all commercial telegraphic communication with Chicago except for the press and leased wires. The widespread results of this condition become apparent when it is remembered that Chicago is the relaying point for the whole country. Only a few messages following through wires could be transmitted across the country.

Meanwhile the strike fever had spread to a dozen cities, where attempts were made to get operators to work with strike-bound points. In Kansas City, Cincinnati, Dallas, Denver, Salt Lake City and Detroit, Western Union operators vented their grievances in abandoning their instruments.

On Sunday the newspapers reported that 30 cities with 3,000 operators outside of Chicago were involved in the general strike which seemed to be spreading over the entire country. While Commissioner of Labor Neill, the federal representative who was successful in quelling the movement of two weeks ago, was hurrying to Chicago to confer with President Small of the telegraphers and others, New York and Boston operators voted to postpone strike action until the result of the meeting was learned.

It was learned that the local unions' actions were without the authority of the national organization, but President Small undertook to explain the cause of the trouble in a message to Commissioner Neill in part as follows:

"Cause of present trouble is repudiation of San Francisco agreement which settled strike. Local Manager O'Brien, Chief Operator Jeffs and Superintendent May have repeatedly discriminated against strikers. Women telegraphers after returning to work were humiliated to such an extent they resigned. Western Union reinstated less than 100 strikers; many are still out of employment, including married men."

In answering Commissioner Neill's question as to the demand for which the strike occurred and upon what terms he would take the responsibility of ordering the "locals" back, Mr. Small wired that he could guarantee immediate resumption of work if the government would insist upon investigation or arbitration of propositions embodied in the memorial address to the board of directors of the Western Union last June.

On Monday, August 12th, the strike spread to New York, Boston, Philadelphia and other eastern cities, and telegraph service of both companies throughout the entire country was badly crippled. In the evening the Associated Press operators in Chicago and many other cities joined the strike.

Value of Tantalum and Other Plates for Electrolytic Rectifiers and Condensers.

The advantage of tantalum for electrolytic rectifiers and condensers, over aluminum which has been the subject of considerable experimenting in connection with its high anode resistance in certain electrolytes, is vouched for by G. Schulze in the Annalen der Physik. According to the results of his researches there is no electrolyte in which tantalum fails to show the valve effect, and the non-conducting anode coating is capable of resisting much higher voltages than those by which the aluminum anode skin is pierced. Thus the coating in a solution of sodium carbonate is capable of withstanding 650 volts, and in various fluorides 600 volts. It is best to have the tantalum electrode entirely immersed, as otherwise sparks may pass from the surface of the liquid to the emergent portion. Such sparks show the tantalum spectrum, whereas sparks through the liquid show nothing but the spectrum of the electrolyte. The anode skin is easily formed in the course of a few minutes, and is not much affected by heat. Herein it has a great advantage over aluminum. But this is to some extent balanced by the instability of the skin on tantalum electrodes, which is greatly reduced in efficiency in the course of a few minutes' break of the current. Niobium and vanadium also show a valve effect in all electrolytes, though it does not approach 1,000 volts, as in tantalum. Other metals, like copper in copper sulphate, show a slight action of this kind, but it is not of any practical utility.

Turkey's Telegraph System.

The telegraph was established in Turkey during the Crimean war. The first line began working between Constantinople and Adrianople in August, 1855, and was joined to the Austrian line by way of Roustchouk. During the years which followed the telegraph was established over all the empire, and at present comprises 22,000 miles of wires. It plays an important part in Turkey, and the work is relatively satisfactory.

The rate was, until 1884, 40 cents for 20 words within the boundaries of one vilayet, and from 60 cents to $2.80 for 20 words between two vilayets, according to the distance. In 1884 this system was modified, the rate becoming two cents a word, with a surplus of six cents in the interior of a vilayet and 20 cents a word between two vilayets. An additional rate of two cents was placed on the use of the cables of the Eastern Telegraph Company. This tariff was reduced in 1897 to two cents a word within the limits of a vilayet and four cents a word between two vilayets. In 1903 the present rate was introduced, which is as follows: Two cents a word within the limits of one vilayet or between two adjacent vilayets and double this amount between two separate vilayets.

The Great Eastern Company has cables only north of Smyrna. Its central offices are in the Island of Syra. Certain islands, such as Chios, Tenedos, etc., can be reached by telegram only through this company.

As a natural result of the extension of railways right into the heart of the country, large trading centers will soon be established, necessitating the increased use of the telegraph. Consul E. H. Harris at Smyrna says that this is an opportunity which American manufacturers interested in this line of business should not miss. As all telegraph lines, with the exception of the Eastern Telegraph Company and the private railway wires, are government property, manufacturers desirous of doing business should apply direct to the Department of Posts and Telegraphs at Constantinople.

One of Edison's Ideas Realized.

Apropos of the recent opening of the new power plant of the Amherst Railway and Power Company, at the Chignecto coal mines in Nova Scotia, it is pointed out that the new system carries out a suggestion made by Thomas A. Edison. This was that instead of building a power plant where the power was required, and carrying coal there by railway, it would be more sensible to build the plant at the mouth of the mines and transmit the power by wire. The maritime company is said to be the first to carry out this idea on this continent.

Mr. Edison sent the Board of Trade at Amherst the following message: "Permit me to congratulate your board and Senator Mitchell on the inauguration of the first plant on the American continent for the generation of electricity at the mouth of a coal mine, and the distribution of the same to distant commercial centers. It is a bold attempt, and I never thought it would be first accomplished in Nova Scotia, where my father was born over 100 years ago."

A Curious Situation in New Brunswick.

A Canadian correspondent of the Western Electrician says that recently the town of Woodstock, New Brunswick had to take to candles and oil lamps once more, and such crude lighting will be in order for some weeks. This is the outcome of a series of fires due to live wires. The secretary of the New Brunswick insurance underwriters notified the electric-light company that if its plant did not cease operating at once, all the fire insurance in the town would be canceled. The lighting company accordingly shut down the entire electric-light system until a rewiring of the town could be completed.

Duluth's Proposed Ordinance.

A new electrical ordinance is being drawn at Duluth, which is said to contain features which are uncommon. It is the work of Inspector Jennings, who is a practical electrician, and provides that both electric-light and telephone companies shall use the same side of the street. They are permitted to have but two cross-arms with a five-foot space. When the wires are too numerous for this arrangement the inspector holds that cables should be put in. The ordinance also provides conditions designed to make it safe for high and low-voltage power wires to be strung on the same set of poles.

Electric Lighting in Germany.[1]

By Prof. Dr. Phil. G. Klingenberg.

The introduction and development of various means of lighting in recent years have been accompanied by critical comparisons between different sources of light, but none have been subjected to more careful tests than electric and gas lights, and it is due to the keen competition between these two systems that each has been brought to the state of perfection in which it is seen today.

It is a fully recognized fact that for units of light giving below about 100 candlepower the electric light produced with steam under normal conditions comes out more expensive than gas lighting, at any rate when comparing the cost per candlepower-hour. However, one cannot maintain that this comparison is correct, and the only one of importance, in view of the present enormous development of electric lighting with small units.

In spite of all improvements that have been made in gas lighting, it has been impossible to obtain for it the peculiarities for which electric lighting is characteristic, and which are commonly known to be the following: Easy control of lights from a distance, agreeable shade, great adaptability, its coolness, the absence of gases caused by combustion, the beautiful and varying effects, the possibility of splitting the light into small units, the better light obtained by fixing lamps at an angle and the possibility of using the current in a lighting installation for other purposes (heating, motors, ventilators, etc.).

Advantages of this kind cannot be expressed in figures; they are, however, in many cases of such importance that the electric system of lighting is adopted in preference to any other, in spite of the higher cost per candlepower-hour.

Tariffs.

Owing to the above peculiarities of electric lighting it is very often regarded as a luxury, with the result that electric lights are used as little as possible, in order to keep the lighting bill low. Economy in this direction is easily obtained, because it is so very convenient to switch the electric current on and off again. The effect this has on the central-station plant is, however, less desirable, since the total capacity installed is annually used for a comparatively short period. A better station load would have been obtained under these conditions if more long-period consumers had been tempted to buy current at more favorable terms than those offered in the uniform rate of charges. The natural consequence of the low consumption in comparison to the capacity of the plant was a high price for current which formed a hindrance to the introduction of electric lighting.

It has become usual to divide the annual cost for the generation of current into constant expenses and variable expenses. On this basis the constant expenses with modern steam-driven central stations of an average size are between 80 and 130 marks per kilowatt. The variable expenses are between 2.5 and 5 pfennigs per kilowatt-hour. [A mark is equal to 24 cents; a pfennig to one-quarter of a cent.] The figures will, of course, vary according to local conditions. Assuming an average of 100 marks and four pfennigs, respectively, we get the following generating costs for the current in relation to time:

Hours.	Pfennigs.	Hours.	Pfennigs.
200	54	2,000	9
500	24	3,000	7.3
1,000	14		

It is evident from the above figures that the extra cost per kilowatt-hour incurred through an increase in consumption, the capacity of the plant remaining the same, is very slight indeed. This, however, is quite contradictory to the tendency for consumers to reduce their expenses for lighting by burning lamps as little as possible, because, as far as the generating station is concerned, the extra hours of consumption make very little difference to generating expenses.

If electricity works had come in before gas works, they would no doubt have had the advantage of supplying current for lighting installations which are used for long periods, as, for instance, street lighting, etc. The result would have been low tariffs and probably a very large development of the supply to installations burning small units of light. It would then have been exceedingly difficult for gas lighting to compete successfully against electric lighting.

In consideration of the above contradictory circumstances, central stations have charged special rates to long-period consumers by introducing tariffs with a certain fixed rate of charges, calculated on the maximum current consumed and an additional price per kilowatt-hour shown on the meter. Tariffs of this kind are largely used at the present moment, and they fairly well correspond to the actual generating costs. General introduction is, however, impossible, owing to the large divergency in the use of current and the difficulty of bringing the influence of various classes of consumers to bear satisfactorily on the maximum capacity of the central station. Installations in private houses, for instance, always require a high local maximum, although the effect on the central station is comparatively small, because local peaks do not overlap. To charge a consumer the same fixed rate for a lamp which does not burn often as for another lamp which is lighted irregularly is no doubt a hindrance of electric lighting.

A double tariff, as extensively applied in Germany, overcomes this difficulty. The principle on which the tariff is based is to charge the normal price for the current during the time of greatest consumption, but at other times to charge a very much lower price.

One of the advantages of a tariff of this kind is that a power load and a light load will not overlap to the same extent as is the case with the single tariff or the maximum tariff.

We will now consider the influence of pressure on electric lighting. The cost of a continuous-current network is known to form a considerable item in the total capital outlay. For the last 10 years preference has been given to a circuit pressure of 2 × 220 volts in Europe, contrary to American practice. The consideration which led to the introduction of this pressure is that a loss of 10 to 12 per cent. in the economy of high-tension carbon-filament lamps is more than balanced by a saving in interest and depreciation in the network. In other words, one could supply current to consumers at lower prices in compensation for lamps with a lower efficiency.

The experience gained with the length of life of 220-volt lamps is favorable. This is partly due to smaller fluctuations in pressure in 220-volt circuits than in those for 110 volts. A reasonable tariff and low initial expenditure with the accompanying low rates of charges, led to a general introduction of electric lighting with glow lamps and helped to overcome the keen competition of gas lighting.

This is a remarkable fact, especially in Germany, where the average consumer very carefully calculates his expenses for lighting. The price of the electric light is, however, still higher than the price for gas lights, and if certain improvements in the manufacture of glow lamps had not been made just in time, the development of gas lighting and the introduction of inverted gas burners, with the accompanying higher efficiency, representing an improvement of 30 per cent., might have seriously hampered the introduction of the carbon-filament lamp, although it would never have brought it to a complete standstill.

Incandescent Lamps.

The improvements referred to consist of the manufacture of lamps with a high efficiency, such as Nernst lamps and metal-filament lamps.

The Nernst lamp reduces the consumption per candlepower-hour to half the value for carbon lamps, and has the advantage of being very suitable for high pressure (220 volts), which led to an extensive use in three-wire installations with 2 × 220 volts. These lamps require a certain time for lighting up after being switched on, but this is a disadvantage which very often is of no consequence. The life of Nernst lamps is practically as long as that of carbon-filament lamps, at any rate as far as continuous-current circuits are concerned. The results in alternating-current circuits are not quite as favorable.

The metal-filament lamps mentioned above consume just about one-third of the current taken by ordinary lamps with carbon filaments. One of the first of these lamps brought out in recent years is Auer's osmium lamp, with a specific consumption of 1.5 watts per candlepower. This lamp can, however, be made only for about 55 volts. Another lamp of this kind is Siemens & Halske's tantal lamp, which will burn in 110-volt circuits and takes about 1.7 watts.

The most prominent and latest of all metal-filament lamps is the tungsten lamp. The filament made by one group of manufacturers is obtained by chemical reaction and not by compression. The inventors state that the manufacturing process, being a chemical one, enables them to obtain very fine filaments with the diameter of 0.04 millimeter, which is impossible with the process involving the application of pressure. Standard lamps will give 30 to 40 candlepower at 110 volts; the consumption is about 1.1 watts per candlepower and is reduced to about one watt after 50 hours' burning. These figures have been verified in official tests.

Another group of manufacturers applies pressure for producing a tungsten filament, but the results are very nearly the same, the pressure being 105 or 110 volts, with a consumption of about one watt per candlepower.

Very interesting comparative tests were made by Uppenborn in Munich. He used four new lamps of different type, but all made for 110 volts. A preliminary test gave the following results:

Filament in Lamps Tested	Current.	Consumption.	Power of Light.	Specific Consumption.
	Amps.	Watts.	C. P.	W. P. C.
Carbon	0.536	58.9	16.7	3.53
Tantal	0.400	44.0	27.3	1.61
Osmium	1.012	111.33	63.4	1.76
Tungsten	0.520	57.2	57.0	1.00

One of the latest metal-filament lamps is the osram lamp, which is at present made for 110 volts. Careful tests made in the physical laboratory of the government in Charlottenburg show an average length of burning of more than 1,000 hours. Thirty-two lamps were tested in all, and only one lamp consumed as much as 1.22 watts after 1,000 hours; all the others remained much below this figure. The initial consumption varied from 1.08 to 1.14 watts.

It is a general characteristic of metal-filament lamps when compared with lamps with carbon filaments that the power of light sinks by five to eight per cent. after 200 to 300 hours and rises again afterward until it reaches the initial power, after about 1,000 hours. The current remains fairly constant the whole time; i. e., the watt consumption per candlepower sinks at first and then rises again gradually. The light of carbon-filament lamps, on the other hand, is reduced 20 per cent. after about 200 to 1,000 hours.

The superiority of metal filaments is further illustrated by the behavior of lamps under variable pressure. With a 20 per cent. increase in pressure above the normal, carbon filaments frequently give three times the normal light, whereas a metal-filament lamp will not give this light at a pressure equal to 35 to 40 per cent. above the normal. From this it is evident how very much more insensible to fluctuations in pressure these lamps are than those with carbon filaments.

In circuits supplying the old type of carbon lamp it was necessary to limit the drop between the constant-voltage feeding point and the point of consumption to two per cent. In calculating lighting circuits one can now allow for a greater drop in pressure than before, owing to the more favorable behavior of metal-filament lamps.

Since the development of metal-filament lamps it has been prophesied that the supply of current from central stations would become less, owing to the fact that just one-third of the energy now consumed will be required for producing the same amount of light. It is the author's opinion that the general introduction of metal-filament lamps will have just the opposite effect.

It should be remembered that as a rule consumers like to burn a certain number of lamps, and are not so much guided by the amount of light they obtain. Every 16-candlepower lamp in their installations will therefore be replaced by a 25-candlepower lamp, since there is no metal-filament lamp yet for a smaller candlepower at 110 volts. Even then the saving in the consumer's light bill will be considerable. In many cases, in restaurants, for instance, the lights which have to burn constantly are not electric but gas or some other kind of light, electricity only being used for table and other lights which are easily switched on and off again according to requirements.

Now that electric lamps with a higher economy are available, it will be worth while for a consumer to change over all these long-burning gas lights to electricity. The decrease in consumption, owing to less energy per candlepower-hour, will be made up by a higher candlepower and longer burning. Central stations will, however, benefit most by the large number of new consumers which have been keeping back up to now, owing to the high cost of electric lighting.

The full advantage offered by metal-filament lamps will not be experienced until the price of the lamps themselves is reduced from three marks to one mark. It is not at all unlikely that lamps will be sold at the lower figure at an early date, because, as far as the cost of manufacture is concerned, there is no very great difference between metal-filament and carbon-filament lamps.

Circuit Pressure.

The fact that metal-filament lamps can at present only be made for 110 volts has given rise to a lively expression of opinions in Germany as to the desirability or otherwise of keeping to the present standard three-wire system with a 2 × 220 volts or of changing over to 2 × 110 volts. The replies to a circular inquiry addressed to the managers of central stations show that a large proportion of central-station engineers are in favor of a pressure of 110 volts. In coming to this decision due consideration was, of course, given to the advantages of 110 volts for lighting with arc lamps.

It is the author's opinion that the question of pressure is largely dependent on another question, viz., whether it will soon be possible to obtain useful metal-filament lamp of small power and for 220 volts. The inquiries made by the author in this direction are all in the affirmative.

An important opinion was expressed by the Deutsche Gasglühlicht Aktiengesellschaft, the manufacturers of the so-called osram lamp. The following is a translation of what the firm had to say:

"With reference to your inquiry relating to 220-volt lamps, we beg to say that past experience confirms our opinion that it will not be possible to make 220-volt lamps on a large scale until the process of manufacture of 110-volt lamps has reached a very high state of perfection, and the price for the lamps themselves has come down in consequence. It is quite evident that lamps for 220 volts must have very long filaments, the natural result will be a very high percentage of break-

1. A paper prepared for the Washington convention (June 4-7, 1907) of the National Electric Light Association. The author is director of the well-known Allgemeine Electric Company of Berlin.

ages during manufacture, in transit and in practical use.

"It also stands to reason that lamps for 220 volts must give twice as much light as lamps for 110 volts. It will, therefore, be very difficult to make the lamp which is wanted, viz., one for 32 candlepower.

"A further consideration, which corresponds exactly to the conditions experienced with carbon-filament lamps, is that 220-volt lamps will not be efficient as 110-volt lamps. The present carbon lamp for 220 volts consumes 15 to 20 per cent. more current than a 110-volt lamp of equal life. Similar conditions will no doubt prevail with the osram lamp, so that this fact will add to the difficulties encountered during manufacture, because a lamp for a certain voltage and a higher consumption in watts per candlepower than another must have a higher filament. We do not think we are misled in believing that the superiority of the osram lamp for 110 volts as now supplied is a sufficient inducement to engineers in central stations to return to the lower pressure again wherever it is possible.

"On careful consideration it is our opinion that the introduction of 220 volts during the time when no other but carbon-filament lamps existed, was a mistake, at any rate as far as lighting circuits are concerned, because the cost of electric lighting was increased, since 220-volt lamps are known to consume 15 to 20 per cent. more current. We will not discuss the question whether central stations suffered a loss by having prevented a large number of consumers from taking in electric light, owing to higher cost of current or whether the saving in mains, due to a pressure of 220 volts, was sufficient to compensate any other deficiency. We have, however, noticed that many engineers consider it absolutely necessary to return to 110 volts wherever possible, and to stop carrying out new installations for 220 volts."

It is evident from the above that eventually we shall get a 220-volt osram lamp, but that it will not show the same favorable results as the low-tension lamp.

The author has also been in communication with other engineers who have confirmed the possibility of making a 32-candlepower lamp for 220 volts, with a consumption of 1.1 to 1.2 watts. As soon as the difficulties in the manufacture of 32-candlepower lamps for 220 volts have been overcome, it must, of course, also be possible to supply 16-candlepower lamps for 110 volts. The conditions can therefore now be summarized as follows:

Points in Favor of a Pressure of 110 Volts.—

1. Smaller units of light can be installed.
2. The efficiency of lamps is higher (experience will have to show to what extent).
3. Half the number of arc lamps in 220-volt circuits will burn in a series.

Points in Favor of a Pressure of 220 Volts.—

1. The capital expenditure for circuits is very much lower. Assuming capacity, distance and losses all to be the same, the section of copper is a quarter of that for 110 volts. Assuming equal drop and the same section of wires, one can cover twice the distance, or four times the area.
2. The result of the advantages described in Point 1 is that one can supply current economically to areas with few consumers.
3. Installations cost less.

The Distribution Favored.—

Assuming the conditions for metal-filament lamps to be similar to those for carbon lamps, the calculations for the writer prove that the possible reduction in generating and distribution expenses is greater than the loss in lamp efficiency. The writer's opinion is, therefore, that new schemes should be based on a supply of 2 × 220 volts as before, in spite of the contrary opinion expressed above.

In three-phase installations the four-wire system has gradually found more and more favor in preference to the three-wire system. It has important advantages, so that higher pressure is of less consequence. The author therefore recommends 3 × 120-volt star connections for three-phase installations, especially because there is then no difficulty in making an alteration in new areas, if necessary.

Arc Lamps.

The revolution in lighting with small units which will accompany the general introduction of metal-filament lamps is sure also to affect the use of more powerful lamps.

For certain purposes for which arc lamps of a particular type have recently gained importance, metal-filament lamps are now entering into competition. In recent years a series of designs of arc lamp for small currents was brought out. The Allgemeine company was the first to supply an arc lamp of this kind; it was called the "Rignon" lamp, after its inventor. Other firms followed suit, giving their lamps names referring to their size, such as Lilliput, Mignon, Baby lamp, etc. Most of these lamps were intended for a current of two amperes, but they required a working pressure of about 110 volts per lamp.

The first lamps were made for continuous current, those for alternating current being made at a later date. The principle embodied in all designs was a limited access of air, which produced a higher efficiency and a steadier arc, although the length of burning was not equal to that of the original long burning lamp. Most of the new small arc lamps will burn from 12 to 20 hours. They found favor very quickly, and were extensively used for lighting in private houses and workshops, in shop windows, for lighting in railway stations and even for street lighting in small towns.

Let us consider the economy of these lamps. A continuous-current arc lamp in a 110-volt circuit consumes two amperes, and gives a light of about 200 candlepower, thus requiring 1.1 watts per candlepower. A lamp for two amperes is therefore not sufficiently economical; even a 3.5-ampere lamp will give an average hemispherical light of only 100 to 120 candlepower; the specific consumption is therefore three to four watts per candlepower. It is evident from the above that the small continuous-current arc lamp is not so economical as the metal-filament lamp, and that the alternating-current lamp is worse still.

It should be borne in mind that metal-filament lamps can easily be made for units of 100 candlepower, so that they are well able to satisfy the same requirements as to power of light as the smallest arc lamps. On the other hand, the latter require to be trimmed; they burn carbons and have a sensitive mechanism, a weak point with all these designs. In view of these facts, it is not difficult to foresee that progress in the manufacture of metal-filament lamps will cause these small arc lamps to vanish altogether.

Arc lamps for 500 candlepower are now considered to be the smallest lamps that it is worth while to make. They are represented by the four-ampere lamps now being manufactured, which has a high economy and will burn on continuous-current circuits. Any source of light of less power than 500 candlepower will be a metal-filament lamp.

It is an experience of the lighting industry that consumers seldom make use of a pecuniary benefit offered when a certain source of light has to give way to a better and more economical one, and the ultimate result is always the use of more light for the same money, due to improvements in lighting. At present there seems to be no limit in this direction. The metal-filament lamp has no doubt created a demand for a better light for indoor lighting, and the eye will soon be accustomed to the improved light indoors and will want equal improvements in streets and open places.

The arc-lamp industry is already prepared to meet the future demand for more light out-of-doors. Constant improvements in the design of flame-arc lamps have now produced lamps which leave nothing to be desired in this direction. The smallest type of these lamps consumes six amperes and gives a light of 1,500 candlepower. The 20-ampere lamps will give up to 5,000 candlepower. An equal power of light from a single arc lamp was quite unknown up to quite recently, and the 10-ampere differential lamp for 100 candlepower was considered quite sufficient for public lighting in large towns.

Units of light giving 5,000 candlepower are by no means beyond practical requirements in roads and places in large towns where traffic is congested, as is proved by the lighting of the Potsdamer Platz in Berlin with eight flame-arc lamps, each for 20 amperes, giving a total of 40,000 candlepower. The lamps are mounted on two high posts so that the burning point is fixed at a height of 18 meters above the level of the road. By this means the source of light itself is not disagreeable to the eye, and the lighting of the square is as uniform as possible.

In America there has always been a great tendency to suspend powerful sources of light in towns at a very great height, in order to obtain the above-mentioned advantages. It is, however, not possible to develop this system completely without having a source of light similar to the flame-arc lamp for 20 amperes, which is now being manufactured.

Another great advantage accompanies the introduction of the flame-arc lamps, and that is the fact of their suitability for alternating current as well as for continuous current. The ordinary alternating-current lamp for 15 amperes will not give a light of very much more than 500 candlepower, and it is not feasible to increase the power of the light by raising the current, on account of the size of wires. This was therefore the limit of lighting with powerful units in alternating-current circuits. Flame arc lamps for alternating current are in every respect equal to those for continuous current, so that single units for 4,000 candlepower can easily be manufactured for both cases.

The consumption of the alternating-current flame arc lamp is not higher than that for continuous current when taking the power factor of the arc into consideration. The progress made in this direction is of decisive importance for future lighting with arc lamps, because alternating current is being used more and more for feeding circuits covering extensive areas.

Certain points in connection with flame arcs at first hindered their introduction; for instance, it only seemed possible to obtain a yellow light, which did not suit the public taste, especially in Germany. Conditions were more favorable in England and America, because there the public had become more accustomed to an unusual color of arc lamps, owing to the extensive use of long-burning lamps of a violet hue. It is, however, now possible to make highly efficient carbons, giving a very agreeable light, which is almost white in color. The steadiness of the arc in flame lamps is not as perfect as it is in differential lamps burning carbons which are not saturated. It is impossible to prevent the arc from flaring up now and then, owing to slight irregularities in the composition of carbons. One has, however, become accustomed to this deficiency in street lamps. A comparison of flame arc lamps with long-burning lamps as used in America for street lighting is in favor of the former type, the arc being very much steadier than in the American lamps, which burn very thick carbons, allowing the arc to wander continually.

The cost of the newer carbons is higher than that of ordinary carbons. To a certain extent this is due to a metal core, which is necessary on account of the high resistance of the carbons, due to their great length. The expenses for trimming lamps, etc., are also higher than similar expenses for other types of lamps, because the mechanism is more complicated, and carbons for flame arcs leave ashes and other deposits, which require to be removed very carefully.

According to the experience made by a large central station in Germany using lamps which burn 16 hours at a time, the costs for every hour of burning are divided as follows:

Trimmers and supervision, about	2 pfg.
Carbons, about	4 to 5 pfg.
Maintenance, repairs, spare globes, etc.	3 pfg.

These figures are comparatively high, and may not always be fully covered by the saving in current. The superiority of flame arc lamps will, however, still remain unquestioned, since there is no other type of lamp which will give more than 1,000 candlepower.

Conclusion.

A new source of light which is gradually gaining ground in Europe and is competing with other sources of light is the mercury-vapor lamp. It is primarily suited for indoor lighting and is used in engine rooms, boiler houses and workshops. An attractive effect is obtained in shop windows and for lighting advertisements. The Berlin Electricity Works have already installed about 60 of these lamps in their boiler houses and engine rooms. The peculiar color of the mercury light is at present a hindrance to its use, but custom and improvements will no doubt overcome this defect in time.

When comparing the power of light, mercury lamps will be found to range between incandescent lamps (metal filament) and arc lamps. Mercury lamps will always retain a certain sphere of usefulness of their own, owing to the peculiar shade of their light.

Progress of Gas Lighting.

In giving a general aspect of electric lighting in Germany, it is impossible to overlook the progress made in gas lighting in recent years. The so-called Lukas light, an improvement of Auer light, was followed by powerful lamps burning compressed gas, such as the Millennium light and others. As yet, however, no type of gas lamp has given results approaching those obtained with ordinary arc lamps, and no single gas lamp will give a power of light equal to that of a single flame arc lamp.

The claim for the superiority of electric street lighting is fully substantiated by test results obtained in Berlin streets by Dr. Bloch. His careful measurements show a consumption of about 18 watts per lux and per 100 square meter with ordinary arc lighting, as against about 50 liters of gas per hour for the same effect produced with Millennium light.

Although improvements in gas lighting have not been able to question the superiority of arc lamps, they have certainly created a state of keen competition which electrical engineers are bound to meet by similar progress if they do not wish to lose ground.

I have to thank Dr. Norden for the assistance he has given me in compiling these notes.

A Compliment for Purdue.

Prof. C. Russ Richards, dean of the school of mechanical engineering of the University of Nebraska, has just concluded a thorough inspection of Purdue University, his visit to Lafayette, Ind., completing a tour of visits to 16 of the leading technical schools of the country. Professor Richards' inspection trip came as a result of the Legislature of Nebraska appropriating $100,000 with which to erect a new building for the mechanical school of that state. Professor Richards paid a high compliment to Indiana, and particularly to Purdue University, when he pronounced that institution the best housed and the best equipped, all things considered, of all the colleges he visited. Professor Richards said that some of the eastern universities had in certain respects a more expensive equipment, but that none had a more complete or more practical engineering school than that of Purdue. Nebraska's new buildings will no doubt be patterned after Purdue's plans, he said.

ELEMENTS OF ELECTRICAL ENGINEERING.

By Geo. R. Metcalfe.

XXIX.—Electric Lighting.

Arc Lamps.

Nearly all arc lamps use carbon rods with their ends slightly separated so as to form an arc between them when current is passing through the rods. In the direct-current arc lamp one carbon is attached to the positive lead and the other carbon to the negative lead. When current is turned on to the lamp the two carbons which were previously in contact are slightly separated and an arc is drawn between them. The mechanism of the lamps is such that the carbons can only separate by a small predetermined distance, and the current maintains the arc constantly across this distance, and therefore the circuit is not broken when the carbons separate.

The light from the arc lamp is produced by the incandescence of the carbon rods at their arcing tips together with the light of the arc itself. In the direct-current arc lamp the upper carbon, as shown in the accompanying illustration, is assumed to be positive and the lower carbon negative. Examination of the tips of these carbons will show the upper carbon at the arcing point to be hollowed out somewhat in the center, and this hollow spot is known as the crater of the arc. The greater part of the light is given off from this crater, which has a temperature of over 3,000° C. The tip of the negative carbon instead of being hollowed out forms a dull point which does not give out nearly as much light as the crater. The arc proper furnishes about five per cent. of the total light of the lamp and consists of a small band of bright violet light surrounded by a zone of yellow light.

In alternating-current lamps there is no positive or negative carbon, as each of the carbons becomes alternately positive and negative. In this case no crater is formed and both of the carbons give off the same amount of light.

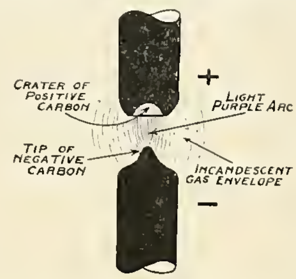
In the direct-current arc lamp the positive carbon burns away about twice as fast as the negative, while in the alternating-current lamp both carbons are burned away at about the same rate. Owing to the burning away of the two carbons the lamp mechanism must be provided with means for feeding the carbons together at the same rate at which they burn away, so that the distance between the points, and consequently the length of the arc, remains practically constant. The complete mechanism must therefore provide for the carbons being in contact when the current is first thrown on the lamp; for the separation of the carbon points to the proper distance for maintaining an arc as soon as the current flows; for feeding the carbons together at the same rate at which they are consumed, and for short-circuiting or open-circuiting the lamp when the carbons are entirely consumed, depending upon whether the distribution is in series or multiple.

The earliest arc lamps were always burned in series and were open arcs; that is to say, the arcs burned exposed to the atmosphere. Under these conditions the carbons were consumed in a few hours, and in street-lighting systems it was necessary to have the trimmers put new carbons in the lamps about midnight where all-night lighting was desired. In order to obviate trimming the lamps twice for each night's run, a lamp with two carbons was invented and came very largely into use. In this lamp one pair of carbons burned until it was consumed, after which the current was automatically cut off from the first pair of carbons and the second pair came into operation, thus completing the night's run without retrimming.

The next notable improvement in the arc lamp was the invention of the enclosed arc, by means of which the life of the carbons was increased from six to eight hours to between 80 and 125 hours. This reduced the labor and expense of trimming by a very large amount, as instead of having to trim lamps once a day it became necessary to trim them only once every week or 10 days.

The economy and convenience of enclosed arcs are so apparent that the open arcs have nearly gone out of use, and almost all arc lamps are now built with enclosed arcs. These lamps are sometimes referred to as double-globe lamps when used for exterior lighting from the fact that two globes are used on these lamps—one, the outer globe, and the other a small inner globe, which encloses the carbons closely. The open arc lamps require about 40 volts across the carbon terminals to maintain the arc. In the enclosed arcs a longer arc is used, and about double the voltage is required to maintain the arc.

When the enclosed arc is first started the inner globe contains air at atmospheric pressure. The intense heat of the arc expands this air within the globe and a check valve on top of the globe permits the heated air to escape, but prevents any fresh air from reaching the arc. The oxygen in the inner globe, being rapidly consumed, permits the arc to burn thereafter in a rarefied atmosphere of inert



CARBON TIPS IN DIRECT-CURRENT ARC LAMP.

gas, which may be described as a partial vacuum, and this prevents the rapid consumption of the carbons and consequently greatly prolongs their life.

Arc lamps are now manufactured in a great variety of types, so that they can be operated on all kinds of circuits. They are made for operating in series, in multiple, and two or more in series on multiple circuits, and for both direct current and alternating current.

There is a large number of arc-lamp mechanisms on the market, practically all of which feed the carbon by means of solenoids acting against a spring or against gravity. The various mechanisms may be roughly classified as series, shunt and differential lamps.

In the series mechanism the carbons are held together when the current is first turned on the lamp, but a series coil separates the carbon when the current flows through it, and this causes the arc to be formed. In case the arc is too long the current is reduced on account of the higher resistance, and consequently the pull of the solenoid is weakened, permitting the carbons to come closer together. This style of mechanism is only adapted to constant-potential circuits.

The shunt mechanism has a solenoid which is connected across the gap of the carbon, the latter being held apart before the current is turned on. The current all passes through the shunt coil first and the plunger of the solenoid draws the carbons together so the arc is started. The solenoid works against springs which may be adjusted to maintain the arc at its proper length. These lamps require high voltage at starting and are therefore not well adapted for starting on series circuits.

The differential mechanism is a combination of the series and the shunt mechanisms. Before the lamp starts the carbons are held together, the series coil being arranged to separate them when the current is turned on, while the shunt coil, which is connected across the arc, prevents the carbons from being drawn too far apart.

In some lamps the feeding mechanism operates upon a rod which holds the carbon, and in other cases the feeding mechanism operates directly upon the carbon itself. With the rod-feed the current is fed to the rod through a sliding contact, and in the carbon-feed lamps the current is led to the carbon by means of a flexible wire and small carbon holder. With both of these types of feed a clutch grips either the rod or the carbon when the carbon is to be lifted and allows the carbon to slip through it when the tension is released. When the carbon-feed is used it is necessary to have carbons with smooth exteriors, and they must be perfectly straight and uniform in cross section.

As the open-arc lamp requires between 40 and 50 volts and the enclosed arc lamp from 70 to 80 volts it is necessary to insert sufficient resistance in series with the lamp when using it on a constant potential circuit so that the voltage across the arc will be maintained at its proper value. By making the resistances adjustable a lamp may be arranged to operate on circuits varying from 100 to 125 volts, or from 200 to 250 volts. If the lamps are arranged for series operation, two enclosed arcs, each requiring, say, 80 volts, can be connected in multiple across a 220-volt circuit, together with sufficient resistance in series to bring the voltage across the lamp terminals down to 80 volts.

Alternating-current arc lamps are quite similar to direct-current arc lamps in their general construction. All iron cores, however, must be laminated in order to avoid excessive eddy currents. A choke coil may be used in place of the resistance for cutting down the voltage of the circuit to that of the arc. Some lamps are also made interchangeable so as to operate on either direct or alternating current, or on constant potential circuits of either 110 or 220 volts, or two of these lamps may be operated in series on 220 volts.

The rating of arc lamps is generally given as 2,000 candlepower for 10-ampere lamps and 1,200 candlepower for 6½-ampere lamps. These ratings, however, are merely nominal, and in fact are nowhere near the true candlepower ratings. If the candlepower be taken from the direction of maximum intensity of the lamp the nominal 2,000-candlepower lamp would show actually about 1,200 candlepower, and the nominal 1,200-power lamp about 700 candlepower. If, again, the mean spherical or hemispherical candlepower of the lamp is taken the actual value of the candlepower readings would be still very much less.

The nominal candlepower of an arc lamp, therefore, gives but little indication of its value, and it has been more common to give a watt rating to indicate the power of the lamp, such as 480 watts for a "full arc," or 350 watts for a "half arc." (Very recently it is proposed to abandon the watt rating also for street lighting and use instead a comparison with an agreed standard of light. See Western Electrician of June 15, 1907, page 533.)

The efficiency of arc lamps varies somewhat with the different types, being in the neighborhood of 2.9 watts per candlepower for the enclosed arc, and in the neighborhood of one watt per candlepower for direct-current open-arc lamps.

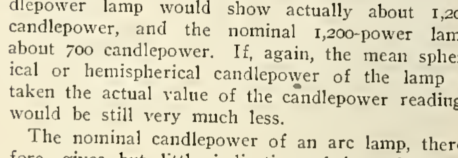
[*To be continued.*]

Note.—This series of articles, intended to survey, briefly, the whole field of applied electricity for light, power and heat, was begun in the Western Electrician of February 2, 1907.

QUESTIONS AND ANSWERS.

Telephone Disturbance Near High-tension Transmission Lines.

E. F., Stillwater, N. Y., submits a diagram similar to that given herewith, showing the relation of some high-tension transmission wires to several telephone lines which suddenly became very noisy. He reports that while separate connections from Stillwater to Greenwich or Stillwater to Fort Ed-



TELEPHONE DISTURBANCE NEAR HIGH-TENSION TRANSMISSION LINES.

ward are quiet, the lines become noisy when the three towns are connected together. The telephone wires are carried on the same poles as the power wires, the distance between the two sets varying from 18 inches to seven feet. The telephone wires are transposed every 10 poles. One telephone pair works fairly well, but the other is almost useless. E. F. thinks he has cleared up all possible trouble such as grounds through trees, carbon arresters or loose connections, but has been forced to take off several telephones on account of the noise. He wishes to know what to do and if there is any good book on this subject.

Answer.

It seems almost impossible that the Stillwater line should work quietly with Fort Edward or with Greenwich separately, and yet be very noisy when the three are together. It leads to the opinion that perhaps there is something in the manner of connection which may cause the trouble. This can be determined only by inspection and test. It is very likely that the insertion of a repeating coil in the Stillwater line at Thomson's Mills, just before the line comes to the switching apparatus, will make the lines quiet when the three are together. Use a ring-through repeating coil. But it seems that if the lines worked all right "till a week ago," some change has come into the system, either on the telephone lines or the high-tension lines. A new line may have been strung between Thomson's Mills and Stillwater somewhere about which the correspondent did not know. This line may be affecting him. He has not given the distances on his sketch, so it is quite difficult to tell very much about it. There may be grounds of a slight nature on the high-tension lines, which should be tested.

A good book on the subject is Hopkins' "Telephone Lines and Their Properties."

Resonance.

H. D., Chicago: What is resonance? When there is a rise in voltage due to resonance, does the current decrease as the voltage increases?

ANSWER.

Resonance occurs when the current in a circuit is in phase with the electromotive force. Such a condition is effected by balancing the inductance, with condensers. The alternating current in such a circuit has the same value for a given voltage as a direct current flowing over the same circuit would have.

In a given circuit E, I, L, C, R represent the voltage, current, inductance, capacity and resistance, respectively, of a 60-cycle circuit.

By formula

$$I = \frac{E}{\sqrt{R^2 + \left(\omega L - \frac{1}{\omega C}\right)^2}}$$

Since $\omega = 2\pi f$ (where f is the frequency), for the 60-cycle circuit we assumed, $\omega = 2\pi f = 2\ (3.1416)\ (60) = 377$.

$$\text{Then } I = \frac{E}{\sqrt{R^2 + \left(377L - \frac{1}{377C}\right)^2}}$$

For resonance $377\,L = \frac{1}{377\,C}$, so that the reactance member, $\left(377\,L - \frac{1}{377\,C}\right)^2$, in the above equation, equals zero, and the equation itself becomes simply $I = \frac{E}{R}$ (Ohm's law)

If $377\,L = \frac{1}{377\,C}$, then $L\,C = \frac{1}{(377)\,(377)} = \frac{1}{142{,}129}$.

Therefore, any values of L and C which make their product equal to this fraction will cause resonance in a 60-cycle circuit.

The second part of the question assumes a rise of voltage due to resonance, which implies certain given conditions of the circuit. There is often a drop of voltage due to resonance. A rise in voltage does not necessarily cause an increase in the current.

If a coil is in series in a circuit having a certain alternating current flowing in it, and some adjustment of the devices, coils, etc., in the circuit suddenly causes resonance, the current in the circuit will increase, and the voltage at the terminals of the coil will increase proportionately.

Thus suppose a 500-volt circuit feeds some small motors, lamps, etc., and has a 100-volt transformer in series, the total resistance is 10 ohms.

$$\text{The current } I = \frac{500}{\sqrt{(10)^2 + \left(377L - \frac{1}{377C}\right)^2}} =$$

say, 40 amperes.

Now resonance occurs, i. e., $\left(377\,L - \frac{1}{377\,C}\right)^2 = 0$.

Then the current $I = \frac{500}{\sqrt{(10)^2 + (0)^2}} = 50$ amperes.

The transformer would show a voltage at its terminals of $\frac{50}{40} \times 100 = 125$.

Take the case where resonance occurs but the current remains unchanged, this could be brought about by altering the main voltage.

For convenience let $\left(377\,L - \frac{1}{377\,C}\right) = X$.

Then $I = \frac{E}{\sqrt{R^2 + X^2}}$ and $E = I\sqrt{R^2 + X^2}$

Now resonance occurs and $X = 0$

$I = \frac{E_R}{R}$ $E = IR =$ voltage at resonance.

$\frac{E_R}{E} = \frac{IR}{I\sqrt{R^2 + X^2}}$, or $E_R = \frac{R}{\sqrt{R^2 + X^2}}\,E$

Therefore E_R is less than E, and L remains unchanged, which means that it takes less voltage to supply a certain amount of power to a circuit during resonance than when there is a lagging or a leading current.

Twenty-five versus Fifteen Cycles for Heavy Railways.[1]

BY N. W. STORER.

At the regular meeting of the Institute on January 25th of this year a paper was presented by Messrs. Stillwell and Putnam[2] dealing with the electrification of steam railways and referring briefly to the question of the adoption of a standard frequency for single-phase railways. This question aroused a great deal of interest and was discussed at greater length than any other feature of the paper. The authors, while enumerating the advantages of both 25 and 15 cycles, drew the conclusion that the advantages were greatest on the side of the lower frequency, and this opinion was concurred in by most of those who discussed the matter. Many good points were brought out, but all were more or less general and while it is obviously impossible for the Institute to standardize at this time a frequency for railways using alternating current, a free and full discussion of the matter can hardly fail to produce good results and to furnish more definite information than was available at the time the paper was presented. The arguments in favor of 25 cycles may be reduced to the following:

1. It is a standard frequency which is in use in a great many plants throughout the country.
2. It is probably better suited for general power distribution and is certainly better for lighting than 15 cycles; therefore any railroad having 15-cycle plant for operating its road would be somewhat handicapped in power for lighting and shop purposes.
3. The higher frequency is better suited for speeds of steam turbines of small size, it being at present uneconomical to build turbo-generators for less than 2,000 kilowatts at 900 revolutions per minute, which is the maximum available for 15 cycles.
4. Transformers are lighter and cheaper for 25 cycles.

The principal arguments in favor of 15 cycles are:

1. An increase of from 30 to 40 per cent. in the output of a motor of a given size and a consequent reduction in the total number of motors required to operate a railway and in the cost of equipment.
2. Better performance of the 15-cycle motors, including higher efficiency, higher power factor and better commutation.
3. Less dead weight to be carried on cars and locomotives.
4. Lower line losses.

The first argument in favor of 25 cycles; namely, that it is a standard frequency in use in a great many plants of the country, is certainly a good one. It is undoubtedly a very serious matter to consider the introduction of a new frequency for any purpose whatsoever. There are, as is well known, a number of frequencies in use at the present time for which there is no justification except that they are in use, and there is no class of service of which we know that cannot be handled with equal efficiency by one of the standard frequencies, with the exception of the alternating-current railway systems. Railway electrification, if developed as every electrical engineer hopes it will be, will mean an undertaking of such magnitude as to make it practically independent of other electrical interests, so that if a frequency differing from the standards now in use will be advantageous it should be adopted.

The second argument in favor of 25 cycles, namely, that it is better suited for power and lighting purposes than 15 cycles, may be granted without admitting that it is a particularly valuable point. Satisfactory lighting can be obtained with 15 cycles by using a low-voltage lamp having a large filament with high thermal capacity. This will be entirely suitable for ordinary railway lighting. Fifteen-cycle induction motors, while not having as wide a range of speed as is possible with 25 cycles, can undoubtedly be used to accommodate practically any class of service required of them, and the fact that the single-phase commutating motor is more satisfactory on the low frequency may make the low frequency even more satisfactory for shop purposes than the high frequency.

In the discussion of the Stillwell-Putnam paper one speaker called attention to the fact that railway companies would probably sell a large amount of power along their right-of-way to consumers for various purposes, and stated that 15-cycle current would be unsuitable for such service. In reply to this it is only necessary to call attention to the fact that the voltage on any railway circuit is so variable as to make it absolutely unsuitable for lighting purposes, and it would therefore be necessary to introduce a motor-generator set in order to get good results. This might just as easily be made a frequency changer to supply current at either 25 or 60 cycles, as might seem best for that particular locality. While this unquestionably detracts some of the simplicity of the scheme, it is undoubtedly what would be necessary in order to give satisfactory service, even if 25 cycles were in use on the railway, unless a separate generator were used for the lighting circuit. It seems, therefore, that the 15-cycle current would be little or no handicap to the railway company in this respect.

The third argument, namely, that the higher frequency is better suited for speeds of steam turbines, is undoubtedly true, but it affects a very small proportion of the work. Heavy railroads will require in practically all cases larger generators than 2,000-kilowatt units. In cases where they do not, high-speed turbines can be used and frequency changers employed. At the same time we must admit that the last word in regard to steam turbine design has not yet been spoken, and it may shortly be an easy matter to make comparatively small units for use with 15-cycle generators.

The fourth argument, that transformers are lighter and cheaper for 25 than for 15 cycles, is undoubtedly true. There will be a difference of probably 25 per cent. in the cost of the transformers for any given service. This difference must be offset by the difference in the cost of the motors.

The meat of the entire argument for the lower frequency is in the greater output of the motors for a given size and weight. It was well shown in the Stillwell and Putnam paper that the cost of car equipments and locomotives would far overbalance the cost of power houses and transformer stations; and while I do not wish at this time to give a mass of estimates as to the saving, I will adhere to the statement previously made that the output from a motor of a certain size will be increased from 30 to 40 per cent. by the use of 15 instead of 25 cycles. This has been proved by tests on several different motors.

A well-known 100-horsepower 25-cycle motor operates with full load at a speed of 620 revolutions per minute, and in the regular one-hour test on the stand has a temperature rise of 89° C. in commutator and 75° C. in armature, other parts of the motor being well below 75° C. This motor operated at the same speed on 15 cycles carried a load of 113 horsepower with a maximum rise in temperature in commutator of 76.5° C. and in armature of 72.5° C. It is safe to say it is good for 115 horsepower with the limiting temperature of 75° C. in armature. This same motor with a larger number of turns on the field and run on 15 cycles carried at the same speed of 620 revolutions per minute a load of 135 horsepower with a rise in temperature in commutator of 76° C., in armature of 75° C. and in field coils of 76.5° C. It is quite safe to rate this motor at 135 horsepower on 15 cycles.

A larger motor carried a load of 255 horsepower with a temperature rise of 71° C. in commutator and 76° C. in armature, other temperatures being well below 75° C. This motor, operated at the same speed under identical conditions on 15 cycles with a load of 300 horsepower, rose 73° C. in commutator and 81° C. in the armature. With new field coils having more turns the motor will carry at least 325 horsepower and probably 340 horsepower with a rise in temperature not exceeding 75° C.

While these results are all based on the one-hour test, the continuous capacities will have the same increase on 15 cycles. The inference to be drawn from these results is, of course, that the temperature rise being the same for both frequencies, the losses must be approximately the same; and, since the output is greater on 15 cycles, the efficiency must therefore be much higher. Further, the tests are all based on 25-cycle motors modified only in field coils. If the motors are designed especially for the low frequency, the results will be still better.

A comparison of the weights of car equipments for 25 and 15 cycles indicates that there will be an advantage in favor of the lower frequency, even with the same number of motors. For instance, a four-motor equipment of 100 horsepower, 25-cycle motors, with oil-insulated transformer, will weigh approximately 30,000 pounds. Such an equipment for 15 cycles would weigh approximately 28,500 pounds. The difference is small, but it is in favor of the lower frequency. If two 15-cycle motors of 200 horsepower each, such as are now building, be furnished, the weight of equipment will be reduced to approximately 23,000 pounds, or a reduction of 23 per cent. in the weight of the car equipment. While it is perfectly practicable to furnish two motors for a 400-horsepower equipment for operation on 15 cycles, it will be necessary to furnish three or four motors for 25 cycles on account of the great increase in the size of the motor. It is therefore absolutely necessary that the 25-cycle equipment weigh considerably more than that for 15 cycles. In the case of smaller motors aggregating 280 horsepower it is possible to furnish a two-motor equipment operating on 25 cycles. There would, however, be a difference in weight of at least 1,500 pounds in each motor in favor of the 15-cycle equipment of the same capacity. This would offset the increased weight of the 15-cycle transformers by at least 1,000 pounds. In every case, therefore, even where the same number of motors are in use for both frequencies, the

1. A paper presented at the annual convention of the American Institute of Electrical Engineers, Niagara Falls, N. Y., June 27, 1907. Mr. Storer is an engineer of the Westinghouse Electric and Manufacturing Company.
2. See Western Electrician of February 2, 1907, page 108.

15-cycle equipment will be lighter, and, on account of the smaller motors, the motor trucks will also be lighter, the amount of saving here depending upon the size of the motor.

The greatest gain from the use of 15 cycles is to be found in heavy railroading, where locomotives are used. In building locomotives it is desirable, on account of the weight, cost and maintenance charge, to concentrate the power in as few motors as possible consistent with weight on the drivers and the tractive effort desired. We have found that in virtually all cases the weight of useful apparatus on the drivers, even with 15 cycles, is sufficient to give the necessary adhesion without adding dead weight; therefore, the use of 15 cycles means that in practically all cases for the locomotive a smaller number of motors can be used than is possible with 25 cycles. It is frequently the case that three motors which are sufficient with a certain size of driver for 15 cycles would have to be replaced by four motors having the same dimensions. It would sometimes happen that three motors necessary for 25 cycles could be replaced by two of the same dimensions for 15 cycles. In the case of locomotives of very high speed, the extra weight entailed by the use of higher frequency motors, and consequently heavier mechanical parts, would increase the weight of the train to such an extent as to call for a considerably larger output from the motors, simply to haul the extra weight. Such a case we have in mind in a high-speed passenger locomotive which has recently been built. This locomotive is designed to haul a 400-ton train both on heavy grades and at high speeds on level track. The locomotive as built for 15 cycles, weighs approximately 140 tons, and has four motors, each with a nominal rating of 500 horsepower. With a 400-ton train behind it this locomotive would thus have to handle a total of 540 tons. A 25-cycle locomotive built to handle a 400-ton train at the same speeds and on the same grades would require six motors of approximately the same dimensions, and these extra motors, together with the extra weight of mechanical parts, would bring the total weight of the locomotive up to approximately 185 tons. The total weight of train would thus be 585 tons, or an increase of about eight per cent. The capacity of these motors would be in the neighborhood of 375 horsepower, which would be just about sufficient to handle the extra weight. It must be seen at once that the motors for this locomotive would cost 50 per cent. more and the mechanical parts also considerably more. The only parts of the equipment which would cost less would be the transformer and preventive coils, and the control equipment would be enough more expensive to counterbalance this.

In this connection it may be of interest to give a brief description of the locomotive as built. It is of the articulated type, each half of which has two pairs of drivers and a four-wheel truck similar to the standard American type of steam locomotive, the two halves being coupled back to back. The drivers are 72 inches in diameter, with seven feet six inches between centers of axles. On each axle is mounted a gearless motor having a nominal rating of 500 horsepower and a continuous capacity with forced ventilation of about 375 horsepower. The motors, weighing approximately 19,500 pounds, are spring-supported, mounted, and connected to the drivers in exactly the same way as the motors on the single-phase locomotives for the New York, New Haven and Hartford Railroad; this feature has been described so many times that it is unnecessary to repeat it. The frame of the locomotive is of the standard steam-locomotive type placed outside of the wheels. It is of cast-steel connected at the front and rear and at three places between the ends by heavy cast-steel girders. The truck, which is of the standard steam-locomotive pattern, has 36-inch wheels, with a wheel base of six feet two inches.

The electrical and other equipment in the cab is mounted on a raised platform, which is about two feet above the floor line and occupies the middle of the cab, allowing for a passageway on either side. There are numerous windows along the sides of the cab, which afford excellent light for the inspection of the apparatus. The equipment is extremely simple and accessible. The main transformer, which is designed for 11,000 volts, is mounted above the truck, with the top just below the platform in the cab. Directly above the transformer is located the electro-pneumatic switch group to which the various taps in the transformer are carried. Back of the switch group are the preventive coils used in passing from step to step on the transformer, and from these preventive coils runs a single lead to the reverser switch group, which is placed directly above the main motors. On this raised platform are also placed the motor-driven air compressor, the motor-driven blower for furnishing air for ventilation of the motors and transformer, and the air reservoirs. Suspended from the structural work between the platform and the Z-bars in the roof of the cab are the oil circuit-breaker in the high-tension circuit leading to the transformer, the small switches used in connection with the auxiliary motors, and the 20-volt battery which is used for operating the valve magnets in the controller. The high-tension current is collected from the overhead wire by the standard type of pantagraph trolley. It will be noted that on account of the large drivers and the comparatively high position of the apparatus in the cab that the center of gravity of the locomotive is higher than usual in electric locomotives. The riding qualities of the locomotive are exceptionally good. The weight of the locomotive, as stated, is 140 tons, there being 50,000 pounds on each driving axle and 40,000 pounds on each truck.

In the case of geared locomotives for heavy freight service, there is still the advantage in favor of 15 cycles. Where the same number of motors is used for both frequencies, it will be necessary to use larger wheels for the 25-cycle locomotive. Low-speed locomotives are especially at a disadvantage with 25 cycles. It is possible to make a geared motor with a capacity of 400 to 450 horsepower for slow-speed freight service with 15 cycles, while with 25 cycles a 300-horsepower motor is as powerful as it is practical to use. This means that in the freight service we have virtually the same condition as in passenger service, namely, that about one-third more motors will be required to perform the service. The locomotive will weigh from 10 to 35 per cent. more.

An examination of the efficiency curves for 15-cycle motors compared with those for 25 cycles will show difference in the losses in the motors alone which will mean a considerable difference in the capacity of the power station. This, when added to the power required to haul the extra weight, and the increased line loss due to the higher frequency, will make a difference of five to 15 per cent. in favor of the 15-cycle equipment. Without giving estimates or long tabulated statements, I leave it to the judgment of the members of the Institute to decide whether it is not advisable, with these facts staring us in the face, to recommend a new frequency.

It is well known that when the advent of the first successful single-phase railway motor was announced by Benjamin G. Lamme in his historic paper before the Institute in 1902, the frequency which he advocated was 2,000 alternations per minute, or 16⅔ cycles per second. It was believed at that time that this frequency was the best suited to meet the many requirements of power plans for railway apparatus. However, owing to the experimental nature of the undertaking, it was deemed advisable to use the standard frequency of 25 cycles temporarily until the commercial success of the system was assured. At the same time it was realized that the practical difficulties to be overcome in the single-phase system would be much greater with the higher frequency. Moreover, in the first equipments sold the motors were of comparatively small size, so that the space occupied by them was not limited. Furthermore, the number of motors in an equipment was fixed by conditions other than dimensions and weight, four-motor equipments being selected in nearly every case, partly on account of the prevailing fad for four-motor equipments and partly because most of the equipments were built for operation on both alternating current and direct current. At any rate, aside from the greater difficulties met with in the design of the high-frequency motor in order to secure good performance, the question of frequency was of comparatively small importance.

Since that time some 15 or 20 roads have been put in commercial operation with single-phase current at 25 cycles, and it has been proved beyond doubt that the single-phase motor is a thoroughly practical and commercial machine. At the same time, as was anticipated, all our experience goes to show the advantage to be gained by the use of a lower frequency. This frequency need not be fixed at exactly 15 or 16⅔ cycles. As far as the motor operation is concerned, a variation of one or two cycles either way will have comparatively little effect; but we believe, for the sake of using proper ratios between this and existing frequencies, that 15, which is one-fourth of the standard 60-cycle frequency, or 16⅔, which is two-thirds of the standard 25-cycle frequency, should be adopted for use, especially on heavy railroads. While this will undoubtedly make it necessary for the manufacturing companies to keep a larger variety of apparatus in stock (as there is no doubt that 25-cycle railways will be operated for a long time to come), the advantage to be gained from the lower frequency in the wider use of apparatus will far outweigh any slight disadvantage of this kind.

The mistake made by the blacksmith when he made the template which fixed the gauge of the standard railways at 4 feet 8.5 inches is a matter of tradition. It is recognized as being one of the most far-reaching mistakes ever made, inasmuch as it has ever since placed a limit on the capacity of the railroads of our country, both by limiting the capacity of steam locomotives and the size of cars, and last, but not least, the capacity of electric-railway motors and locomotives. What an enormous benefit would be gained from even a paltry increase from 4 feet 8.5 inches to five feet. What powerful machines could be built for a gauge of six feet. But the mistake has been made, and it will cost so much to rectify it, that the boldest of our railway magnates is staggered by the suggestion.

Electrical engineers have an enormous responsibility in deciding upon matters of detail, such as frequency, which will have an effect that will far outlast anyone who has a voice in the matter; and it certainly behooves us as engineers to consider carefully before recommending the continuance of the present standard frequency of 25 cycles, where it imposes such a handicap on the capacity of our transportation systems.

The Preservation of Wood.

Wood preservation has become a matter of importance to electric-lighting engineers and others who have to do with the installation of poles and other wood in connection with electrical plants. The C. A. Manufacturing Company, Austin, Tex., and also Mannheim, Germany, has recently opened an office at 358 Dearborn Street, with Mr. George H. Erich as sales manager.

Its product consists of the high boiling oils of coal tar manufactured at its chemical works at Mannheim, Germany, and imported into this country in original barrels. The results of the application of "C. A." wood preserver on butts of poles, also gains and roofs of poles and on cross-arms, pins, brackets, ties, etc., have been very highly successful in the prolonging of life of all timber to which it has been applied.

This wood preserver is made under the following specifications, which are said to be the strictest specifications in existence for wood preserver or carbolineum:

Specific gravity at 20° C.	1.12
Flashing point	149°C
Burning point	175°C
Distillate up to 235° C	0.40%
Distillate between 235° C and 300° C	10%
Residue above 300° C	89.60%
Solids—No separation from 0° C to 5° C.	
Tar acids	1.3%
Ash	.15%

The secret of any wood preservative lies in the fact that if it is a germicide it will preserve timber, as all rot is caused by germs either from the outside or inside of the timber. If these germs are destroyed the preservation of wood which is treated will result. Mr. Erich says that closing the pores of wood with the application of tar or lead paints, asphaltum, etc., which will form a coating, will not give any preservation to the timber other than to the outside rings and causes dry rot.

As such substances as tar, lead, asphaltum, etc., have no penetrating power or specific gravity, it remains that the high boiling oils, which will penetrate timber, due to their high specific gravity, will remain in wood indefinitely. "C. A." wood preserver is not soluble in water, nor will it leach out in time. Treatment of timber in the bath, if this is convenient, is the most satisfactory, but where poles are to be treated a brush treatment at the butts is sufficient, provided that the preserver is applied in quantities sufficient to fill the checks of the wood. It is of importance also that butts of poles be treated about 18 inches above ground line, and when these instructions are properly carried out the life of timber will be increased over 100 per cent., according to Mr. Erich, who will be glad to furnish any further information relative to the preservation of timber.

The Writing of Business Letters.

Better write no letter than a poor letter.

Too many business letters are today failing in their mission. A business letter is the representative of the house sending it out, and should be so carefully worded that its meaning will be absolutely clear to the recipient. Too many business men are today striving to clear their desks quickly of all correspondence, and thus rush through their work, when they should strive so to write each letter that it will do the same work for the house that a man would do if sent out instead of the letter.

The ordinary business correspondent possibly dictates his letters to a stenographer who may not know much about the business, and then does not read them over carefully to see that they express the exact thoughts that he wished to convey. He drops into his chair a few moments before the letters should be mailed, hurriedly glances over them, and lets them go.

In the first place, the writer of a letter is very likely to not express his thoughts as clearly in the letter as though he were talking to the person addressed. Then there remains the chance that the stenographer will, through misunderstanding or poor punctuation, put an entirely different meaning to the letters. Guard against both possibilities.

If you cannot give a letter enough attention today to make it clearly express your views, do not write it. Better wait another day to start than make a wrong start.

If your stenographer fails to express your meaning in a letter, correct it thoroughly and have it entirely rewritten, even though it is not started on its mission for another day. Better a little delay, if that is absolutely necessary, than the possibility of making a wrong impression.

Resistances in Telephone and Telegraph Practice.

As the telephone and telegraph service is of vital importance in quick, modern business transactions, anything which promises increased efficiency in this service is worthy of close investigation and of the best engineering talent. The Ward Leonard Electric Company of Bronxville, N. Y., has devoted its attention to the specific task of producing a complete unit of high resistance and current-carrying capacity, combining in a small space the salient features of a strong, durable telephone and telegraph resistance unit.

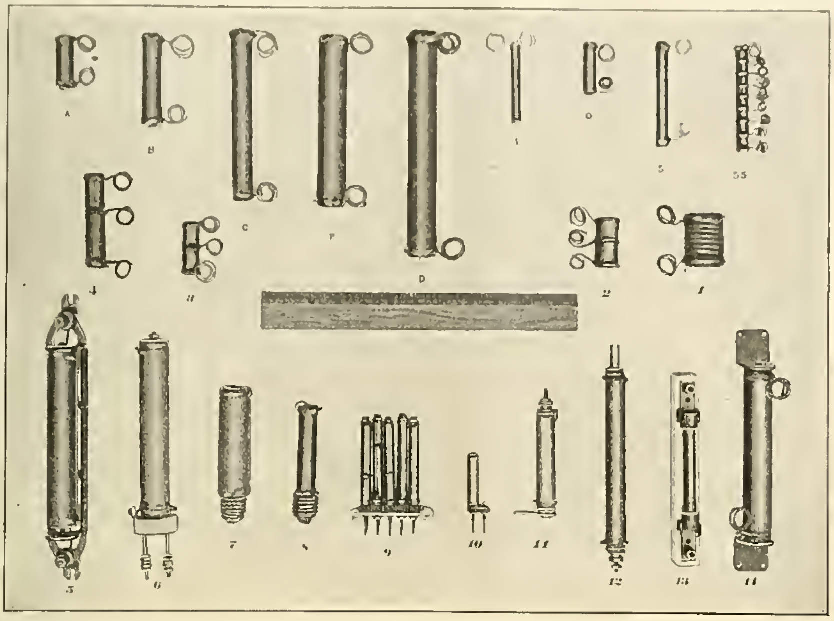
The cut shows these units made of wire enameled on porcelain tubes, possessing the following advantageous features:

The resistance wire is embedded in a material which will expand and contract at the same rate as the resistance itself, within the limits of usage, thus preventing the adjacent coils from closing together and short-circuiting, preventing, therefore, a change in the resistance of the unit which might cause a burnout of the circuit. The vitreous enamel in which the wire is embedded, and by which it is entirely covered, protects the wire from the atmosphere. As the entire wire is hermetically sealed, it cannot deteriorate, owing to the action of moisture or other corrosive elements. The coating of enamel on the wire is so thin and so good a conductor of heat, that the heat generated is dissipated very rapidly, because the radiating surface is practically increased from that of the fine wire to that of the porcelain tube. The resistance wire has a practically zero temperature coefficient; that is, its resistance does not alter or change in temperature, the importance of which is well known. These units are very strong mechanically, are non-abrasive, rust-proof, water-proof, fire-proof and dust-proof. The terminals are strong and the connections between the resistance wire and the lead are embedded in an enamel which preserves the joint from any deterioration.

The copper lead wires consist of a round braid, made up of a large number of small copper wires. The shape is the best possible for mounting in practice, as will be evident from the cut, which shows units designed for mounting in cord circuits of telephone exchanges. They are two inches long by one-half inch in diameter and can be wound with any resistance from five ohms to 2,000 ohms.

The cut also shows units designed for ringing circuits in telephone exchanges. These resistances are 3¼ inches long by one-half inch in diameter. Also shown are 650-ohm units arranged for mounting in Edison sockets, mounting against the wall of the section or for mounting upon a slate panel; also balancing units for telegraph circuits, and the manufacturers assert that they can build units as high as 30,000 ohms, in a space approximately five inches long by 1½ inches in diameter, and that it can place 10,000 ohms upon a unit four inches long by seven-sixteenths inch in diameter.

The Ward Leonard Electric Company solicits the opinion of telephone and telegraph men and will gladly take up any problems of design mounting, etc., which they may suggest. The Postal Telegraph-cable Company, always progressive, has adopted these units of the larger size, in the construction of its quad, trolley and duplex rheostats.



RESISTANCES IN TELEPHONE AND TELEGRAPH PRACTICE.

The legal domicile of the Cumberland Telephone and Telegraph Company has been moved from Hopkinsville, Ky., to Louisville. The capital stock was increased $200,000, making it $20,200,000.

Telephone Competition in Ohio.

A largely attended special meeting of the Ohio Independent Telephone Association was held in the Southern Hotel, Columbus, on August 6th, with President Frank L. Beam of Mt. Vernon in the chair. Harry M. Daugherty of the Columbus Citizens' Telephone Company spoke on "Why Is Independent Telephony so Successful?" W. G. Thompson of Hamilton, James B. Hoge of Cleveland and H. B. Folsom of Circleville discussed "Why Is Competition Desirable in the Telephone Business?" and A. Hess of Sidney told of the enforcement of the general laws of Ohio in reference to the telephone business.

Following these addresses, the following preamble and resolution were adopted:

"Whereas, It is the sense of the Independent telephone companies of Ohio composing this association that its members refuse to enter into any contracts or arrangements whereby competition is eliminated, and that all violation of law arising from such arrangements or contracts will be prosecuted by this association.

"Resolved, That the executive committee is hereby authorized to take such steps as are necessary to carry this resolution into full effect."

This resolution means that the association may invoke the Valentine anti-trust law against any company which enters into a contract with the Bell company for the retirement of the latter from the local field in exchange for the long-distance business of the Independent company.

Harry Burkhardt of Cincinnati spoke on the prospect of telephone competition in Cincinnati, saying that it would not be many months before the Ohio Independents would have entrance to that city.

After luncheon the subject of the advances being made by the Bell companies to the Independents was again taken up, and, after a long discussion, the following resolution was unanimously adopted:

"Whereas, Certain Independent telephone companies have violated their contracts with the United States Telephone Company by permitting unauthorized connections and interchange of business prohibited thereby, to the serious injury of every Independent telephone company in Ohio or interchanging business therewith; and,

"Whereas, The maintenance of competition in long-distance telephone business is deemed necessary for the best interests of the companies as well as the public; therefore, be it

"Resolved, By the Ohio Independent Telephone Association in convention assembled that we deem it the duty of the United States Telephone Company to enforce its contracts wherever violated; and, be it further

"Resolved, That we demand that the United States Telephone Company bring suits, if necessary, against all companies violating their contracts with it, and that this association pledge its unqualified support to said company in the prosecution of such actions."

It is said that the Independent long-distance company will bring suits for violation of contracts against several Independent companies and the adoption of this resolution means that it will have all the moral backing of the association behind it in any legal proceedings it may take.

The Cumberland Telephone and Telegraph Company has closed down its exchange at Petersburg, Ind., rather than pay to the city $500 cash and two per cent. of its annual gross earnings for the renewal of a 20-year franchise.

Canadian Telephone News.

Steps are being taken toward establishing a municipal telephone system in the municipality of Whitewater, Man. Reeve Scott, Fairfax, Man., can give further information.

The Manitoba government has decided to accept the offer of Wilson Smith of Montreal, Que., for the purchase of $500,000 telephone debentures at a rate to produce 4.43 per cent. to the investor.

The matter of the construction of the telephone exchanges and conduits, both in Brandon and Winnipeg, was considered by the council of the province of Manitoba. It was decided to let contracts at once for the construction of both. This is the initial start on the government-owned system to be built in Manitoba.

At the convention of municipalities of the province of Saskatchewan, held at Regina, a strong discussion took place in favor of government and municipal ownership of telephones, and during the argument the Bell company was sharply criticized. During the meeting the following resolution was adopted: "That this convention desires to place on record the fact that it objects to the excessive rates charged for the use of telephones by the Bell company on the ground that, instead of decreasing with the increase in the volume of business done by them, they have increased charges, and the convention urges upon the provincial government that the convention is in favor of government and municipal ownership of telephones within the province." After the convention several members of the government were spoken to on the matter, and it is understood that at the next session efforts will be made toward the establishment of a similar system of government-owned telephones as that now being built by the governments of Manitoba and Alberta. Francis Dagger, telephone expert for the province of Manitoba, has been engaged to perform similar work for Saskatchewan.

For some time negotiations were carried on between the Bell Telephone Company and the Alberta government looking toward the buying out of the Bell company's lines by the provincial government. At one time it looked as though an agreement would be arrived at, but the company declined all offers, so that in future the company and the province will be the keenest competitors in the newly formed province. The Bell company offered to take the southern half of the province, leaving the northern half to the government lines, but this was refused.

R.

The Telegraph and Telephone in China.

In view of the present tendency of the Chinese to assume the management and control of the railroads and other important business enterprises, a résumé of the annual report of the Imperial Telegraph administration, prepared by Mr. F. D. Cloud, student interpreter at the Shanghai consulate-general, contains some interesting items:

"Originally this system of telegraphs was a private concern organized by wealthy Chinese officials and gentry, but some eight or nine years ago the central government took over control of the company, allowing certain merchants to retain their shares, increased the capital, and secured a monopoly of the business throughout the empire. Under government management the system is approaching a tolerable degree of completeness and usefulness. Of late years, also, it has been paying fairly good dividends, amounting to 10 per cent. in 1906, and this, too, in the face of rather large extensions of the system.

"The total receipts of the system for the year were $1,597,176 United States gold, while the gross profits for the year were $645,537, and that, too, from a working capital of $1,232,000. After paying the government royalty of $129,807 the administration was still able to pay the private shareholders a dividend of 10 per cent. This goes to show that the telegraph, like the railways, has come to be regarded by the Chinese as a public necessity.

"The telephone also, while still in an undeveloped state, is destined to play an important part in the development of the new China. Wherever the telephone has been used by the Chinese it has made a lasting place for itself, and at the present writing there are many systems in various parts of the empire being talked of and organized, many of which are certain to be installed, and since the Chinese do not manufacture telephonic or telegraphic supplies, there should, in the near future, be an extensive market in China for this line of goods."

Liquor Men Boycott the Telephone.

The liquor interests of Bedford, Ind., have declared war against the Bedford Home Telephone Company, and up to August 4th 120 patrons of the telephone company who favor the liquor men had ordered the removal of the company's telephones from their homes and places of business. The reason for this is because Edward B. Thornton, president of the company, was one of the leading workers in the circulation of a petition to keep saloons out of the Third Ward. One patron, who ordered his telephone removed, became so angry at the delay that he took an ax and chopped the instrument to pieces. The company is not worried over the loss of patronage, since it has had orders for months for 180 new subscribers' stations, but had been unable to fill them because it was unable to obtain the instruments.

Telegraphone on Canadian Railroads.

The telegraphone (combined telegraph and telephone service) has proved so successful in the operation of railways, that both the Canadian Pacific and Canadian Northern railroads have installed systems. The principal purpose is to minimize the time spent in securing help after an accident has occurred. However, the Canadian Northern finds other uses for it and already has its wire between Winnipeg and Brandon connected with one of the Brandon newspapers, so that at night news is transmitted between the two cities by this line, saving the cost of a night operator at Brandon, as the ordinary commercial business does not warrant such an expense. It is the intention of this company to install a number of similar lines in Manitoba, where the circuits will not be more than 150 miles. Where the line exceeds this, a metallic circuit will be needed, though in the former case the single Morse circuit is used. The great use of the device is at the time of an accident on the road, as on the western lines it is always possible this may happen 15 miles from the nearest station in telegraphic communication with a working crew. This distance would in all probability have to be walked, meanwhile the track would be blocked. When the instruments are installed along the system, and an accident happens, the conductor takes the instrument, gets connection with the wires, and calls up the nearest station. A jointed conducting pole, connected to the instrument, is arranged to be hooked over the dispatching wires along the track. The other wire from the instrument is fitted with a small clamp, which may be screwed tightly to the rail, completing the circuit. The machine is arranged with two jacks, so that if the conductor wishes to talk to the station west of him he inserts a plug in one jack or to the east in the other. In this way he can get in almost immediate communication with a station, call help and receive orders from the dispatcher.

One other system of this kind is in operation in Western Canada at the present time, that on the main line of the Canadian Pacific Railroad, between Fort William and Winnipeg, but the company is making preparations to equip the rest of its main line and a number of its branch roads

GENERAL TELEPHONE NEWS

The Mutual Telephone Company of Elida, N. M., of which R. E. Tusha is president, has begun the installation of its exchange.

The Del Rio (Texas) Western Telephone Company has been incorporated with a capital stock of $20,000 by T. S. Sharpe and others.

The Cumberland Telephone Company will begin the construction of its long-distance line from Jackson, Miss., to Memphis, Tenn., within a week or ten days.

The Chicago Telephone Company made a net increase of 2,111 in the number of its telephones in service during July. The total number now in service is 192,264, an increase of 31,387 in a year.

The entire capital stock of the Cuyahoga Telephone Company of Cleveland is now $3,500,000. Papers were recently filed with the secretary of state, increasing its common stock from $1,500,000 to $2,000,000.

Greater competition is promised for the Chicago Telephone Company, now that the new interests in the Chicago Subway Company propose to take up actively the exploitation of the telephone franchise which the company holds. Before the meeting of the City Council in the coming autumn the company says it will be prepared to make a statement of its position, including its ability to furnish adequate telephone service for the city of Chicago. The company's present switchboard is to be replaced by one of much larger size and having the recent improvements in automatic service.

A hitherto "unknown" tunnel under the Chicago River, 85 feet below the street level, and six by 6½ feet in cross-section, the property of the Chicago Telephone Company, was "discovered" last week by city officials in deciding upon a place to dig a water tunnel. They selected La Salle Street as the only available place, and were confronted by the telephone company's tunnel. City attorneys were unable to discover any enabling ordinance and gave the opinion that the telephone company had no right to construct the bore. Attorney W. P. Sidley of the company then produced a copy of a permit signed by Superintendent of Streets Doherty and correspondence with former Commissioner of Public Works O'Connell to show that he knew about the construction at the time the digging was taking place, which was between May and October, 1906.

CORRESPONDENCE.

Continental Europe.

Paris, July 30.—According to the most recent news from Switzerland, it appears that the Federal Railroads have decided definitely to construct the second tunnel of the Simplon. It will be remembered that at the time of building the first tunnel arrangements were made so as to provide for a second and parallel tunnel which should have a single track, like the first one, with an overhead trolley wire supported upon brackets and cross-wires from the top of the vaulting. Owing to the successful operation of the present tunnel and the electric trains, the Administrative Council of the Federal Railroads was brought to take the above action, for the time has already come for operating a second line. Accordingly, the conditions of traffic will be greatly improved upon this section. The dimensions of the second tunnel are to be somewhat larger than for the first one, and will be determined according to the experience which has been gained in the former work. Among the improvements to be made, I may state that the lateral niches in the tunnel will be greater in number, and the lining of the new tunnel will be in Portland cement instead of lime, as before. Two side conduits running parallel to the tunnel will be used to draw off the hot air by means of motor-driven fans of large capacity, and the air will be sent in the direction of the south opening. At the last meeting of the council a report presenting the main lines of the project was read by Engineer Von Arx in behalf of the railroad officials, and it was adopted unanimously by the council.

One of the most important electric-railroad projects which has appeared for some time on the Continent is the one announced from Holland, and it appears that the government is considering the feasibility of running an electric-railroad system, including a number of lines, in the frontier provinces of the country which lie next to Germany and Belgium. One of the principal lines is to be constructed from Maestricht to Aix-la-Chapelle, passing by Vaals and taking in a number of large towns in this region. The total length of the different lines which it is proposed to build at present is no less than 200 miles.

A convention has been lately established between the French and Swiss telephone administrations in relation to the use of the international lines for night messages. According to this, the tariff for the night messages is now fixed at three-fifths of the rate for day messages. However, in the case of subscribers, a still lower rate is decided on, this being only one-half the usual rate. The tariff is established on the basis of three-minute conversations.

A scientific expedition to the South Polar region is being planned under the direction of the eminent explorer, R. Amundsen, whose work in the Arctic regions resulted in much important data. The discovery of the south magnetic pole is to be the principal object of the present party, and it is to be remarked that the exploration will be much more difficult in the Antarctic region, owing to the presence of an open sea and the absence of any land, as far as is known at present, in the region through which the party is to navigate. It is expected to find the magnetic pole at latitude 73 degrees 39 minutes S. and longitude 146 degrees 15 minutes W.

Japan is now importing electric motors at a constantly increasing rate. The imports seem to have commenced in 1896, but at that time the annual figure was not more than $7,000. According to the recent reports, the figures for the last few years show a remarkable increase. Thus, for the year 1900 the imports were $100,00, which was already a good increase, but we find that for 1904 the amount is no less than $600,000, and for 1905 it reaches $1,200,000. A. de C.

Great Britain.

London, August 2.—At the moment of writing, the only serious business transacted at the British Association meeting is the delivery of the presidential address. The president is the late astronomer at the Cape, Sir Daniel Gill, and, as may be expected, there is little of interest to the electrical engineer in the address. Mr. Francis Darwin, F. R. S., has been nominated president for 1908. An interesting paper is one describing methods of dealing with the ice problem in Canada in relation to hydro-electric power installations.

Tramway proposals, involving an expenditure of $1,755,000, are now before the London County Council. Nearly one-third is for street improvements consequent upon the introduction of the tramways, which, with but two exceptions, are connecting links to facilitate the working of existing lines. The overhead trolley system is proposed in three instances, mainly for the reason that these lines will join up with systems outside London.

A strong effort is being made to put the South Wales Electrical Power Distribution Company on a substantial basis once more. A company has been formed composed of the principal consumers, and this will manage the affairs of the concern under the guidance of the present engineer and secretary.

The chairman of the English General Electric Company made strong complaints at the annual meeting, at the British government continuing to persist in its policy of free imports. He asks for a conference of British manufacturers and government representatives, when he believes that the latter would very soon be convinced that a system of regulation of foreign imports would be to the benefit of manufacturers.

A curious case was decided at Bristol last week, when a florist was awarded small damages against the local tramway company for alleged injury to his plants, etc., from the creosote on the wood blocks with which the tramway track was being paved, the stench from which, he stated, ruined his crops.

The officers of the Marylebone (London) electrical undertaking are to be congratulated upon the results achieved for the year ended March 31, 1907. If ever an undertaking started under inauspicious circumstances, this undertaking did, for it will be remembered that after being refused permission to compete with the local company, the latter had to be bought out at $7,250,000. Despite this, the first complete year's working, after allowing for interest and debt charges, showed a profit of nearly $120,000.

In the House of Commons this week, the final word was spoken on behalf of the government regarding the wireless-telegraph convention of 1906. The government intends to ratify the convention forthwith, without further discussion.

It is stated that a proposal has been made to convert the whole system of cable tramways in Edinburgh to electric traction. G.

Dominion of Canada.

Winnipeg, August 9.—The Hon. A. B. Aylesworth has advised the Department of Marine that there is nothing in the agreement with the Marconi company to prevent the government erecting wireless stations and equipping them with instruments other than Marconi instruments. Consequently the government has proceeded to erect and operate wireless stations on the Pacific Coast, independent of the Marconi company, and will fight the claim of the company for an absolute monopoly of wireless-telegraph business of the government.

Morrison Bros. of Lloydminster, Alberta, have decided to erect an electric power supply plant in that town.

The James Stuart Electric Company of Winnipeg has received the contract for installing the municipal electric-lighting plant at Battleford, Sask.

The Canadian Northern Railroad Company has strung its telegraph wires 75 miles west of Brandon, Man., on the Regina branch, and expects to have the lines completed early in November. Two lines are being put up, one for railway and the other for commercial purposes.

The electric power plant owned by the Claresholm Milling and Elevator Company was destroyed by fire. Since then the town has been in darkness.

Grading on the British Columbia Electric Street Railroad Company's line between New Westminster and Eburne, B. C., will be commenced as soon as the right-of-way has been secured. R.

New York.

New York City, August 10.—An advertisement in the City Record has revealed the fact that the municipal lighting plant on which many thousands of dollars have been spent by the city, and which used waste material and refuse as its fuel, is to be discontinued. It is said that it costs the city about $60,000 to light the Williamsburgh Bridge and that the New York Edison Company would undertake to do this work for about $25,000. The building, in which the most modern machinery was installed, will be still used for the disposal of refuse, although no power will be generated. Altogether this experiment has been a costly one for the city. It marks another point of vantage for the central station over the isolated plant. Chief Engineer Lacombe stated that the main reason for the change was the slow-burning quality of the fuel. The waste material would not always burn readily and steadily and it caused the lighting to be uncertain.

The contract which the American Railway Traffic Company has for the removal of ashes and waste in Brooklyn does not expire till December, 1908. This is the decision rendered by the corporation counsel to the department of street cleaning, and it will give the department the much-needed time in which to find some other contractor than the Brooklyn Rapid Transit Company, which has refused to continue with the work, asserting that it has always been done at a loss.

Suit has been begun in the Chancery Court in Newark to have set aside the lease of the United Electric Company by the Public Service Corporation for a term of 999 years. One of the points made against the lease is that under the terms of its charter the Public Service Corporation has no right to conduct a business like that of the United Electric Company, and further, that the lease is unfair to the stockholders of the United Electric Company in that it takes from them all chances of benefiting by a possible increase in the income of that company.

The Up-state Public Service Commission has arranged for a trip through the Electric Zone of the New York Central.

It is said that 50 of the new steel cars have been delivered to the barns of the New York and Queens County Railway Company at Woodside. The new car is provided with multiple control and automatic air brakes, and is suitable for operation singly or in trains. This car is steel throughout and is for use in the Belmont Tunnel.

A. E. Blackmar, counsel to the Public Service Commission, handed in an opinion to that body, in which he declared that the commission had the authority to act independently of the city department in all matters pertaining to the issuance of permits for work of any kind. No plans issued by the commission of work to be done by any contractor are therefore required to be submitted to the department of water supply, gas and electricity.

Word comes from England that experiments in wireless telephony are shortly to be begun on an extensive scale. For some time past a number of experts in England and Germany have been working along these lines with a marked degree of success. The Amalgamated Radio-Telegraph Company possesses experimental stations at Oxford and Cambridge, and these are now being converted into wireless-telephone stations. Mr. Poulsen, the Danish inventor, is in charge of the experiments, and considerable interest is now being directed as to the outcome of these tests.

E. H. S.

Indiana.

Indianapolis, August 10.—Track laying on the Indianapolis, Columbus and Southern traction line between Columbus and Seymour is completed. The road has been ballasted as far as Sand Creek, and the work of stringing the trolley is almost completed. The new cars have been mounted and everything will be ready for the opening of through service between Indianapolis and Louisville in a short time.

The Richland branch of the Evansville and Eastern traction line will be open by August 15th.

The managers of the Chicago, South Bend and Northern Indiana Railway Company have pledged the expenditure of $150,000 for improvements and extensions of the street-railway service in Elkhart in case the council ratifies the franchise granted by the Board of Public Works. Extensions will be built to Elleston and Briggsdale.

The Terre Haute, Indianapolis and Eastern Traction Company has begun the construction of a new and modern freight depot in Greencastle. The structure will be on the same lot with the newly completed passenger station, and resembles it in architecture. When completed the terminal facilities in Greencastle will be first class in every appointment.

The City Council of Richmond has taken another rap at the traction lines by passing a resolution authorizing the city attorney to ascertain what legal rights the Terre Haute, Indianapolis and Eastern and the Dayton and Western traction companies have in operating over the city streets. The fact that neither traction company manifested any uneasiness over the council's previous action to force them to accept a franchise providing for transfers between interurban and local cars has "riled" the city officers, who are now determined to bring the matter to an issue and settlement.

It is announced that the Fort Wayne and Wabash Valley Traction Company promises to be the first interurban company to use storage batteries for car lighting. Plans are now being made for installing this system.

The stockholders of the electric-light plant of Washington, Ind., have ordered the trustees of the plant to turn over to the city all the books, machinery and the like, putting it in direct control of the City Council. The council was empowered to enter into an agreement with Robert Ash of Richmond to repair the plant, taking a mortgage on the plant until final payment is made. By the terms of this agreement he will install new machinery, including boilers and electric apparatus, a new system of arc lights, and will also rewire the city. It is believed that the city will accept the proposition.

S. S.

Illinois.

Peoria, August 10.—The directors of the St. Louis, Terre Haute and Quincy interurban electric road held a meeting in Quincy this week, and William C. Frick of that city was added to the board of directors. The outlook for the building of the road is very bright, and the directors are confident of the success of the proposed road. The road has petitioned the council of Virden for a franchise through that city.

The Pond Engineering Company, which has the contract for the construction of the electric railway that will be built to Nauvoo and Hamilton, has established headquarters in Hamilton and will commence at once on the construction of the line from Elvaston to Nauvoo. The line from Elvaston will be built first, so that the material for the power house at Nauvoo can be carried to the site at the latter city, as at present Nauvoo has no railroad connection at all.

Sealed bids will be received by the commissioner of public works of this city for changing the steam elevator at the City Hall to an electric one.

From Medora, which is 50 miles from St. Louis, it is reported that oil and gas have been discovered. If the supply shows any sign of holding out it is proposed to run a pipe line to St. Louis and Alton.

Since the Illinois Traction Company has been hauling freight from this city east on the Peoria and Bloomington line, the business has increased to such an extent that the company now finds that the building used for a depot is not large enough to accommodate the business, and is trying to secure a location where it can erect one that will be large enough.

As the result of the city of Streator refusing to grant the Peoria and Ottawa electric line a satisfactory franchise, the city may lose the road entirely. This is the line that the Illinois Traction Company will build to get to Chicago. The company has a forfeit of $5,000 posted to build the road to Ottawa and Streator, but the company says that it will forfeit this rather than accept the franchise as offered. The Streator franchise calls for the building of the road with two very short turns and does not permit the hauling of freight. The company may now build to Kankakee and connect with the Southern Traction Company, which is now operating between Chicago and Kankakee. From Kankakee lines are practically completed which will give a line to Indianapolis, also. By building from Dwight to Kankakee and from Pontiac to Bloomington, two lines of about 25 miles each, the Peoria-Chicago route will be realized.

A bulletin issued by General Manager Fischer of the Illinois Traction Company announces the appointment of the surgeons that will be in service for the company at the various stations. This in line with the proposed hospital association that is being organized by the company and the employes.

Mr. Trotter of this city has opened up a wiring and supply store in Decatur.

The strike of the electrical workers is in about the same state as it was last week. The men are holding firm in refusing to work for those who do not sign the agreement, and the firms seem to be no nearer to signing than they were last week.

Peoria will next week see a demonstration of radio-telegraphy. A company has rented Turner Hall and will give three days' free exhibition of the working of the apparatus.

Bartonville, a coal-mining town, now has electric lights. The town is about four miles south of this city, and the Peoria Gas and Electric Company has extended its lines and will light the town, using 12 alternating series arcs. The company will also furnish current for commercial lighting.

V. N.

Michigan.

Grand Rapids, August 10.—Jerry Boynton, promoter, has purchased a railroad for $151. The Central Michigan Railroad Company, which is said to be worth $400,000, was sold by Deputy Sheriff Munshaw at the county building to satisfy a mortgage of long standing held by Frank Chase of Ionia, trustee for the Central Trust Company of New York. The trust company foreclosed the mortgage because of alleged failure on the part of the railroad company to pay the interest of the bonds, which is said to amount to $970,833.33. The successful bidder is the promoter of the Grand Rapids Electric Railway, for which a franchise to enter the city was asked some time ago. The Central Michigan Railroad is about 120 miles in length, and the company was organized by Boynton and others in 1888. The railroad was completed over a considerable distance. The road extends from Rogers City in Presque Isle County to the southern state line.

Edward T. Sykes of Minneapolis has made plans and specifications for a municipal-lighting plant in Hancock.

W. E. Tench & Co. of Detroit have been given the contract for the grading of the proposed Lansing-Jackson electric railroad by the Northern Construction Company.

M. Antoine Robert of Montreal is promoting an electric railway to extend from Adrian to Detroit. It will be known as the Detroit and Adrian Traction Company and will be capitalized at $2,000,000. It is said that the company has received liberal franchises from Adrian, Tecumseh and Milan. Outside the cities the road will be built on a private right-of-way. It is said that no bonds will be issued and that the road will not be built on credit, the working being pushed ahead only as the money is forthcoming to pay for it.

L. W. B.

Northwestern States.

Minneapolis, August 10.—The La Crosse Water Power Company proposes to build an electric interurban line from La Crosse, Wis., to Galesville, Wis., and ultimately to Winona, Minn., where it has secured control of the local street-railway system. A line is also proposed from Winona to Rushford, Minn.

Work is to be started shortly, it is reported, on the interurban line projected between Marquette and Negaunee, Mich., by the Lake Superior Railway Construction Company of Cleveland, Ohio.

The La Moure (N. D.) Electric Light and Power Company is installing a new system.

A fire in the building occupied by the Burgess Electric Company of Duluth, caused a loss of $110,000.

The council of Webster City, Iowa, will consider installing a small engine in the electric plant, to furnish current during the day.

The White River Power Company of Ashland, Wis., has completed its dam and will be able to furnish electric power to Ashland by December.

R.

Pacific Slope.

San Francisco, August 7.—The electrical business of this city is growing rapidly in every branch, including lighting, general supplies, electrical machinery and electric-railway business and equipment.

The San Francisco Gas and Electric Company has closed contracts for two additional 11,000-volt three-phase generating units, which are to be installed in the Potrero power station to provide for the increase of business. Two General Electric generators, of 5,000 kilowatts and 8,000 kilowatts capacity, respectively, will be direct-connected to two Curtis steam turbines. Notwithstanding the healthy competition of the City Electric Company, which will begin within less than three months, this large concern will find it necessary to increase its city plants considerably to take care of the growth of business.

F. G. Drum, president of the Pacific Gas and Electric Company of this city, recently made the following explanation of the necessity for levying an assessment by the board of directors of $10 a share: "The Pacific Gas and Electric Company during the calendar year 1906, earned net over and above all liabilities and obligations, including bond interest, sinking funds and debenture retirements, the sum of $690,898.07. For the six months of the present year, ending July 1, 1907, it has earned net $674,374.55, or nearly as much as was earned during the year 1906. From this it is evident that the affairs of the company are in a most prosperous condition from an earning standpoint, and that the surplus upon the above basis should, for the year 1907, amount to $1,800,000. The above net revenue in 1906, and for the first six months of 1907, have been inadequate to take care of the following construction work: First, to rehabilitate the San Francisco system, following the fire of April 18-19-20, 1906; second, to take care of the abnormal growth of the Oakland division, caused by the rapid peopling of that territory; third, in the care of contracts for light and power throughout our entire system, which contracts were made subsequent to April 1, 1906, these principally being in the nature of new cement works, interurban railways and gold dredgers on both the Feather and Yuba rivers. These improvements and extensions in the several plants, made necessary to preserve the integrity of the same, cost approximately $5,750,000. It may be confidently stated that, with the completion of the work in hand, the amount of which is represented in part by the increased debt mentioned, for three or four years to come no extraordinary extension of betterments need be made, and the usual growth of plants can readily be taken care of by the surplus."

The Portland General Electric Company has filed plans with the city engineer for a plant costing $200,000 to furnish steam heat to the business section of the city. Pipes will be laid first along Fourth Street, from Washington and Stark. Section to be served includes from the Willamette River to Twelfth Street, and Glisan to Taylor.

The electric plant at Cottage Grove, Ore., which was destroyed by fire with a loss of about $30,000 with small insurance, will be rebuilt at once. Mr. Welch of Portland is interested in the company.

The election at Cashmere, Wash., resulted in favor of issuing bonds in the sum of $13,200 for construction of electric-light and water systems. The Town Council has ordered the calling of bids for construction. A well will be sunk near the Wenatchee River and a standpipe erected.

Proposing to furnish the cities and towns of King County what additional electric power is needed for all purposes, the Tolt Power and Transportation Company yesterday asked permission of the Superior Court to condemn 146.5 acres of land in Township 26, Range 8 East. It is stated that the company is organized for the purpose of utilizing the waterpower of Tolt River.

A.

PERSONAL.

Arthur von Schlegel, contract agent for the Northwestern Telephone Exchange Company, in Minneapolis, has gone to Detroit, Mich., to take the position of general contract agent for the Michigan Bell Telephone Company, with headquarters at Detroit. Mr. von Schlegel has been in

Minneapolis for 12 years and was for several years local manager of the company.

R. W. Beatty, manager of the Central Union Telephone Company at Washington, Ind., has resigned and will be succeeded by F. R. Rowe of Indianapolis.

D. N. Cameron of Keokuk, Iowa, is manager of the Iowa Telephone Company at Iowa Falls, Iowa, succeeding W. J. Holderness, who is transferred to Des Moines.

Charles H. Newhall of Lynn, Mass., president of the Lynn Gas and Electric Company, has presented the title to 10,000 square feet of land to the Lynn Hospital Corporation. The land adjoins the present grounds of the hospital. Mr. Newhall is vice-president of the hospital corporation.

The American Telephone and Telegraph Company has made Edgar C. Bradley manager of the Pacific Telephone and Telegraph Company of San Francisco and all its holdings. Mr. Bradley was elected third vice-president and general manager, both positions being especially created for him. President H. T. Scott and Vice-presidents Louis Glass and E. J. Zimmer still remain.

An appreciative biographical sketch of George A. Damon, managing engineer of The Arnold Company, Chicago, with an excellent portrait, is the leading feature of the Michigan Technic for June, 1907. The article is from the pen of Prof. M. E. Cooley, and is a cordial recognition of Mr. Damon's ability and energy. Mr. Damon graduated from the University of Michigan in 1895.

The monthly publication Concerning Municipal Ownership says of Mr. Dexter Marshall's recent article in the Western Electrician on the "History of Municipal Telephony in Glasgow" that it is by far the best study of the subject that has yet appeared. "Mr. Marshall is a newspaper man of long experience, whose training enabled him while in Glasgow a year ago to get beneath the surface and ascertain the real facts about the operation of the municipal telephone system."

E. M. Herr, the chief executive of the Westinghouse Electric and Manufacturing Company, under Mr. Westinghouse, has had exceptional experience as an engineer and manufacturer. He was for a time the successful head of the locomotive department of the Northern Pacific Railroad, where he showed great tact in the management of men and won a national reputation for his expert skill in the construction and operation of locomotives. In 1898 he became vice-president and general manager of the Westinghouse Air Brake Company, and it was his remarkable record in that position which undoubtedly prompted Mr. Westinghouse to place Mr. Herr in charge of the electric company. Mr. Herr became vice-president of the electric company in 1905, and his connection has proved most effective.

ELECTRIC LIGHTING.

Yegen Bros. will construct an electric-light plant at Billings, Mont.

W. H. Horton will put in an electric-light and heating plant at Heber, Ark.

Falls City, Neb., has issued $10,000 in bonds for improvements on its electric-light plant.

Plans have been prepared for a city electric-light plant at Tecumseh, Neb., to cost about $20,000.

The Fremont (Neb.) Gas and Electric Light Company has been incorporated with a capital stock of $150,000.

The Consumers' Power and Light Company of Waco, Texas, has been incorporated with a capital stock of $150,000.

W. F. Davis and others are incorporating an electric-light and ice plant, with a capital stock of $200,000 at Waurika, Okla.

The Minneapolis (Minn.) Heating and Transmission Company is seeking a franchise for an electric-light and heating plant.

The American Electric Company has been incorporated in St. Joseph, Mo., with a capital of $50,000, half paid, by Luther E. Reid and others.

The City Council of Pine Bluff, Ark., has rejected the municipal-ownership scheme and has renewed the contract for lighting for five years.

The Attleboro (Mass.) Gas and Electric Light Company has been authorized to issue 700 shares of stock at the par value of $100 per share, the proceeds to be used to pay for additions to its plant.

At an election held in Sparta, Tenn., recently, upon the question of whether the town should issue $40,000 in bonds with which to own and operate a municipal electric-light and waterworks plant, the proposition was defeated by a vote of 95 to 18.

The Massachusetts gas and electric-light commissioners have given authority to issue 600 shares of stock to the Electric Light and Power Company of Abington and Rockland, to be sold at $100 a share. The proceeds are to be used for paying for additions to the company's plant, made before January 1, 1906.

The Gardner Electric Light Company of Gardner, Mass., has petitioned for authority to issue additional stock amounting to $35,000 and bonds amounting to $65,000, the proceeds to be used to pay for additions to the company's plant and to meet floating indebtedness.

ELECTRIC RAILWAYS.

Th municipality of Buenos Ayres, Argentina, advertises for short-term tenders for the construction of underground electric tramways.

It is reported in railway circles that the Aurora, Elgin and Chicago Electric Railway officials are planning a branch from the third-rail line to Naperville, to be built next year.

An electric line between Elgin and Sycamore is being projected by Chicago capitalists, who have already made preparatory plans for an interurban line between Elgin and Sycamore.

The request of the United States Steel Corporation at Gary, the city the steel company built, for a referendum on the disposition of the new street-railway franchise there has been denied by the Gary Board of Trustees.

During the Boston Old Home Week the Boston Elevated Railway Company transported about 9,000,000 passengers, against the normal weekly average of 5,043,600 last year. The receipts from fares during Old Home Week were $300,000.

The permanent survey of the proposed electric line of the Louisville and Northern Railway and Light Company from New Albany to French Lick and West Baden Springs has been completed and the corps of surveyors have begun the permanent survey of the proposed line of the company to Corydon.

The news comes from Oakland, Cal., that as a part of the scheme of electrifying the suburban train service the Southern Pacific will soon build on the estuary a large electric power plant. The plans for the power house have been finished, and Engineer Babcock has gone East to submit them to Harriman.

A really handsomely illustrated folder of the Inland Empire System, operating in the state of Washington, announces that with the inauguration on August 1st of freight and passenger service from Rosalia to Colfax the lines of the system will aggregate 200 miles. The lines extend into the prosperous Cœur d'Alene mining country from Spokane.

The increasing business of the Northern Texas Traction Company has rendered it necessary to again add to the capacity of the power house at Handley. The capacity of the power plant has already been doubled since the interurban was built five years ago, and the present enlargement will make it one of the largest power plants southwest of St. Louis.

The New York Public Service Commission's inquiry has brought out the fact that the original charter of the Manhattan Railroad Company, which operates all the elevated roads in the city as a part of the Interborough system, provides that a passenger who can obtain no seat need not pay fare. The charter dates from 1875, and it does not appear that this provision has ever been superseded.

Announcement is made that the DeKalb-Sycamore (Ill.) and Interurban Railway Company has financed its projected extension northward from Sycamore to Belvidere, and that building operations will begin when material can be secured. The construction of these 23 miles will give Janesville, Wis., good electric connections with Sycamore and DeKalb and numerous cities between those two places and surrounding.

The second tube of the Belmont Tunnel under the East River between Manhattan and Long Island City, N. Y., was completed last week, and the event was signalized by the engineers and others employed on the work with sports, feasting and some ceremony at the mouth of the tunnel at West and Fourth streets, Long Island City. Every workman received an extra day's pay. Since the work was started, a year ago last October, there have been 18 fatalities in the tunnel.

The New York Metropolitan Street Railway Company has decided to try the "pay-as-you-enter" cars and has ordered 100 of them. The new cars are odd-looking affairs. The rear platform is twice as large as on the ordinary street car, and is fitted with a modification of the rail and turnstile arrangement sometimes seen at elevated stations. A small railing, within which the conductor stands and collects the fares as the passengers get on the car, stands in the center of the platform. There are two doors instead of one opening into the car, the left for those entering the car and the right for those getting off. The doors in the front of the car are controlled by the motorman, who sees to it that only passengers leaving the car pass through them. The "pay-as-you-enter" car has been a success in Montreal.

New York city is pressing the Interborough Metropolitan Company to change the type of cars in the subway. The commissioners are inclined to believe that the Illinois Central type of car as used in Chicago is best adapted to the heavy traffic conditions. This car has 12 side doors and is considered more efficacious in handling passengers than the Boston car, which has only one side entrance. The change would mean an expenditure of $3,250,000 by the company.

The walls and roof of the Park Avenue tunnel leading from the New York Grand Central Station are whitewashed by a pneumatic spraying machine. The other day while an open surface car was alongside the apparatus the hose burst and the motorman, observing something wrong, stopped his car at the psychological moment. The motorman and 15 passengers were added to the list of those who are said to be imitating Mark Twain and James J. Hill in the matter of wearing white clothing.

A double-tracked electric line between Minneapolis, Minn., and the Gulf, is the avowed purpose of a company which has been chartered with $50,000,000 capital stock under the name of the Minneapolis, Kansas City and Gulf Railway Company, with headquarters at Minneapolis. The proposed route is via Des Moines, Kansas City, Wichita, Guthrie, Oklahoma City, Dallas, Waco, Houston and Galveston, with branch lines connecting Topeka, Omaha, St. Joseph and Lawrence, Kan. C. B. Holmes, former president of the Chicago City Railway, is chairman of the board of directors.

RADIO-TELEGRAPHY.

As a result of the experiments at Vienna of Reithoffer and Norawetz, it is now possible to regulate clocks by wireless telegraphy with considerable success. In that instance the clock was controlled by wireless impulses from a regulator 3¾ miles away, and it kept perfect time, with no interference from stray currents.

A German engineer named Heinicke has invented an apparatus for radio-telegraphy for short-distance service which can be transported from point to point with remarkable ease and rapidity. The transmitting and receiving apparatus are both fitted in one small case, with a weight of approximately 40 pounds, which can thus be carried on a man's back. The weight of the pole for the wires and other accessories is approximately 100 pounds, so that an entire station weighs approximately 140 pounds.

POWER TRANSMISSION.

Fayetteville, N. C., is promised electric power transmitted from the Cape Fear Electric Power Company at Buckhorn Falls by the first of January, 1908.

H. A. Orr, president of the Savannah River Power Company, capitalized at $8,500,000, announces that the Calhoun Falls property will be developed this summer, with 35,000 horsepower.

By the explosion of dynamite against a retaining wall the tail-race of the hydro-electric power development on the Chicago Drainage Canal near Lockport, Ill., was filled with water from Lake Michigan on August 6th. The exact date for putting the plant in service has not been fixed.

An extensive project for the utilization of hydro-electric power is reported for the Chicago, Milwaukee and St. Paul Railway in the controlling of 35 miles of the St. Joe River between North Fork and St. Joe in Northern Idaho, east of Spokane, Wash. The scheme contemplates the development of 180,000 horsepower from the river, a part of which will be used as motive power on the adjacent sections of the railroad.

The big power project now in course of construction at the head of Packwood Lake, in the Cascade Mountains, is well under way, and some five miles of canal have already been built. The project involves the construction of a canal 50 miles long from Packwood Lake to a point above the Cowlitz River, where, at Snyder's ranch, the power plant will be located. It is estimated that the water at this point will have a fall of 1,500 feet and will be capable of developing 100,000 horsepower.

PUBLICATIONS.

"Paistery," for August, or Bulletin No. 46 of H. T. Paiste Company, Philadelphia, illustrates a few of the many wiring specialties manufactured by this house. These include switch boxes, panel boxes, receptacles, plugs, rosettes and cut-outs. Those persons interested in shop management will read with profit about the precise system of checking during manufacture, assembly and inspection, which prevails in the Paiste company's factory, and leaves a permanent record to be filed away.

T. J. Cope, manufacturer of underground electrical specialties, of 3244 North Fifteenth Street, Philadelphia, has sent out a little booklet illustrating some of his apparatus and methods for underground cable construction. The design of these appliances shows the results of an experience covering over 20 years in underground conduit work, while many of the devices have been designed from time to time under the spur of practical necessity. One of Mr. Cope's appliances is "the only machine in the world for threading electrical conduits."

SOCIETIES AND SCHOOLS.

Colorado College will spend between $12,000 and $15,000 in improvements and new equipment before college opens in September. To the electrical laboratory is being added a room 25 by 50 feet, making a total floor space of 1,250 square feet, and large additions will be made for the wood-working, machine-tool, forge and testing laboratories. Electric-motor drive is being installed in all the departments.

The board of directors of the American Electrochemical Society held a meeting in Philadelphia during the last of July and elected a number of prominent chemists members of the organization. New managers of the society and members of the board were chosen at a previous meeting and were: Prof. S. A. Tucker, Columbia University; Mr. F. A. J. Fitzgerald and Mr. F. S. Tone, both of Niagara Falls. The next meeting of the society will be held in New York early in October. The president is Prof. C. F. Burgess of the University of Wisconsin.

MISCELLANEOUS.

It is said that the Jamestown Exposition is now practically completed.

The Independent Canning Company is fitting up an additional sardine-canning factory in Eastport, Maine, which will be electrically operated.

The Central of Georgia Railway Company will electrically equip its shops in Columbus, having signed a contract with the Columbus Power Company for current. The Central seems to be adopting electricity as its standard power for shops, as it has awarded a contract for an electrical installation in its Savannah shops, and the road's new million dollar shops now being built at Macon will be driven by the same power.

A fluid invented by a Monterey (Mexico) man and manufactured in that city, designed for the purpose of cleaning steam boilers of scale or preventing the formations thereof, is meeting with great success. It is said to remove effectually scale from boiler tubes and to work no injury to the tubes or to the boiler shell. The compound has been introduced into various countries in America and Europe. It is manufactured wholly from vegetable substances from plants found in Mexico and is developing into a large local industry.

This curious story is told in a newspaper dispatch from Atlanta, Ga., dated August 8th: "Alleging that she was completely disrobed by a live wire, Mrs. Maude S. Orr has sued the Georgia Railway and Electric Company for $10,000 damages. Mrs. Orr was shopping on Whitehall Street when the broken end of a guy wire, which had been charged in some way, touched her belt. The shock tore off the belt and most of Mrs. Orr's clothing. In addition to this humiliation, Mrs. Orr alleges that the shock caused her serious physical injury."

TRADE NEWS.

The Canadian General Electric Company will erect a five-story office building, costing $180,000, on the northwest corner of King and Simcoe streets, Toronto.

Bids will be received until August 27th at the City Hall of Trenton, Ill., for furnishing and erecting addition to building, engine, dynamo, switchboard, heater, boiler-feed pump, piping and pole-line material, for extending the present direct-current three-wire lighting system of that place. Specifications are on file at the office of Newton Rebe, city clerk, at Trenton, Ill., and at the office of the engineer, W. A. Fuller, 1122 Chemical Building, St. Louis, Mo.

The Battery Light and Power Company is reported as having been organized with a capital of $5,000,000 to exploit an invention of Frank Curtis of Milwaukee, Wis., relating to a new primary battery to which some reference has already been made in the Western Electrician.

Tenders are invited until October 1st by the Swedish government for three 350 kilowatt direct-current generators, one accumulator battery of 4,800 ampere-hours capacity, four three-phase generators, each of a maximum of 11,000 kilovolt amperes, 12 transformers, each of a maximum of 3,070 kilovolt-amperes, cables, switchboard, etc. Particulars may be had for 50 kroner ($13.40) by addressing the managing director, Royal Trollhattan Canal and Waterworks, Trollhattan, Sweden.

In the suit of the Westinghouse Electric and Manufacturing Company against the Wagner Electric Manufacturing Company of St. Louis, Mo., on Westinghouse oil cooled transformer patent No. 366,362, the master has awarded damages to the Westinghouse company amounting to $132,433.35. This amount is the master's estimate of the defendant's profits from the sale of the transformers in question. A preliminary injunction was issued on July 15th by the United States Circuit Court for the Southern District of New York in the case of the Westinghouse Electric and Manufacturing Company against the Wagner Electric Manufacturing Company for infringement of Stanley patent No. 469,809. This refers to self-regulating transformers.

BUSINESS.

The Pacific Coast Pole Company of Spokane, Wash., is distributing an attractive souvenir in the shape of a glass paper-weight with a mirror in the reverse side. The company is a well-known producer of Idaho cedar poles, and its friends will appreciate this useful memento.

ILLUSTRATED ELECTRICAL PATENT RECORD.

Issued (United States Patent Office) August 6, 1907.

862,127. Centrifugal Switching Device. Carl B. Auel, Wilkinsburg, Pa., assignor to the Westinghouse Electric and Manufacturing Company, Pittsburg, Pa. Application filed December 3, 1906.

A conducting ball is so mounted as to close a circuit between ring contacts by centrifugal force at a given speed.

862,135. Automatic Trolley Retracting Mechanism. Henry B. Clarke, Highland Park, Ill. Application filed March 1, 1906.

Sudden tension in the trolley cord opens valves allowing fluid pressure, such as compressed air, to enter a cylinder whose piston applies a clutch to the trolley reel.

862,145. Process of Making Seamless Tubular Pockets or Receptacles for Storage Battery Electrodes. Thomas A. Edison, Llewellyn Park, Orange, N. J., assignor to the Edison Storage Battery Company, West Orange, N. J. Application filed April 28, 1905.

The process consists in depositing a thin film of copper on a suitable mandrel, then depositing a nickel tube on the copper film, and finally rolling the nickel tube to separate it from the mandrel.

862,146. Electrically Heated Shaft Furnace. Johannes S. Edström, Vesteras, Sweden. Application filed March 30, 1906.

A primary winding is arranged on an iron core enveloped by fireproof material which forms the hearth of the furnace.

862,159. Trolley. Aaron Hill, Lynn, Mass. Application filed March 2, 1907.

The trailing trolley-pole proper is mounted at its lower end on a pivoted arm of such length as to bring the trolley wheel practically over the deck pivot. An arrangement of gears and shafting enables the trolley to be reversed from the inside of the car without the wheel leaving the wire.

862,168. System of Control for Electric Motors. Henry D. James, Pittsburg, Pa., assignor to the Westinghouse Electric and Manufacturing Company, Pittsburg, Pa. Application filed November 13, 1905.

A resistance is placed in the circuit at the secondary winding of an alternating-current motor having primary and secondary windings. A generator is operated by the motor to supply energy for controlling the operation of means for removing the resistance from the circuit. There are also means for closing the circuit of the auxiliary generator through a braking resistance and the primary winding of the motor.

862,191. Trolley Wheel. Piatt M. Orlopp, Indianapolis, Ind. Application filed July 12, 1906.

The trolley harp has elastic arms so that the axis of the wheel may be slightly inclined to follow the wire.

862,192. Controlling Means for Electric Motors. William A. Paris, Edgewood Park, Pa., assignor to the Westinghouse Electric and Manufacturing Company, Pittsburg, Pa. Application filed December 4, 1905.

Apparently for driving machine tools where the direction of drive must be continually reversed, the control and reversing switches are actuated by a limiting device comprising a screw-threaded shaft driven by the motor and on which a traveling nut is located to move between fixed pawls.

862,198. Suspension Means for Electric Motors. Charles A. Psilander, Pittsburg, Pa., assignor to the Westinghouse Electric and Manufacturing Company, Pittsburg, Pa. Application filed December 27, 1906.

The truck frame is resiliently supported by members seated on the bearings which are surrounded by the side portions of the motor supports.

862,209. Electric Signal System. Alfred L. Sohm, Los Angeles, Cal., assignor to the National Electric Works, Los Angeles, Cal. Application filed September 22, 1906.

A combination of electromagnets controlling figured wheels which combine to present the number corresponding to the station from which the signal was sent.

862,211. Insulator Support. William Steiner, Muskegon, Mich. Application filed March 24, 1906.

The support comprises a pole having radial arms which hold a ring having segments to support the insulators.

862,226. Motor Regulator. George H. Whittingham, New York, N. Y., assignor to the Automatic Switch Company. Application filed July 16, 1903.

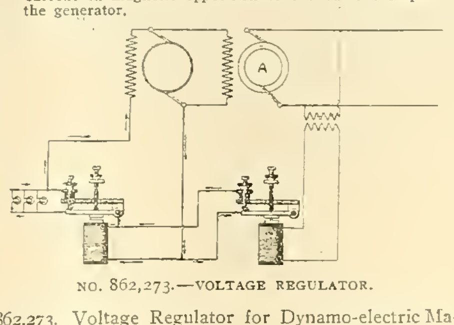
Mechanical and electrical means are combined for respectively varying the armature and field circuits of an electric motor by auxiliary electrical circuits.

862,242. Telephone Attachment. Theodore Endean, Cleveland, Ohio. Application filed April 16, 1906.

A writing pad with feed roll may be attached to the standard of a desk instrument.

862,272. Field Regulator for Dynamos. George S. Neeley, St. Louis, Mo. Application filed June 18, 1906.

The field is regulated by the automatic insertion of resistance through switches operated in response to differential magnetic forces resulting from placing the field current in magnetic opposition to the current output of the generator.



NO. 862,273.—VOLTAGE REGULATOR.

862,273. Voltage Regulator for Dynamo-electric Machines. George S. Neeley, St. Louis, Mo. Application filed November 30, 1906.

The regulation is secured by a principle similar to that in the same inventor's preceding patent. (See cut.)

862,274. Voltage Regulator for Dynamo-electric Machines. George S. Neeley, St. Louis, Mo. Application filed November 30, 1906.

The intensity of the exciter field current and the voltage of the exciter work in electromagnetic opposition to the force of a spring.

862,277. Spring for Trolleys and Harps. Ralph E. Noble, Chicago, Ill. Application filed January 13, 1905.

A bent strip of spring metal has a loop formed at one side at the point of bending and holes in the free ends to engage the axle of the trolley harp.

862,329. Sparking Dynamo and Governor. Albert P. Griebel, Woodstock, Ill. Application filed September 11, 1906.

The governor mechanism comprises a spring-regulated field coil, which is opposed by the action of a magnet.

862,333. Method of Creating a Vacuum. Peter C. Hewitt, New York, N. Y., assignor to the Cooper Hewitt Electric Company, New York, N. Y. Application filed July 1, 1904.

The method of creating a high vacuum in an inclosed chamber containing mercury and also a material incapable in its natural state of combining with the gases in the chamber, consists in exhausting and sealing the chamber by any approved process, and afterward amalgamating the inactive material, producing in it a change of condition such that it will absorb or combine with the gases within the chamber.

862,334. Coin Collector. Howard B. Holmes, Park Ridge, and Edward B. Craft, Chicago, Ill., assignors to the Western Electric Company, Chicago, Ill. Application filed February 13, 1906.

The slot chute delivers the coin to a grooved guide rail with which it makes a signaling contact. A grooved arm engaging the top of the coin is operated by electromagnets to throw the coin into either the cash or refund box on opposite sides of the rail.

862,344. Electric Time Switch. Max Neumann, Munich, and Siegfried Regensteiner, Pasing, Germany. Application filed September 6, 1905.

A contact lever is engaged by a bar lever which projects into the path of the descending clock weight, but is so released when the weight descends upon a second lever, as to close the circuit.

862,350. Trolley Wheel. Harry B. Sawyer, Cleveland, Ohio. Application filed February 20, 1905.

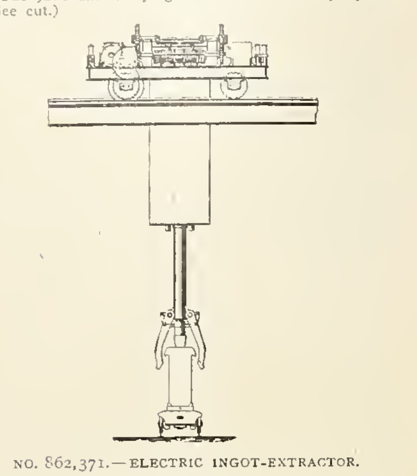
The tread portion comprises a sectional grooved ring.

862,361. Electrical Apparatus. Wilbur H. Thompson, Wilkinsburg, Pa., assignor to the Westinghouse Electric and Manufacturing Company, Pittsburg, Pa. Application filed July 17, 1905.

A transformer applicable for giving varying potentials at the secondary, is described. The primary winding is on one of the yokes linking two pivoted iron spools on which flexible secondary windings are so wrapped as to be transferable from one spool to the other, resulting in cumulative or substractive inductive relations. The secondary windings are led out through slip-rings and an arrangement of gears connects both spools to be turned by a hand-wheel.

862,371. Electric Ingot Extractor. Henry Aiken, Pittsburg, Pa. Application filed April 27, 1904.

The jaws and carrying truck are electrically operated. (See cut.)



NO. 862,371.—ELECTRIC INGOT-EXTRACTOR.

862,380. Adjustable Box for Switches and the Like. Max D. Baron, New York, N. Y. Application filed February 24, 1906.

A two-piece wall box has a cover portion provided with a socket which is variously adjustable.

862,397. Electric-light Cluster. Louis Hruska, Chicago, Ill., assignor of one-half to George De Blois, Chicago, Ill. Application filed March 27, 1905.

Details of construction are given.

862,400. Magnetic Transmission Mechanism. Frantz Jensen, Copenhagen, Denmark. Application filed March 15, 1905.

In a set of electromagnetic reversing gears, between the driving and the driven bodies are intermediate devices constituting two alternative series for rotating the driven body forward or backward.

862,402. Printing Telegraph. Charles L. Krum, Chicago, Ill. Application filed October 6, 1904.

Shifters, electrically operated, serve to move a type carrier in successive different directions making an angle with each other.

862,409. Treating Sheet Metal by Electrolysis. Josef Müller, Schönau, near Schluckenau, Austria-Hungary. Application filed April 18, 1906.

By this process of electroplating the edges of a number of individual sheets or plates are temporarily connected to form a continuous band, which is passed through the electrolyte.

862,423. Telegraphic Transmitter for the Morse System. Theodorus C. Van de Stadt, Aardenburg, Netherlands, assignor of one-half to Josephine Shelton, New York, N. Y. Application filed April 2, 1907.

A series of keys operate contact arms which engage contacts on a revolving roller to form the Morse characters.

862,441. Electric Controlling System. Charles P. Breese, Norfolk, Va., assignor to the Hall Signal Company. Application filed August 11, 1902.

The invention contemplates dividing the trolley line into sections, each fed through electromagnets at local and adjacent sections, which affect the connections of each section so that two cars connected with the same section are mutually controllable.

862,442. Electric Car-controlling System. Charles P. Breese, Norfolk, Va., assignor to the Hall Signal Company. Application filed August 11, 1902.

This patent covers an addition to the preceding one by the same inventor, for controlling the amount of current fed to a section in front of the section to which the electromagnet is connected, as well as that fed to a section in the rear.

862,449. Hook Switch. Edward B. Craft, Chicago, Ill., assignor to the Western Electric Company, Chicago, Ill. Application filed April 9, 1906.

One of the contact springs is long and curved, to be pressed by an insulating stud on the hook arm.

862,478. Watch-service Recorder. Howard B. Holmes, Park Ridge, Ill., assignor to the Western Electric Company, Chicago, Ill. Application filed October 20, 1905.

A carrier having a threaded block is advanced by a continually moving worm shaft when brought into engagement by an electromagnet, which also controls a signal-marking device.

862,485. Trolley Wheel. Josiah R. Kidney, East Hampton, Conn., assignor to the East Hampton Bell Company, East Hampton, Conn. Application filed February 25, 1907.

A bushing which closely fits the hub has exterior grooves in which wood plugs are inserted.

862,497. Holder for Telephone Receivers. William J. Mogridge, Spokane, Wash. Application filed November 16, 1906.

A hinged arm supported from the standard, holds the receiver in position for the ear. When not in use, the receiver is pushed back where it rests on an extension, depressing the hook.

862,506. Induction Coil Unit. Carl A. Pfanstiehl, Highland Park, Ill., assignor to the Pfanstiehl Electrical Laboratory, North Chicago, Ill. Application filed December 27, 1906.

The induction coil is designed to be built up of sections connected by wires through small passages arranged in the spool heads.

862,513. High-potential Circuit-breaker. Laforest G. Robinson, Plattsburg, N. Y. Application filed December 12, 1905.

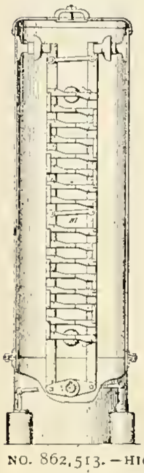
The circuit is broken at a number of points by means of two engaging rows of contact springs carried on oppositely movable insulating bars. (See cut.)

862,520. Electrical Rosette. James S. Stewart, New York, N. Y., assignor to Annie Stewart, New York, N. Y. Application filed July 21, 1906.

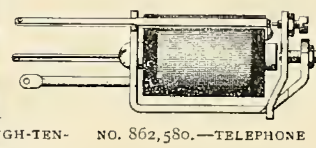
The rosette has a protuberance with inclined slots in its lateral faces, over which a housing fits to clamp a pair of extension wires in the slots.

862,532. Electric Transformer. Isaac Anderson, Tacoma, Wash., assignor of one-third to Hans Anstenson, Puyallup, Wash., and one-third to Alfred Sundell, Tacoma, Wash. Application filed April 29, 1907.

The primary coil has a horseshoe core formed of spaced and insulated plates, notched to form tongues which are disposed in staggered order. The secondary coil is similarly constructed, with tongues opposite those of the primary. Provision is made for air cooling.



NO. 862,513.—HIGH-TENSION CIRCUIT-BREAKER.



NO. 862,580.—TELEPHONE RELAY.

862,542. Cable Terminal and System of Protection. Frank B. Cook, Chicago, Ill. Application filed January 18, 1906.

The cable terminal is mounted on a circular sheet-metal base plate around whose edges are fastened suitable insulators and metal strips to support the terminal.

862,543. Cable Terminal. Frank B. Cook, Chicago, Ill. Application filed May 28, 1906.

A pair of flat sheet metal protector mounting strips are set vertically on a suitable base with space between throughout their extent and formed to accommodate lightning protective apparatus.

862,580. Relay. Frank R. McBerty, New Rochelle, N. Y., assignor to the Western Electric Company, Chicago, Ill. Application filed July 16, 1906.

The armature is mounted in knife-edge bearings and is prevented from coming unseated by the unthreaded portion of a screw which also serves as a back-stop. (See cut.)

862,582. Trolley Switch Frog and Pole. Augustus Neubert, Elizabeth, N. J. Application filed February 15, 1906.

The frog is described as composed of spaced plates on opposite sides of the trolley wires and having outwardly-curved, inwardly-projecting, oppositely-disposed lugs in the spaces between the wires.

862,589. Automatic Electric Signaling Device. Avila J. Roy, Providence, R. I., assignor of one-half to Auguste Zenon Trachy, Providence, R. I. Application filed March 9, 1906.

A depressible contact actuated by a train passing the semaphore closes the circuit of a bell located in a distant station.

862,616. Telephone System. William W. Dean, Chicago, Ill., assignor to the Kellogg Switchboard and Supply Company, Chicago, Ill. Application filed September 3, 1901.

Battery feed is by the Stone quartered repeating coil system. The two sides of the cord-circuit are led through two windings on the single supervisory relay. The line relay has a back contact which serves to hold up the cut-off relay, when the plug is in the jack.

862,618. Coupling for Lead-covered Electric Cables. John J. Dossert, New York, N. Y., assignor to Dossert & Co. Application filed January 19, 1904.

This mechanical connection for lead-covered cables comprises a coupling having compressible rings within the spread ends of the sheathing, inter-engaging coupling sections.

862,660. Rosette for Electric Wiring. William F. Ritter, Cincinnati, Ohio. Application filed October 28, 1905.

Details of the construction of the fitting are given.

862,696. Governing Mechanism for Pneumatic Tube Systems. Birney C. Batcheller, Philadelphia, Pa., assignor to the Pearsall Pneumatic Tube and Power Company, New York, N. Y. Application filed March 21, 1905.

A piston acted on by the line pressure is opposed by a spring, and operates the switch-arm of a governing device for the motor which drives the compressor.

862,701. Trolley Wheel. William H. Bradt, Schenectady, N. Y. Application filed December 5, 1906.

The trolley wheel consists of two independent halves, running on the same axle.

862,713. Telephone Exchange System. Merritt S. Conner, Rochester, N. Y., assignor to the Stromberg-Carlson Telephone Manufacturing Company, Rochester, N. Y. Application filed May 28, 1904.

Impedance coil-condenser system of battery feed is used. The cut-off relay is differentially wound and is the only one depending on current directional relations.

862,723. Annunciator System. Wolfgang E. Ebert, St. Louis, Mo. Application filed May 19, 1906.

Operation of one signal locks all other machines against movement.

862,740. Electric Controlling Device. Martin Kallmann, Berlin, Germany. Application filed June 1, 1905.

Each branch of a shunted circuit has a constant resistance connected in series with a variation resistance, while another constant resistance in the common path absorbs the greater portion of the working pressure. The variation resistance has a high temperature coefficient and is capable of becoming incandescent by the passage of a current. A bridge connects the branches at opposite ends and contains indicating means acted upon by all the changes of potential.

862,758. Insulator. Austin A. Pratt, Los Angeles, Cal. Application filed October 25, 1906.

The insulator comprises a body portion with a transverse bore and tube containing a pin which supports resistance coils clamped in contact with the ends of the tube.

862,776. Dynamo-electric Machinery. William L. Waters, Milwaukee, Wis., assignor to the National Brake and Electric Company, Milwaukee, Wis. Application filed December 9, 1905.

The manner of construction of a squirrel-cage armature is described.

862,781. Electro-therapeutic Apparatus. Leonidas G. Woolley, Lima, Ohio, assignor to Stephen A. MacMahon, Lima, Ohio. Application filed May 28, 1906.

A faradic coil furnishes current to electrodes placed in a nonconducting vessel, for therapeutic treatment.

862,783. Electrolytic Cell. Edward A. Allen, Rumford Falls, Me., assignor to the Allen Electro-chemical Company, Rumford Falls, Me. Application filed July 17, 1905.

The cell comprises a tank having decomposing and oxidizing compartments containing a mercury cathode and an anode in the decomposing compartment. A return-flow conduit for amalgam extends between opposite portions of the tank, which is arranged to heat the amalgam in the return-flow conduit.

862,842. Rheostat. Edwin F. Northrup, Philadelphia, Pa., assignor to the Leeds and Northrup Company, Philadelphia, Pa. Application filed May 3, 1907.

An insulated electrical conductor is spirally wound, forming a hollow tube which has a portion bare of insulation furnishing a contact surface.

PATENTS THAT HAVE EXPIRED.

Following is a list of electrical patents (issued by the United States Patent Office) that expired August 12, 1907:

434,948. Electric Conductor Terminal. C. A. Lieb, New York, N. Y.
434,007. Machine for Covering Insulated Conducting Wire with Lead. L. W. Tracy, New York, N. Y.
434,008. Machine for Covering Insulated Conducting Wire with Lead. L. W. Tracy, New York, N. Y.
434,017. Method of Welding Metals by Electricity. H. E. Fowler, New Haven, Conn.
434,030. Electric Railway. R. M. Hunter, Philadelphia, Pa.
434,036. Trolley for Electric Railways. J. H. Wehrle, Newark, N. J.
434,063. Brake Mechanism for Electric Street Cars. J. Illingworth and A. M. Baker, Cleveland, Ohio.
434,076. Underground Electric Conduit. F. G. C. Zopke, Berlin, Germany.
434,087. Electric Rail Connector. C. A. Lieb, New York, N. Y.
434,093. Secondary Battery. P. Schoop, Zurich, Switzerland.
434,144. Electric Insulator. J. K. Dunbar, Austin, Tex.
434,147. Electric Railway. R. M. Hunter, Philadelphia, Pa.
434,148. Electrically Propelled Vehicle. R. M. Hunter, Philadelphia, Pa.
434,149. Cut-out and Connection for Electrical Apparatus. C. J. Klein, New York, N. Y.
434,151. Switch for Electric Circuits. P. Lange, Pittsburg and O. B. Shallenberger, Rochester, N. Y.
434,152. Switch for Electric Circuits. P. Lange, Pittsburg, Pa.
434,153. Incandescent Lamp Socket. P. Lange, Pittsburg, Pa.
434,154. Electric Indicator. L. Lange, Pittsburg, Pa.
434,162. System of Electrical Distribution. O. B. Shallenberger, Rochester, and Henry M. Byllesby, Pittsburg, Pa.
434,163. Protector for Electric Machines. L. B. Stillwell, Pittsburg, Pa.
434,164. Core for Electrical Apparatus. C. A. Terry, Pittsburg, Pa.
434,165. Subway for Electric Conductors. G. Westinghouse, Jr., Pittsburg, Pa.
434,166. Electric Arc Interrupter. A. Wurts, Pittsburg, Pa.
434,167. Lightning Arrester. A. Wurts, Pittsburg, Pa.
434,168. Safety Fuse for Electric Circuits. A. Wurts, Pittsburg, Pa.
434,169. Electric Safety Fuse Box. A. Wurts, Pittsburg, Pa.
434,170. Lightning Arrester. A. Wurts, Pittsburg, Pa.
434,206. Armature for Dynamos. A. Schmid, Alleghany, Pa.
434,261. Printing Telegraph. T. M. Foote, Boston, Mass.
434,275. Electric Railway. R. M. Hunter, Philadelphia, Pa.
434,276. Current Collecting Device for Electric Cars. R. M. Hunter, Philadelphia, Pa.
434,301. Method of Making Electrodes for Secondary Batteries. P. Schoop, Zurich, Switzerland.

WESTERN ELECTRICIAN

EVERY SATURDAY

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Blue Island Power Station of the North Shore Electric Company of Illinois.

Three large central-station companies supply Chicago and its suburbs with electric light and power. The downtown district is the territory of the Chicago Edison Company. All the rest of the city is furnished by the lines of the Commonwealth Electric Company. The broad fringe of suburban towns surrounding the city is supplied by the North Shore Electric Company, which company has set out to acquire the old power stations built by small local concerns and to replace them all with four interconnected large modern central stations.

As will be seen from the map of Chicago and neighborhood, Fig. 3, the region served by the North Shore Electric Company contains a number of towns and villages whose total population is about 200,000. The names and general position of these places are as follows:

North of Chicago—Waukegan, Libertyville, Lake Bluff, Lake Forest, Fort Sheridan, Highwood, Highland Park, Ravinia, Glencoe, Gross Point, Wilmette and Evanston.

Northwest of Chicago—Edison Park, Park Ridge, Desplaines and Niles.

West of Chicago—Maywood, Melrose Park, Elmhurst, River Forest, La Grange and Grossdale.

South of Chicago—Morgan Park, Harvey, Homewood, Flossmoor, Thornton, Chicago Heights, Steger and Crete.

The four new plants when all are completed will be located at Waukegan, Evanston, Maywood and Blue Island. The first one of these new stations to go into operation was that at Maywood, which was the subject of a very complete illustrated article in the Western Electrician of February 16th.

On the evening of July 3d steam was turned into the turbines of the second and by far the largest of the North Shore stations, that at Blue Island, 18 miles south of the center of Chicago. Since then, while the finishing touches of construction have been added, the plant has been giving good service.

In explanation of the name Blue Island it deserves to be pointed out that despite the fact the term sounds of waves and lake breezes, the region probably owes its name to a remarkable ridge, with a crest extending for several miles, in the midst of an otherwise flat country. Of suspected glacial origin, this ridge was the first to appear above the waters of the prehistoric lake that once filled the bed of Lake Michigan and had its shores far back in the higher land of Illinois. With the establishment of the present water level, the band of flat country in which Chicago lies was exposed, leaving the Blue Island ridge 10 miles inland. While the strict literal value of the name has thus passed, Mr. McKenzie, the chief engineer of the Blue Island station, after a year's residence in the neighborhood during the construction of the plant, avers that the real reference of the name is to the violence of the winds that prevail there at times.

The present station is the only one of this company which has been designed for the double duty of generating both lighting and railway current. Chicago Heights, Thornton, Homewood, Flossmoor, Crete and Steger are for the present supplied with 60-cycle alternating current at 10,000 volts, while the nearby town of Harvey receives current at the bus voltage of 2 300/4,000. When completed the Chicago and Southern Traction Company's line to Kankakee will be operated from this station, though the only part on which cars are running now is between Steger and the corner of Sixty-third Street and South Park Avenue, Chicago. The track and trolley wire are already complete the whole length of the road, and the Blue Island station will soon be called upon to furnish its full load to the traction company's sub-stations along the line.

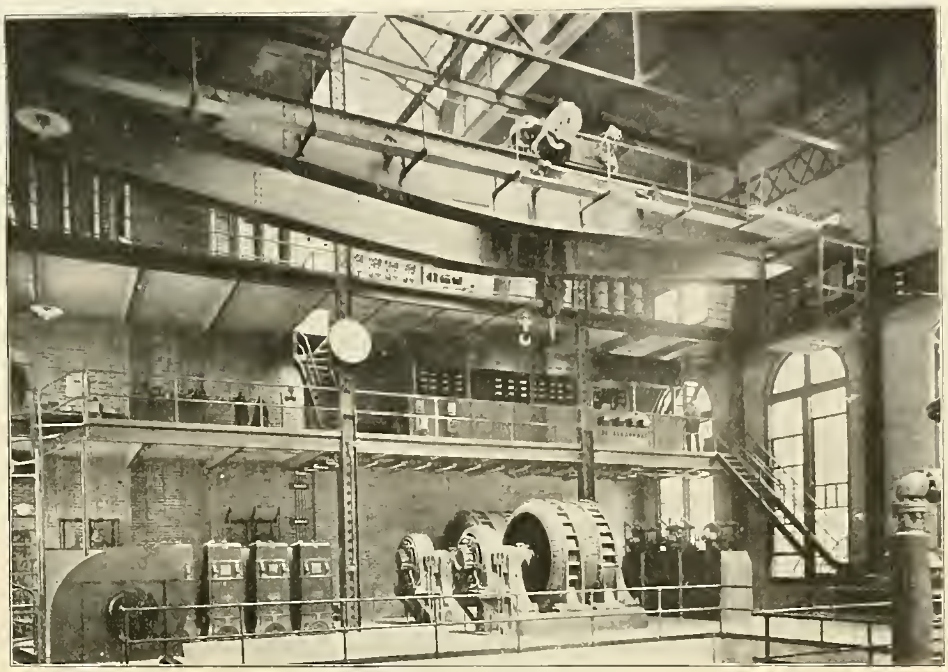

Fig. 1. North End of Generator Room, showing Transformers, Frequency Changers, Switchboard Gallery, Lightning Arresters and Traveling Crane.

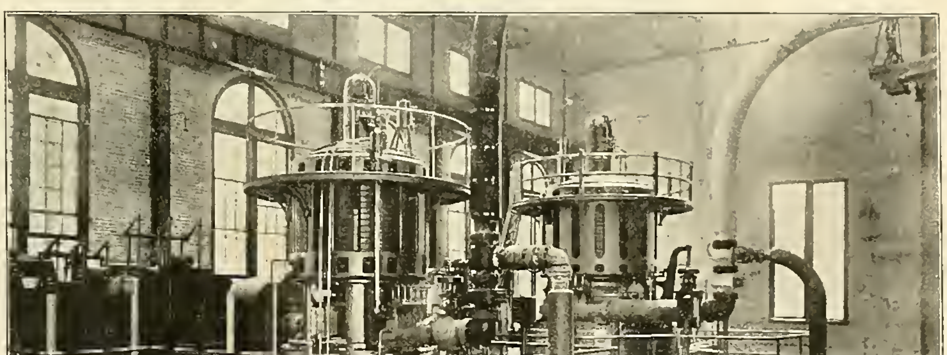

Fig. 2. Turbo-generators of 1,000 and 2,000 Kilowatts Capacity, respectively. Condensers and Auxiliary Apparatus in Foreground.

BLUE ISLAND POWER STATION OF THE NORTH SHORE ELECTRIC COMPANY.

The Blue Island station stands upon a plat of 15 acres on the south bank of the Little Calumet River, which supplies plenty of water for condenser and other purposes. The station is also located on a switch of the Chicago Terminal Transfer Railroad, whose tracks connect with all of the roads entering Chicago, so that ample rail facilities for the transportation of coal are assured. A spur extends into the generator room under the path of the large electric crane.

The building is of red brick and the ultimate structure planned for is shown in Fig. 5, which is an architect's sketch depicting its appearance as it will look when the plans are fully carried out. The present appearance of the station is shown in the illustration, Fig. 4, reproduced from a photograph. The north wall of the present building is temporary, and may be torn down, permitting the continuation of the present turbine and boiler rooms and the building of the other stacks. In Figs. 4 and 5 the structure containing the boiler room is shown to the right and the turbine room with the extension containing the converting, transforming and switching apparatus, at the left.

A clear idea of the general layout of the plant will be gained from an inspection of Fig. 9, showing a plan of the station, includng the two galleries, and Fig. 8, which is a vertical cross-section showing the arrangement of turbine and boiler rooms. The present buildings cover the greater part of a rectangle 171 by 130 feet, the boiler room measuring 65 feet 7 inches by 108 feet 1 inch, while the turbine structure is 128 feet

8 inches long and 62 feet 10 inches wide.

The stacks are self-sustained and of steel. They are eight feet in clear internal diameter and 180 feet high. They are lined all the way to the top with fire block, the lining diminishing from nine inches in thickness at the bottom to four inches at the top.

The coal-handling apparatus seen in Fig. 5 has

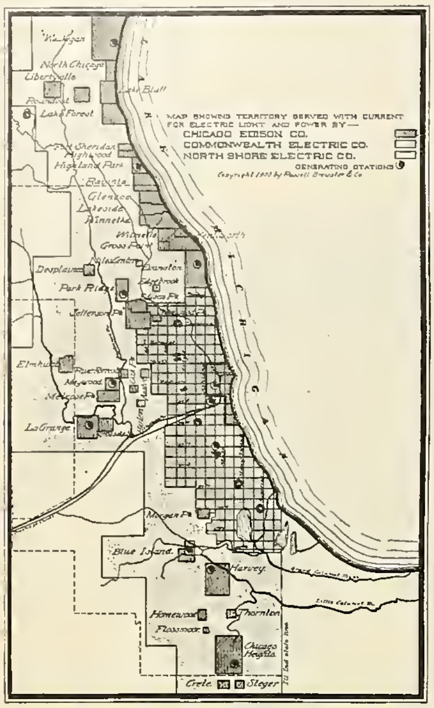

FIG. 3. MAP OF CHICAGO AND VICINITY, SHOWING LOCATION OF BLUE ISLAND PLANT.

not been installed yet, some delay having been experienced in getting the motors. The apparatus will comprise a crane traveling on a steel trestle and carrying a one and one-half-ton bucket. All of the motors in the equipment will be operated by 25-cycle alternating current at 440 volts. When finished this arrangement will permit of the coal being unloaded from the cars and carried in to be dumped directly into the bunkers. There are eight of these, each having a capacity of 60 tons. The automatic stokers are of the new "Chicago" chain-grate type, manufactured by the Babcock & Wilcox Company. Disposal of the ashes has been provided for by ash cars running on a narrow track under the ash pits. The marshy land at the rear of the plant will furnish more dumping ground than will be filled in several years.

The present boiler room (see Fig. 6) is large enough to contain eight Babcock & Wilcox boilers of 400 horsepower each, six of which have been installed. Each has a heating surface of about

FIG. 4. PRESENT EXTERIOR VIEW OF NORTH SHORE POWER STATION AT BLUE ISLAND.

4,000 square feet and furnishes steam at a pressure of 190 pounds, superheated 150° F. The boiler feed pumps are 16 by 14 by 20 inches, the product of the Dean Works, Indianapolis. A Webster open heater has a total capacity of raising the temperature of 150,000 pounds of feed water from 72° to 212° F. every hour.

Each group of four boilers is connected with the 14-inch steam header by 12-inch pipes. The turbines, at present two in number (shown in Fig. 2), of 1,000 and 2,000 kilowatts capacity, are supplied with steam by 7-inch and 10-inch pipes, respectively. The turbines are of the Curtis four-stage type, with the thrust of the heavy vertically rotative parts carried by oil under pressure in step bearings. The 1,000-kilowatt machine runs at 1,500 and the 2,000-kilowatt at 750 revolutions per minute. There is space in the present turbine room for another similar unit of 2,000 or 3,000 kilowatts capacity, and one of these sizes will be installed as soon as the demand on the station exceeds its present total capacity of 3,000 kilowatts. Hydraulic valve gear is used to govern both machines, the pressure being supplied from the step-pressure oil line through reducing valves.

The turbines are supplied with steam at 180 pounds boiler pressure and exhaust into Wheeler surface condensers which maintain a vacuum equivalent to an absolute pressure of two inches of mercury. To maintain this vacuum under full load the 1,000-kilowatt turbine requires 4,200 gallons of water per minute, and the larger machine twice as much. The condenser water is obtained from the Little Calumet River, which flows a few feet from the station, through an intake crib fitted with screens to keep flotsam out of the 18-inch and 24-inch sucton pipes which lead to the condensers. From these the water is returned through 20-inch and 18-inch discharge pipes to the wells leading to the discharge tunnel. The 1,000-kilowatt condenser has 4,000 square feet of surface and the 2,000-kilowatt proportionally. Each condensing unit consists of the condenser, a horizontal rotative dry vacuum pump, a centrifugal circulating pump and a wet pump.

A 24-inch relief valve connects the larger unit with the atmosphere through a 28-inch pipe and a Wright "Cyclone" exhaust head, while a 14-inch pipe serves to connect the smaller machine with the vertical atmospheric exhaust.

The oil system of the station is of especial inter-

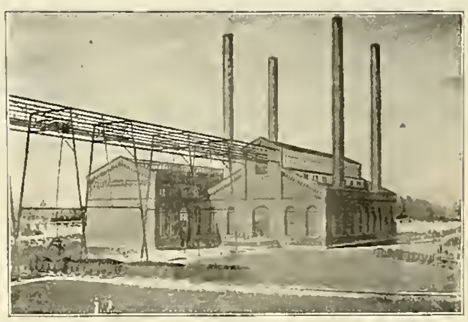

FIG. 5. BLUE ISLAND PLANT AS PLANNED FOR THE FUTURE.

est on account of its completeness, there being really three separate systems of oil distribution, viz., the step-pressure system, the lines supplying general lubricaton and the cylinder-oil system.

The step-pressure pumps have four-inch steam and two-inch oil cylinders working with a six-inch stroke. The pressure maintained at the pumps is about 700 pounds per square inch, but this is reduced at the bearings by hand-controlled baffling. The accumulator, which is a weighted piston designed to float on the step-pressure system and maintain the pressure for a short time in case of failure to the pumps, has not been received at Blue Island yet. It will, however, be so arranged that the valve of one of the pumps will float with the accumulator piston, automatically starting the pump when the accumulator capacity gets low. The bearing of the 1,000-kilowatt turbine requires about seven gallons of oil per minute and the larger machine slightly more—in fact about eight gallons. After leaving the step-bearings the oil is passed through a Turner oil filter to the receiving tank from which the step-pumps draw.

The various auxiliary pumps and engines about the plant receive oil from another system. Whatever is recovered from them is collected in an oil sump which is fitted with a float adapted, when full, automatically to start a Yeomans electric pump which forces the oil through a Turner filter, similar to that above mentioned, to the gravity tank under the roof, which is the point of supply. The oil pump consists of a Yeomans vertical bilge-pump equipment especially adapted for handling oil. The pump is operated by a two-horsepower vertical Jenney 60-cycle motor, direct-connected by flexible coupling to the pump shaft. The automatic controller is mounted on the sump cover and operated by a brass rod from the float in the catch basin. The catch basin is of cast iron, 24 inches in diameter and five feet deep, and the pump has a capacity of 25 gallons per minute against a head of 20 feet.

Another gravity oil-system supplies cylinder oil to the various lubricators of the auxiliary machinery.

Two low-pressure house-service pumps, used for washing and available for fire protection, measure 10 by 10 by 24 inches and are rated at 5,000 gallons.

The generating features of the plant have been arranged to supply several different classes of service. The Chicago-Kankakee interurban road

FIG. 6. BOILER ROOM IN BLUE ISLAND STATION OF THE NORTH SHORE COMPANY.

takes 25-cycle current at the generator voltage of 9,000 for its Blue Island sub-station, which is less than a mile away. The transmission to the other sub-stations of the road at Moline and Bradley will be accomplished at 33,000 volts. The surrounding towns are supplied with 60-cycle current at 10,000 volts and 2,300/4,000 volts, depending on the distance. It may be explained that the latter transmission is an extension of the three-phase 4,000-volt four-wire buses, in which the pressure between any wire and the neutral is 2,300 volts.

The standard of high-tension construction throughout station apparatus and pole lines has been rigidly maintained for 20,000 volts, insulators, lightning arresters, etc., being all designed for this voltage, and as soon as the capacity of the distribution system is taxed at the present potential of 10,000 volts the voltage will be doubled to the value originally designed for—20,000 volts.

The 1,000 and 2,000-kilowatt General Electric generators are direct-connected to the turbines and each furnishes a pressure of 9,000 volts. Both

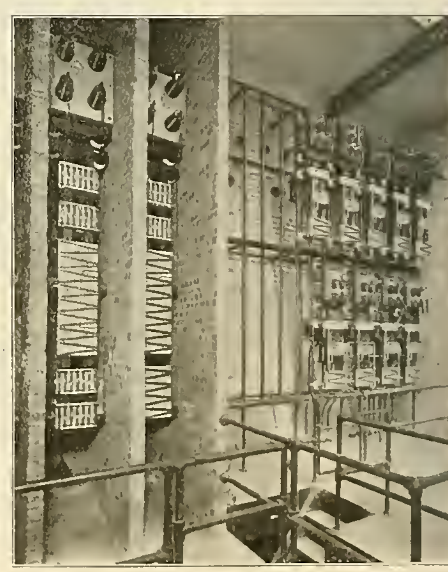

FIG. 7. 20,000-VOLT LIGHTNING ARRESTERS IN BLUE ISLAND PLANT.

units are capable of a momentary 75 per cent. overload or 50 per cent. two-hour overload. The larger machine has four poles and runs at 750 revolutions per minute, the smaller has two poles and runs at 1,500 revolutions, resulting in both generating 25-cycle current.

Reference to Fig. 12, which gives the system of connections, shows that the 9,000-volt 25-cycle current from the turbo-generators is led through current transformer oil switches and disconnecting switches to the main bus-bars.

For the distant interurban sub-stations the delta-connected primaries of groups of three 335-kilowatt and three 700-kilowatt transformers are supplied through disconnecting and oil switches. The 33,000-volt star-connected secondaries are connected to the high-tension 25-cycle buses from which the distribution takes place, protected by oil and disconnecting switches and lightning arresters.

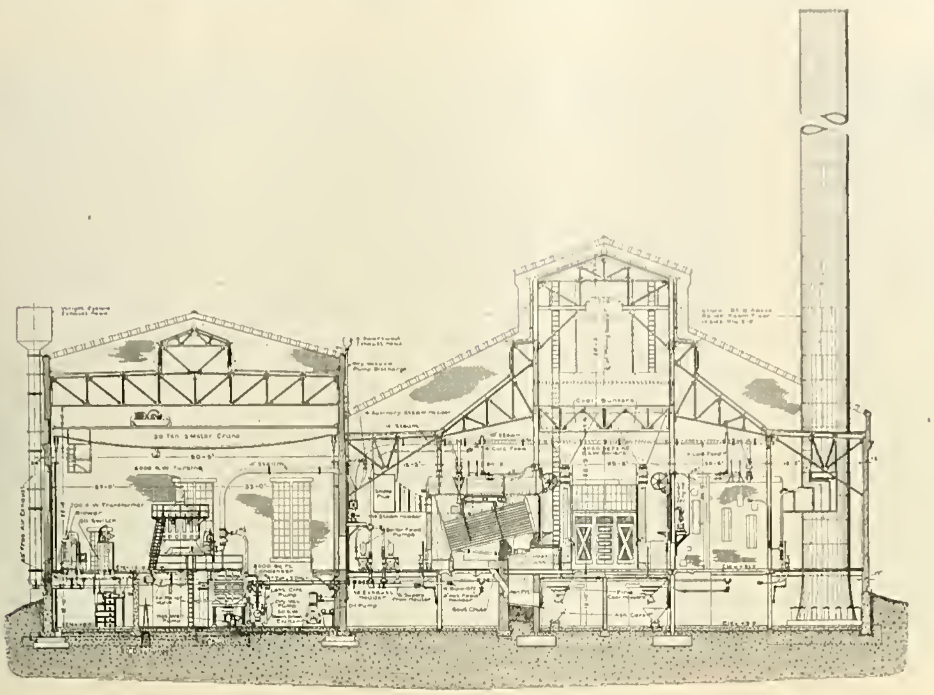

FIG. 9. VERTICAL CROSS SECTION THROUGH BLUE ISLAND POWER HOUSE.

To secure the 60-cycle lighting current the frequency changers (seen in Fig. 1, ground floor) consist of 9,000-volt 530-kilowatt 25-cycle synchronous motors direct-connected to 2,300/4,000-volt 60-cycle generators supplying the star-connected primaries of the lighting transformers through the 60-cycle buses. The secondaries of these transformers are delta-connected and feed to the 10,000-volt 60-cycle buses from which the long lighting transmission lines are supplied.

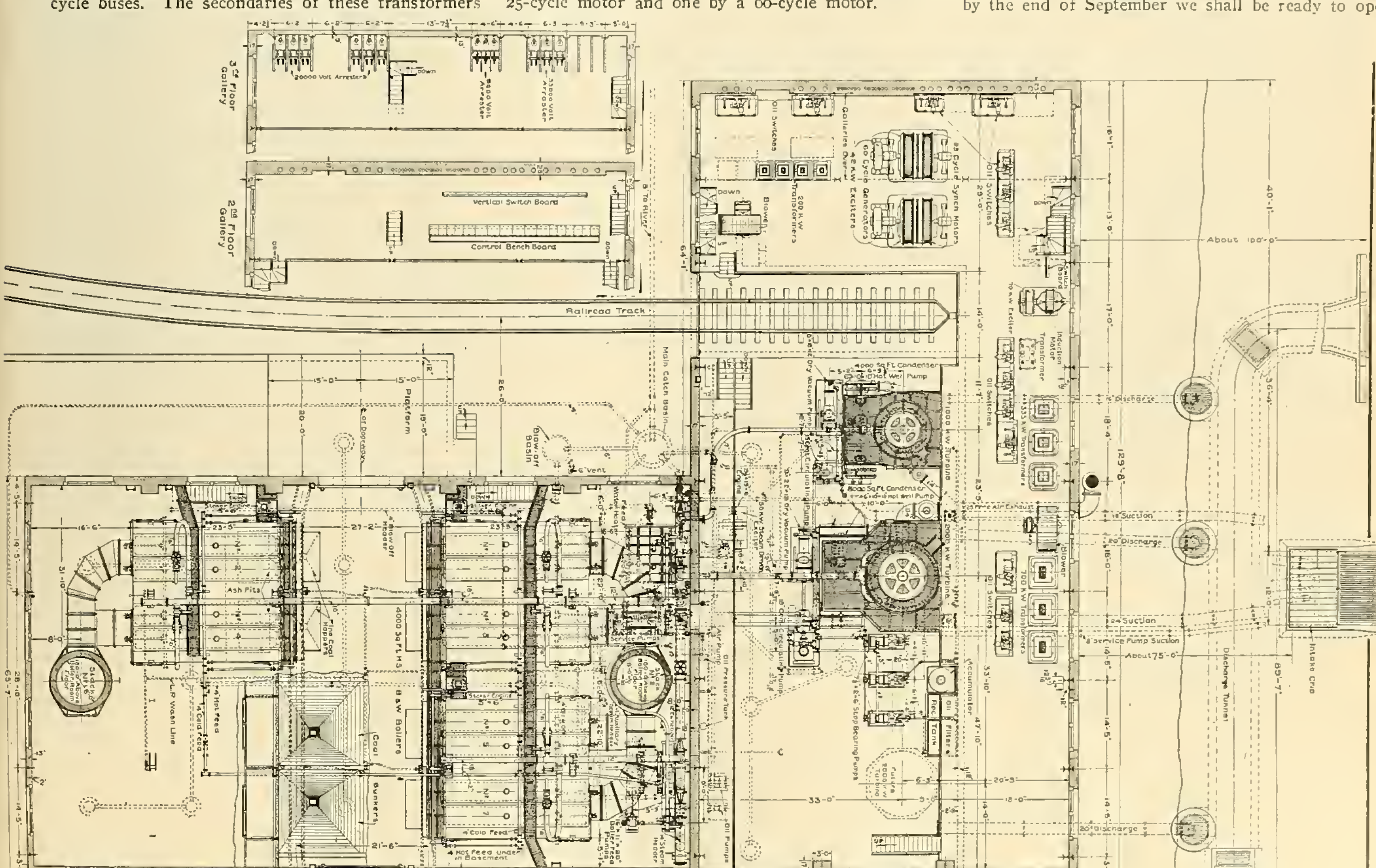

FIG. 9. PLAN OF THE BLUE ISLAND POWER STATION OF THE NORTH SHORE COMPANY.

The elaborate auxiliary system of control, as well as the complete metering, isolation and protection apparatus, is evident from the diagram of connections in Fig. 12.

Field excitation is supplied by four Stanley G. I. compound-wound 125-volt direct current generators, three of 50 and one of 75 kilowatts output. Two of these are mounted directly on the frequency changer shafts, one is driven by a 440-volt 25-cycle induction motor supplied through a transformer from the main generator buses and one is steam driven.

All the transformers are cooled by air blast furnished by two blowers, one driven by a 440-volt 25-cycle motor and one by a 60-cycle motor.

In Fig. 1, the north end of the generating room, the lightning arresters and switchboard galleries are well shown, and a plan of their arrangement is given with the station layout in Fig. 9. Some of the 20,000-volt lightning arresters and switches on the top gallery may be seen in Fig. 7. As has been explained, this apparatus is now operating at just half its designed pressure. The current is led out through the wall behind the arresters to the pole lines. The vertical board and the control bench-board on the second gallery are shown in Fig. 10. A feature of the Blue Island station is the remote control of all high-tension switches, avoiding the risk and danger of bringing these circuits up to the operator's switchboard.

The floor on which the frequency changing sets are located carries all the transformers, the motor-driven blowers and the motor-controlled oil switches.

The bus-bar compartments are at the same level as the turbine-room floor, and the starting compensators are located just below the floor on which the frequency changers are mounted.

A four-motor traveling crane (see general view, Fig. 1), built by the Northern Engineering Company, travels the length of the turbine room and is able to pick up any part of the generating or auxiliary equipment. The crane has a capacity of 30 tons, with an auxiliary hoist of five tons capacity. The span is 58 feet, while the lift is 38 feet. The crane is operated by 25-cycle 440-volt alternating-current motors at approximately the following speeds: Main hoist, 12 feet per minute; auxiliary hoist, 40 feet per minute; bridge travel, 250 feet per minute; trolley travel, 100 feet. All the principal gearing is enclosed, the bronze bushed bearings which are used being capped.

The Blue Island station was designed and built under the supervision of Sargent & Lundy, consulting engineers, in co-operation with the engineers of the North Shore Electric Company.

Transatlantic Wireless Service Promised.

William Marconi was scheduled to leave England for America on August 22d for the declared purpose of inaugurating a transatlantic wireless telegraph service. Officials of the company in New York say that all preparations will be completed by September. The following statement has been issued by John Bottomley, secretary and treasurer of the Marconi Wireless Telegraph Company of America:

"For some weeks regular communication between the Irish coast and Glace Bay has been going on very successfully. We are no longer troubled by the sun's rays, and the messages can be sent day or night without any trouble. While we have as yet made no formal announcement, I believe that by the end of September we shall be ready to open to the public and transmit commercially messages from the one side to the other."

The Irish station is at Clifton and the Canadian at Cape Breton. The schedule of charges is issued and shows a rate of 10 cents, plus the inland charges and five cents a word for press messages.

British Association for the Advancement of Science.

London, August 10.—The British Association meetings, of which some mention was made in the Western Electrician of August 10th, have now been concluded. Chief interest, of course, is annually centered upon Section G, of which Prof. Silvanus P. Thompson, F. R. S., was chairman. His address dealt largely with the relation of pure and applied science, and much of it was historical, a direction in which the professor is par excellence. Not unnaturally his subject led him to the training of engineers, and Professor Thompson emphasized the change of opinion that is now taking place in the abandonment of the principle of taking premium pupils by engineering firms. A long list of British electrical and other firms who have followed in this way are given.

The arc and the spark in radio-telegraphy formed the subject of a lecture by Mr. W. Duddell. This recorded all the previous work in this direction, but the lecture concluded with the following reference to wireless telegraphy: "An extremely interesting development, which is now progressing rapidly, owing to the possibility of producing continuous oscillations by the arc method, is wireless telephony. Suppose that we vary the intensity of the oscillations in such a manner corresponding to the vibrations of the air which constitute sound and speech, then we can obtain at the receiving station a train of Hertzian waves whose amplitude varies in a corresponding way, and by allowing these waves to act on a telephone receiver which is sensitive to the intensity of the waves, we can obtain in the telephone a reproduction of these sounds. This has actually been carried into effect by employing an ordinary microphone to modify the current through the transmitting arc so as to vary the intensity of the oscillation current produced, and by employing what is known as a point detector and a telephone at the receiving station. Another method which may be used consists in causing the microphone to vary the frequency of the oscillations of the generator, and arranging the receiver so that it is more or less strongly affected, according to the frequency of the received waves."

Another paper on wireless telegraphy was by Sir Oliver Lodge, and this had reference to the tuning methods which have been adopted in the Lodge-Muirhead system of wireless telegraphy. These dispense with the earth connection, and Sir Oliver claims to be able to tune out all disturbances except those within five per cent. of the correct frequency. To economize power he recommends every part being tuned separately by adjustable inductances and condensers. This system, he said, was working with such good results in the Burmah-Andaman Islands installation, that the expenditure of energy was less than one horsepower for the 300 miles.

Other matters discussed were tramway rail corrugation, in which the author, Mr. W. Worley Beaumont, argued that the remedy was lighter cars, harder rails and moderate speeds; developments in incandescent lamps, by Mr. L. Gaster, who showed samples of every kind of lamp extant. Mr. Gaster has only just returned from a visit to the United States, and he seems to have been particularly impressed with the work of the engineering department of the National Electric Lamp Association. He spoke also in favorable terms of Dr. Sharp's laboratory, and he threw out the hint that a similar institution would be inaugurated over here with the support of all electric supply authorities, whether municipal or company.

A paper of particular interest in America and Canada was entitled "The Ice Problem in Engineering Work in Canada," by Dr. H. T. Barnes of the McGill University, Montreal. He dealt with the three kinds of ice that have to be met in hydro-electric installations, viz., surface ice, frazil ice and anchor ice. He said that the most effective prevention to the formation of both frazil and

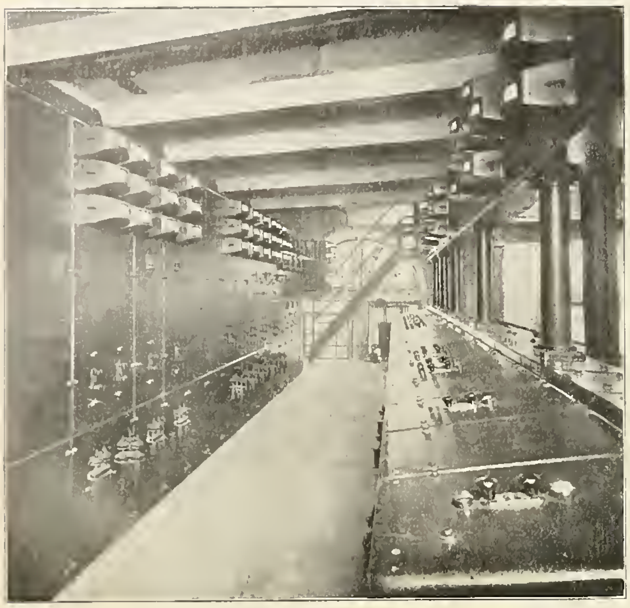

Fig. 10. Switchboard Gallery, Showing Vertical and Control Bench Board.

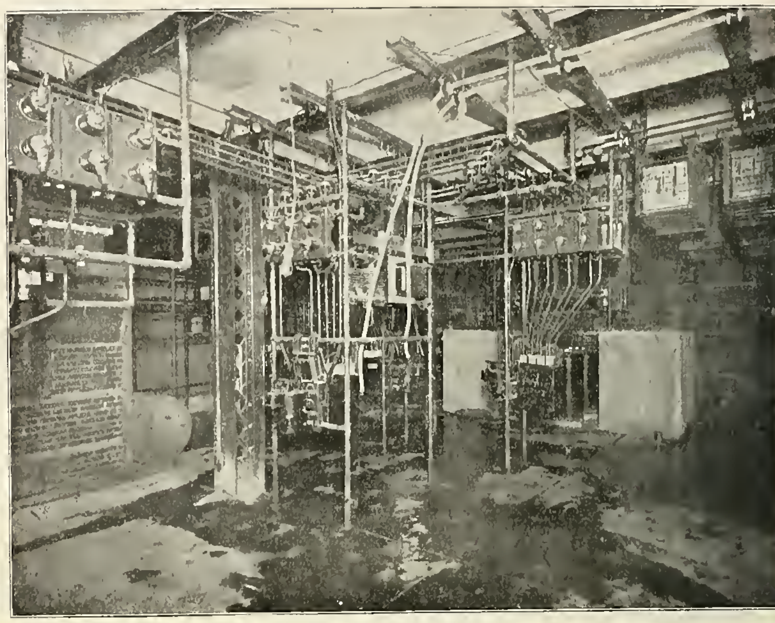

Fig. 11. View in the Bus-bar Compartments.

BLUE ISLAND PLANT OF THE NORTH SHORE ELECTRIC COMPANY.

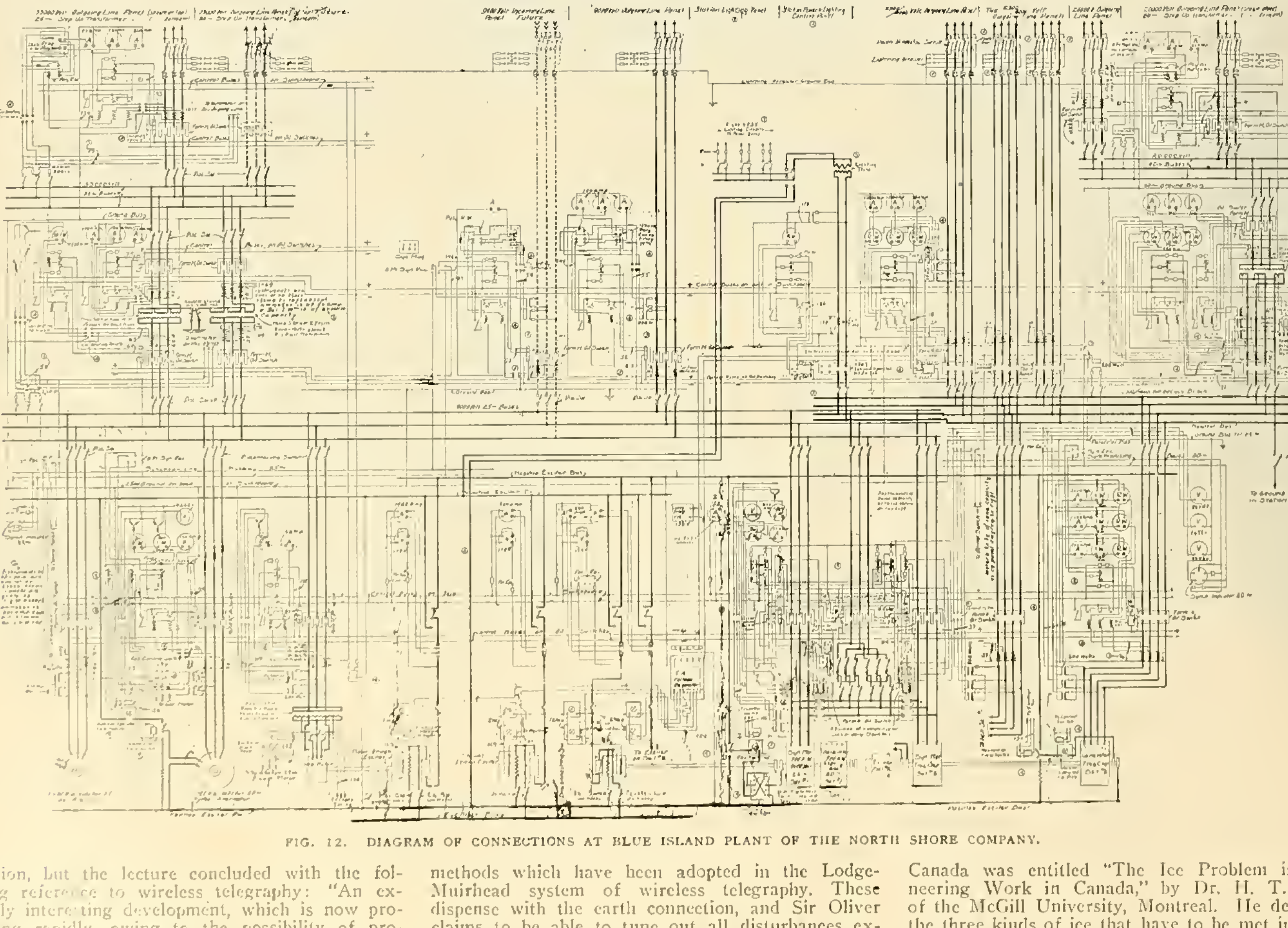

FIG. 12. DIAGRAM OF CONNECTIONS AT BLUE ISLAND PLANT OF THE NORTH SHORE COMPANY.

anchor ice was, when the power house was located at the foot of rapids, or at the head of a rapid with water above, to construct a headrace of sufficient magnitude to serve as a settling basin for the ice drawn in.

The meeting of the British Association next year will be held in Dublin, and in 1909 in Winnipeg.

G.

Proposals for Lighting Fixtures.

Sealed proposals will be received at the Treasury Department, Washington, D. C., until 2 o'clock p. m., Wednesday, September 4, 1907, for manufacturing and placing in position, in complete working order, in the new United States Custom House, Baltimore, Md., certain combination gas and electric-light fixtures. Drawings, specifications and blank forms of proposal can be obtained upon application to the department. The department reserves the right to reject any and all bids and to waive defects. Partial bids will not be considered. Proposals from actual manufacturers of fixtures only will receive consideration. Each proposal must be accompanied by a certified check in the sum of 10 per cent. of the aggregate amount thereof, drawn to the order of the secretary of the treasury, as a guarantee of good faith. Proposals should be addressed to the Secretary of the Treasury, Washington, D. C., and indorsed "Proposal for Fixtures, United States Custom House, Baltimore, Md." J. B. Reynolds is acting secretary.

Chicago Street Railway Situation.

Judge Grosscup has granted an appeal from his decree in the matter of the acceptance of the traction-settlement ordinance by the Chicago Railways Company. The appeal will be heard September 5th by Judges Baker and Seaman of the Circuit Court of Appeals and Justice Brewer of the United States Supreme Court. It is expected that a decision will be given by the three judges, who will sit in the United States Court of Appeals, before September 14th, the limit of time set by the City Council for acceptance of the ordinance.

With the presence of a Supreme Court justice on the appellate bench, it is expected that the decision will be of sufficient weight to insure the acceptance of the traction-settlement ordinance by the Chicago Railways Company, if Judge Grosscup is sustained.

The financial interests that expect to furnish the money for rehabilitation of the North and West Side lines demand an appeal decision before they will supply the money.

Central Station Growth in a Chicago Suburb.

The fashionable Chicago suburb of Oak Park, lying directly west of the city limits on the line of the Chicago and Northwestern Railway, has no manufacturing plants or saloons, and only such stores as found in a high-class suburb. In the fall of 1901 the Oak Park Yaryan Company commenced operating a central heating and lighting station, primarily to furnish heating service to the residents. In the station was installed two 300-horsepower Sterling boilers and 11 100-kilowatt direct-current generators.

A competing company was then furnishing light at the rate of 20 cents per kilowatt-hour, while the Yaryan was restricted by ordinance to 10 cents. As soon as the company entered the field with a 24-hour service a third company commenced to furnish current at six cents in the district covered by the Yaryan company, so that the customer had a choice of three rates for current, depending upon where he lived or which company he desired to do business with. The advent of the third company proved to be an advantage rather than a detriment in getting business.

The Yaryan company now has in its station 3,000 horsepower in water-tube boilers, 750 kilowatts in direct-current generators, and a 500-kilowatt 60-cycle three-phase alternating-current steam-turbine set. There are two 100-kilowatt motor-generator sets run from the direct-current end during the day load, and reversed during the peak load. There are connected on the lines 45,000 incandescent lamps, 322 arc lamps and 350 horsepower in motors. In one season 155 flatirons were sold. A large number of fans, house pumps, dental apparatus and heating appliances have been placed in service, although many were purchased by the customer in Chicago.

The company's lines now cover about two-thirds of the Oak Park territory and all of River Forest, the first suburb west. A franchise has lately been granted in Harlem, with a contract for 125 arc lamps and current for pumping water at the village waterworks. On the heating mains there is connected 500,000 square feet of hot water, and 12,000 square feet of steam radiation. A unique feature of the plant is a 500-kilowatt Westinghouse-Parsons steam-turbine unit operating non-condensing. This unit has operated satisfactorily for eight months. The large 12-panel Westinghouse switchboard is also an interesting feature.

Simultaneous Transmission of Telegraphic and Telephonic Impulses.

When telegraphing is done by the ordinary direct current no difficulty is encountered in arranging condensers and impedance coils to smooth out the telegraphic impulses and make the rise of the current value so gradual that no sound is heard in a telephone receiver. Thus a path may be established for the telephonic impulses, opaque or nearly so to the impulses due to the make and break of a straight current. For such purpose different arrangements have been devised and are more or less successful.

But when the telegraphic impulses are due to induced currents, that is, when the secondary impulses of an induction coil are sent over a line the same are retarded by the impedance coils just as well as the telephonic impulses, and electrostatic devices—such as condensers—are just as transparent to the flow of such impulses as to telephone currents. Such arrangements, therefore, as shunting the telephonic receiver with condensers or trying to sidetrack, so to speak, the telegraphic-induced impulses with the aid of coils opaque to telephonic impulses, are out of the question.

In his efforts to telegraph with induced currents (generated in the secondary of an induction coil by interrupting the primary current), while transmitting telephone impulses over the same wires, Mr. Isidor Kitsee of Philadelphia devised the following arrangement of circuits (covered by patent) after fruitless efforts in other directions:

By shunting the secondary coil inserted in the line with the aid of condensers success was complete when the condenser represented a capacity of about five microfarads.

These experiments were varied by trying, first, an all-metallic line; second, a one-conductor line grounded, and third, a composite line, that is, a line consisting of two conductors insulated from each other but in inductive relation, each conductor being grounded at one terminal, the other terminal being free.

In the tests which gave satisfactory results an induction coil, a Morse key and an electromotive force of about three volts were used. The secondary of the induction coil was connected in series with the line and its resistance was arranged to be varied from six ohms to somewhat over 200 ohms. The primary had a resistance of about three-fourths of an ohm. The receiving device consisted of a polarized relay with a combined resistance of the coils equal to about 1,500 ohms. The coils were wound with No. 36 silk-covered wire. The telephone transmitter consisted of the usual desk set, an induction coil, the primary resistance about three-fourths of an ohm and the secondary arranged to have its resistance varied from six ohms to 200 ohms. The electromotive force used was about one volt more than that used with the telegraphic transmitting device. The telephone receiver was of the usual type. The line had a length of nearly 45 miles. The best results were obtained when the different coils of the secondary of the telegraphic transmitter were connected in multiple so as to give a combined resistance of 12 ohms.

The telephone receiver was not connected directly to the line, but through an induction coil, the secondary of which was connected to the line and the primary to the receiver proper. The secondary of the induction coil presented a resistance of about [illegible] ohms.

Referring to the drawing, Figs. 1, 2 and 3 are diagrammatic views of different circuits including telegraphic and telephonic devices, which were developed during the experiments. Fig. 1 is a one-conductor line grounded on both ends; Fig. 2 is a composite line consisting of two conductors, each grounded with one terminal; Fig. 3 is a composite line comprising two composite conductors, each consisting of two conductors in inductive relation to each other, all four conductors forming two open circuits.

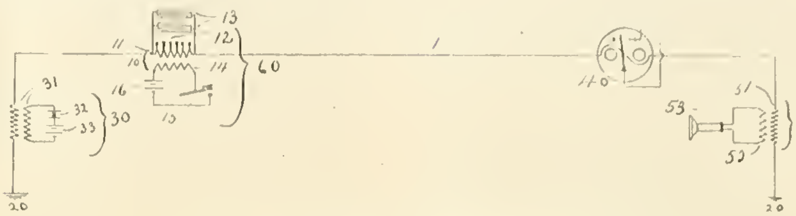

FIG. 1. ONE-CONDUCTOR LINE GROUNDED AT BOTH ENDS.

In Fig. 1 (1) is the line of transmission; (20) are the grounds for this line; (60) is the telegraphic transmitting device entire; of this (10) is the coil used as a telegraphic transmitter. Of this again (11) is the secondary connected in the line and provided with means (12) to vary its inductive value. The condenser (13) shunts the secondary; (14) is the primary; (15) the key, and (16) the source of current, here shown as two batteries. The telephonic transmitting device entire is shown at (30), comprising the induction coil (31), the transmitter (32) and source of current (33). A telegraphic receiving device is indicated at (40). It is shown as a polarized relay; (50) is the telephonic receiving device, comprising the secondary (51), the primary (52) of an induction coil and the ear telephone (53).

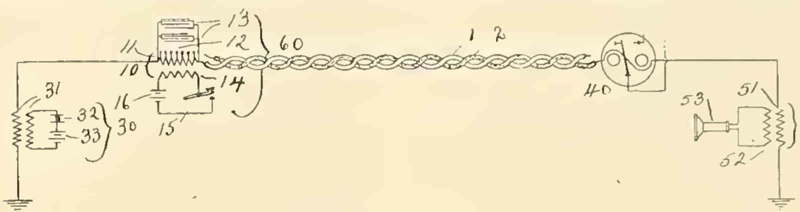

FIG. 2. COMPOSITE LINE WITH GROUND RETURN.

The same numbering is followed in the other diagrams. Wires (1), (2) and (3) (4) represent the pairs of a composite line, defined above.

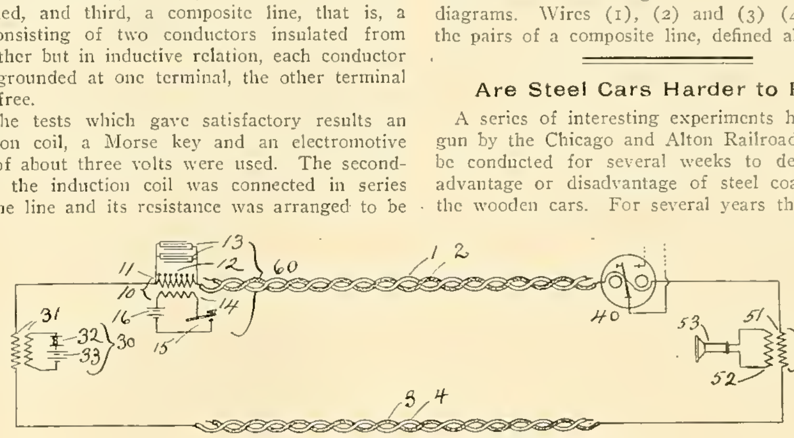

FIG. 3. COMPOSITE LINE WITH TWO COMPOSITE CONDUCTORS.

Are Steel Cars Harder to Pull?

A series of interesting experiments has been begun by the Chicago and Alton Railroad which will be conducted for several weeks to determine the advantage or disadvantage of steel coal cars over the wooden cars. For several years the Alton has been replacing its wooden coal cars with steel cars of greater capacity, and lately the engineers have been complaining that the steel cars are much more difficult to handle in a train than the wooden cars, the relative weight of the trains being the same. As the trucks of the steel and wooden cars are identical the officials are skeptical as to difference in the pull, but repeated complaints of the engineers have resulted in the ordering of a test with a dynamometer car as the only certain method for discovering the difference. The tests will be made with a train of 3,000 tons of coal, the weight to be the same in each test. It is declared by the engineers that the greater elasticity of the wooden cars makes the strain in the pull less than the more rigid steel cars. This, they say, is particularly noticeable on curves.

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CONTENTS OF THIS NUMBER.

DEPARTMENTS.

DATES AHEAD.

Canadian Independent Telephone Association (annual meeting), Toronto, September 4th.

Canadian Electrical Show, Power Building, Montreal, September 2d to 14th.

Colorado Light, Power and Railway Association (annual meeting), Savoy Hotel, Denver, Colo., September 18th, 19th and 20th.

Central Electric Railway Association (regular meeting), Columbus, Ohio, September 26th.

New York Electrical Show, Madison Square Garden, September 30th to October 9th.

American Street and Interurban Railway Association and affiliated societies (annual convention), Atlantic City, N. J., October 14th to 18th.

TELEGRAPH operators have, as a rule, been unsuccessful in strikes, and it remains to be seen whether the one now in progress is to prove an exception. Present indications are that the existing strike will fail like its predecessors, for the companies are transacting a considerable proportion of their normal business, while the number of amateur operators or former telegraphers in the country is very large, and from these men and women no doubt an emergency force can be pressed into service for a short time.

It is to be noted that the long-distance telephone is profiting by the strike to a marked degree, while "wireless" is not availing itself of this opportunity at all. No doubt the telephone will be permanently benefited as the result of the strike, while once more it appears to be shown that radio-telegraphy is of little avail in actual, commercial service over land.

Another probable result of the strike is that a great impetus will be given to the use of automatic or semi-automatic machine telegraph systems, which will in the end no doubt replace a large number of operators. There are a number of these mechanical devices in existence, nearly all of them very ingenious, but some of them too complex for practical operation. Others, however, have demonstrated their usefulness in service, and the companies will no doubt redouble their efforts hereafter to extend the use of automatic systems, several of which require merely a knowledge of the keyboard of the typewriter.

FEW TEARS will be shed at the passing of the Williamsburg Bridge municipal electric-light plant in New York city. In the first place the bridge from the first could have been lighted more economically by private enterprise; there was no need for the municipal plant. Further, the station was established with the idea that wonderful economy would result from utilizing street refuse as fuel. This pleasing fancy has been demonstrated to be fallacious in England, where the experiment has been carefully worked out. This American experience should serve to put a quietus on the advocates of the burning of street rubbish in steam-raising plants with an idea of utilizing it as a fuel.

It appears that the municipal plant has been out of service for the last six months. "Too expensive" is the excuse given by the engineers of the Department of Water Supply, Gas and Electricity. It is now admitted that the city could not furnish light so cheaply as the Edison people, and that there was nothing left for the department to do but to discontinue the plant. It is said that it has cost the city $60,000 each year to keep the plant running. The Edison Company has agreed to light the bridge for $25,000. Then, again, it is pointed out that the city could not profitably secure the refuse and waste that was necessary to keep the incinerators going. Many thousands of dollars were spent by the city in installing the plant, which has now been discontinued. The building in which the plant was installed also cost considerable money.

THE NORTH SHORE Electric Company of Illinois is greatly improving the lighting and power facilities in the suburban district of Chicago by replacing the numerous small local lighting plants with four modern interconnected electric power stations. The first of these new plants to be put in operation was that at Maywood, where a medium-sized plant embodying the best engineering practice is now in successful operation. This plant was thoroughly described in the Western Electrician of February 16th. The latest plant to be placed in operation is that in Blue Island, about twice the size of the Maywood station. The other two are located at Waukegan and Evanston. In another part of this issue the Blue Island installation is fully described and illustrated. The decision of the North Shore Electric Company to acquire the local lighting plants in the suburban district of Chicago and supply the thirty or more towns with electric light and power from four larger central stations is an important step toward a prevailing tendency to centralize electric power generation. The new plants may be taken as a good example of the most advanced central-station design. They are sure to prove economical and efficient, as the best business judgment and engineering skill have been exercised in the planning and construction. A careful study of the North Shore system will not be amiss, as it represents the ideas of some of the best known central-station men and engineers in the profession. Mr. Samuel Insull is president of the company, and Mr. Frank J. Baker is vice-president and manager. The designing and construction was done by Sargent & Lundy, in conjunction with Mr. J. L. Hecht, construction engineer of the North Shore company.

THE incandescent electric lamp has proved able to meet nearly all of the adverse claims urged against it as a form of illuminant competing with the old flame lights of oil-lamp and gas, and even the item of expense has been routed by the cheaper lighting rates and the convenience of a non-combustible, enclosed light available by the twisting of a switch. Yet there still prevail faulty ideas of the effect on the eye from continued reading by the aid of the electric light. "The strained look in the eyes of workers who have had to use the electric light for many hours," has been noted by factory inspectors, and while at once admitting the superiority of electric lighting from the hygienic standpoint of the maintained purity of the air, they take no pains to discover that the results for which the incandescent lamp is condemned follow, in part, almost directly from its very convenience. The fact that an electric light may be put in any position without fear of fire leads the average reader or worker to arrange the light so that a high degree of illumination is obtained upon his subject, while a matter of less consideration is the protection afforded his own eyes. This is not possible with a gas burner, often purely for reasons of safety flame illuminants may not be placed in a position where the eye will suffer from its direct glare. There is little difference in the quality of the light, and it may be reasonably assumed that experiments with unshaded gas lamps in similar positions would show up just as speedily in their physiological effects. Any form of artificial illuminant, especially one where the luminous body is so small and brilliant as the lamp filament, must be given thought and skill in adjustment and diffusion.

POWER TRANSMISSION from waterfalls of various descriptions has been remarkably extended in the South within the last few years. One river, the Catawba, furnishes a particularly interesting example. This stream, having its origin near the foothills of the Blue Ridge Mountains, is hardly to be termed a large river, yet, under the guidance of the electrical engineer, it has been "harnessed" to an extent that is significant of the results that can be accomplished in this direction. A few years ago the power was going to waste, but now numerous cotton mills and other factories and various electric-light and power installations obtain their energy from this source.

Beginning near the headwaters of the river, one finds at the Rodhiss cotton mill 1,500 horsepower developed; then the Long Island mill, with 300 horsepower; Monbo mills, 150; Mountain Island, 1,000, and Tuckaseegee, 250 horsepower. The Catawba power plant develops 10,000 horsepower, and the Great Falls plant, both of the Southern Power Company, 30,000 horsepower. On the south fork of the river, over 3,000 horsepower is utilized entirely for cotton-mill operation. A few miles below the Great Falls plant work is in progress on the Rocky Creek plant, with 20,000 horsepower, and above Great Falls a 15,000 plant is to be erected. The plants complete, underway, or yet to be developed, require about $250,000 a month outlay.

This one river promises soon to be the source of all the power for manufacturing and lighting purposes throughout a section about 100 miles wide and twice that length. The latest estimate is that there will be 140,000 horsepower in use alone in a radius of 70 miles from Charlotte, N. C. The power company principally interested in the work has had no difficulty so far in disposing of all available power.

ILLINOIS STATE ELECTRIC ASSOCIATION.

The meeting of the Illinois State Electric Association this year, the eighteenth annual, took the form of an outing rather than that of a convention. Through the courtesy of the Illinois Fish Commission the steamer Illinois was placed at the disposal of the association. The members assembled at Peoria on August 14th and at 10 o'clock in the morning boarded the boat which left for La Salle by way of the Illinois River. About 100 members and their friends, including the supply men, took the trip. Lunch was served on the steamer on the up trip.

The party arrived at La Salle at five o'clock in the evening. Upon arrival cars were in waiting to take the party through Utica to Starved Rock Landing, where the steamer Lola was in waiting to take the party for a trip to the canyons, after which the steamer proceeded to the landing at the rock proper.

A fine banquet was served at the hotel at eight o'clock, the balance of the evening being taken up with a vaudeville performance given on the lawn in front of the hotel. During the banquet President Shumway called the members together and stated that this meeting of the association would be an outing only and very little business would be transacted, that he would give his address later. The minutes of the last meeting were accepted as printed.

At the suggestion of Charles E. Sharpe of Moline a nominating committee of three was appointed to report on the boat on Thursday. David Davis of Litchfield moved that a committee on resolutions be appointed and W. E. McCollough of Beardstown, L. E. Fischer and R. W. Harris of Streator were named.

President Shumway then said that the efforts of one of the officials of the association had more to do with the success of the meeting than was generally known, that this official had worked in season and out of season for the good of the association, and that thanks were due to him for this outing. As a token of the love and esteem that the members held for this official Mr. Shumway presented the secretary of the association, H. E. Chubbuck, a diamond-studded charm. Mr. Chubbuck responded gracefully.

W. E. McCollough, in a pleasing presentation speech, presented President Shumway with a gold-headed cane, the gift of the association. After this the meeting adjourned till the next day to meet on the boat upon the return trip.

The boat was scheduled to make the return trip to Peoria at 11 a. m. on Thursday, but as those who visited Deer Park did not return till nearly noon the steamer did not start till 1 p. m. Many of the members remained at Starved Rock over night, but for those who wished to stay at Ottawa or La Salle the Illinois Valley Railway Company had special cars provided to carry them to either city. The badges of the members, through the courtesy of the railway company, were honored for transportation on the interurban and the local lines in La Salle, and also through the courtesy of the Northern Illinois Light and Power Company the same privilege was extended to the members and their friends on the local lines in Ottawa.

The return trip from La Salle was commenced at 1 p. m. on Thursday on the steamer Illinois. The same arrangements were provided as on the up trip. During the afternoon the members were called together and a resolution was passed thanking the commissioners and the captain for the pleasant trip and accommodations provided. In behalf of the association the commission was presented a silver water pitcher. Both President Cohen and the captain thanked the association.

The nominating committee reported the following-named officers for the ensuing year and their election followed:

President—E. L. Brown, Elmwood.

First Vice-president—F. M. Sinsabaugh, Carrolton.

Second Vice-president—E. W. Smith, Kewanee.

Third Vice-president—W. G. Austin, Effingham.

Fourth Vice-president—H. A. Foster, Pontiac.

Secretary—H. E. Chubbuck, La Salle.

Treasurer—E. MacDonald, Lincoln.

After the reading of the treasurer's and secretary's reports the new president, Mr. Brown, took his seat. The membership committee was instructed to secure the membership of every light plant in the state. Just how this was to be done was not decided; the idea of making a committee, the members of which will be chosen from each senatorial or congressional district, seemed to be the best that was broached. This would bring the present members closer to the ones that it is desired to get into the association. The committee is to visit those that are not members. The committee on insurance will consist of J. J. Frey of Hillsboro and E. H. Grey of El Paso. The membership committee: D. Davis of Litchfield, O. L. Hyatt of Chicago Heights, and H. O. Channon of Quincy.

The steamer reached Peoria at 6 p. m. Handsome souvenirs were given to the members at the dinner.

The following members were in attendance: J. C. Robinson, Atlanta; W. H. Ramsey, Orlan Winan, Auburn; W. E. McCollough, Beardstown; W. J. Day, Bement; C. F. Snider, Bloomington; S. W. Pappleton, Cambridge: F. M. Sinsabaugh, Carrolton; H. J. Pepper, John C. Eversman, Champaign; E. C. Jenks, Charleston; Homer E. Niesz, E. W. Loyd, H. J. Markham, Chicago; O. L. Hyatt, Chicago Heights; J. E. Johnson, Danville; W. B. McKinley, Decatur; W. H. Few, Delavan: W. G. Austin, Ed Austin, Effingham; E. L. Brown, E. V. Brown, Elmwood; E. H. Grey, El Paso; E. G. Schmaltze, Evanston; H. A. Foster, N. J. Foster, W. B. Decker, Fairbury; F. C. Duncan, W. A. Martin, W. J. Achenpool, R. A. McLaughlin, Roy L. Piatt, Galesburg; E. D. Bell, Granite City; J. H. Crickenberger, Henry; J. J. Frey, Hillsboro; J. P. Doan, Jacksonville; Ed Curry, Joliet; E. W. Smith, A. W. Kendall, Kewanee; H. E. Chubbuck, D. McAfee, Ed Fowler, La Salle; E. MacDonald, Lincoln; E. Davis, Maroa; Charles F. Lathrop, Mindota; Charles E. Sharpe, Moline; Louis W. Hess, Ottawa; A. D. Mackie, W. H. Brown, L. Owen, R. S. Wallace, S. L. Nelson, Peoria; R. H. Abbott, Petersburg; H. O. Channon, J. A. Seipker, M. M. Hess, Quincy; R. L. Flanigan, Springfield; R. W. Harris, L. L. Bennion, Streator; Charles Custer, Sullivan; J. N. C. Shumway, Taylorville; John A. Glover, Urbana; Harry J. Frith, Evanston; John G. Learned, Ira E. Price, L. E. Fischer.

About a dozen supply men made the trip with the members. Handsome books showing the various parts of the country traversed by the Illinois Valley Railway Company, called the "Illini Trail," were distributed by the railway company.

Stanislaus Power Project.

The Stanislaus Electric Power Company, which is erecting one of the largest electric plants in the West to supply power for San Francisco and intermediate points, is now doing work in San Joaquin County, and it is promised that the power lines will be extended to Stockton by the first of next February. W. L. McKinley has closed all contracts for rights from the power station 12 miles east of Vallecito, in Calaveras County, to the San Joaquin County line. The transmission wires will be run in a straight line from Vallecito to San Francisco, and a branch line will be run into Stockton from a point near Lathrop.

The company is erecting a power plant on the Stanislaus River east of Vallecito to supply 30,000 horsepower, and at another station farther east it is planned to erect a second plant of the same capacity. The first station will be rushed to completion in time to meet a contract to furnish power in San Francisco by February. The other plant will be erected when the system is in operation. The scheme calls for an expenditure of $10,000,000, and the movements of the company indicate that a vast sum is to be expended in the construction of the great project.

The construction of storage reservoirs in the mountains of Tuolumne County along the course of the south fork of the Stanislaus River is taking a large amount of money, many miles of railroad having been built to carry along the great work. A large storage reservoir is being built at Relief, in Tuolumne County, where men have never before attempted to winter, but the Union Construction company maintained camps there throughout the past year.

A great supply camp has been established at Middle Camp, in Tuolumne County, where quantities of machinery have been delivered by the Sierra Railway, and from that point traction engines and mule teams move the supplies to the construction camps in the higher mountains.

The transmission line will be one of the best in the West, steel towers being used throughout. The towers will be 50 feet high and will rest on four legs, embedded six feet in the ground. These towers will be placed from 800 to 1,000 feet apart. It is the purpose of the company to sell power to all buyers along its line, and farmers will be offered power at reasonable rates. Modern farming demands electrical power for the operation of pumping plants, and the company plans to meet this demand; also to supply electricity to manufacturing points.

Discrepancy Between Real Figures and M. O. Campaign Figures.

When the Ashland (Wis.) City Council held a special meeting to open and consider bids for the proposed municipal electric-light plant there was only one offer, in which the amount called for was $130,000.

The bid was rejected and it was decided to re-advertise, as the bid was $50,000 in excess of the estimate made last fall by the special committee appointed to investigate and report on the probable cost of building and equipping such a plant, the estimated figure being $80,000. This figure was the one used previous to the election which was held for the purpose of voting on the question of whether the city should build a municipal plant.

Periodicity in Hampshire.

Learnedly writing of an extension to the electric-lighting plant in Northampton, England, the Daily Hampshire Gazette explains some modern improvements to the uninitiated in the following terms:

"Another costly and important apparatus will be the new "cycle." It will be of less power than the present one, which is larger than needed. The change is made to standardize the plant, the standard "cycle" being of 7,500 waves per minute, the size of the new one. The present one is 15,000 alternating wave flashes per minute, called a 120 "cycle." The new one will be a 60. Its object is to flash the current over the wires. Of course, a slower current will result, that is, it will reach Florence and Leeds later, but after it gets there it will be just as powerful. And as 7,500 flashes go per minute, it will suffice."

The Pacific Wave-power Project.

One of the most recent of the many sporadic attempts to harness the mighty surges of ocean tides and waves is now being tried out, according to local newspapers, at a pier built into the Pacific at Rodondo, Cal. The Los Angeles Wave Power and Electric Company has let the contract for construction to the Atlantic Gulf and Pacific Construction Company, which has begun work. The new pier will extend seaward a distance of 812 feet, and when completed it will be 16 feet wide for a distance of 700 feet and 52 feet wide for a distance of 112 feet at the end. The wharf will cost $7,500, and on it the wave-power apparatus will be installed.

Fred Starr, president of the company, says that the first unit of the contemplated plant will be built at once and will cost $30,000. the entire plant, when completed, to cost about $2,500,000, and to furnish power to the extent of 50,000 horsepower.

Work was also started on the new barge whose movement generates the power, and the dimensions of which are: Length, 91 feet; width, 24 feet; draft, six feet. The barge will be anchored so that it can travel a distance of 16 feet either seaward or shoreward, and will have a sideway movement of two feet. It will be so constructed that in time of storm, by opening valves, the barge will sink a few feet beneath the surface of the water out of the heavy surface waves. It is floated again by pumping in compressed air.

Inspector to Give Practical Talks on Electrical Work.

The Hartford (Conn.) Board of Fire Underwriters has arranged for a series of illustrated talks by Thomas Henry Day, the electrical inspector of the board. The first one will be given early in October, and it is expected that there will be at least six talks. They will be open to all in the nearby towns who are engaged as wiremen, electricians in factories, or to anyone engaged in the installation of electrical appliances for light and heat.

Changes in the National Electrical Code, which have been effected this year will be explained, and it was thought by the local underwriters that a series of illustrated talks would best bring these changes and additions to the attention of those interested in the matter.

In addition to persons from the nearby towns, the electrical students in the Hillyer Institute will be invited.

The General Electric Company at Schenectady has written Mr. Day that it will be glad to co-operate with him and will loan him photographs and films to be used in the stereopticon. The company will loan him several hundred views. J. E. Cole, wire chief of Boston, C. J. H. Woodbury of the American Bell Telephone Company of Boston, H. O. Laccount, an electrical expert of Boston, and J. H. McCarthy, municipal inspector of Detroit, have also expressed a willingness to co-operate

Wind Power for the Generation of Electricity.[1]

Surprise is frequently expressed that wind is so little used in this country [England] for all kinds of purposes, requiring small and moderate motive power. If the velocity of the wind were constant throughout the year, or for a certain number of hours during each day, a large amount of power now provided by oil or gas engines could be much more cheaply obtained by means of windmills. Unfortunately, the speed of the wind is continually varying from day to day, and sometimes the velocity will scarcely rise above 10 miles an hour for several days together, the consequence being that windmills can only be utilized (1) for the production of power in such a form as to be capable of storage; (2) for running machinery which can be used intermittently whenever the weather is suitable.

The second purpose need not be considered here, as wind power is already in use extensively for driving chaff cutters, circular saws, root cutters and other farm implements. With regard to the storage of energy only two means of doing this are available—the raising of water into a tank and the storage of electricity in a battery of accumulators.

The method of raising water to be afterward used as a source of power by means of a water motor is put out of court by the cost of the storage tank, which must be of enormous dimensions to provide an appreciable amount of power over a calm period of several days. Supposing, for instance, that one horsepower be required for four days of 10 hours each, and assuming the fall to be 60 feet, 33,000 ÷ 60 pounds of water will be wanted per minute, or

$$\frac{33{,}000 \times 60 \text{ minutes} \times 40 \text{ hours}}{60} =$$

1,320,000 pounds of water for the period in question. Dividing 62¼, it is found that 21,000 cubic feet capacity is necessary, requiring a tank 36 feet in diameter by 21 feet deep, and this estimate takes no account of the losses incurred in the water motor. Such figures as these dispose finally of any wind-power scheme based upon the storage of water, our only remaining course being to accumulate energy in an electrical storage battery.

To more clearly illustrate the difficulties to be overcome and the means and cost of meeting them, a proposal to light a private house will be considered, followed by some reference to what has already been done in this direction.

Suppose the house to require 100 lamps of 21 candlepower (assuming tantalum lamps to be used at 100 volts), out of which 50 will be alight at once, on the average during ordinary evenings when no entertaining is taking place. We may now safely take 1.7 watts per candlepower; therefore, 50 by 21 by 1.7 equals a total of 1,800 watts, or, say, 18 amperes at 100 volts.

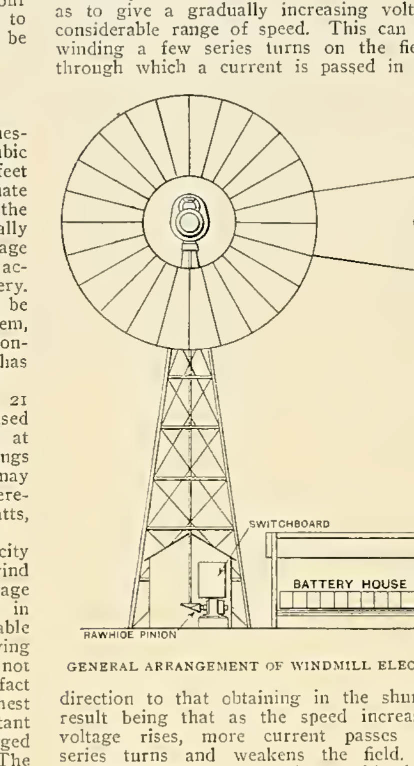
The next question to consider is the capacity of the storage battery, and a study of the wind velocity diagrams representing the daily average speed of the wind at a meteorological station in the eastern counties for the year 1905, will enable this point to be settled. Although the varying velocities for night and day, respectively, are not shown, the actual wind charts disclose the fact that during periods of light winds the highest speeds occur in the daytime. This is an important feature, as it enables the battery to be charged in daylight, when no current is required. The calmest period will be noted extending from July 3d to 22d, but at this time of year very little light is required, and if we assume that current be turned on half an hour after sunset and the lights are put out at 11:30 p. m., current is only consumed for three hours each night.

Suppose the battery to be fully charged on the second instant, 18 ampere-hours must be given out up to the 8th, when charging will again commence and go on during the 9th until the battery is fully charged. Hence we require a storage of 18 amperes by three hours by five days, equals 270 ampere-hours. But 18 amperes is not a sufficient allowance; possibly entertaining may take place on two evenings out of the five, and lights will be used during the night, so that an allowance of 25 amperes will be nearer the mark, making a total of 375 ampere-hours. If the actual daily velocity charts be examined, however, it will be found that enough wind for charging occurred for six hours on the 4th, three hours on the 5th, 10 hours on the 6th, and seven hours on the 7th, in each case during daylight working hours, when the battery could be charged, assuming always that a wind velocity of 10 miles an hour is sufficient for this purpose.

A more serious calm for five days occurs from November 30th to December 4th, when lighting current is required for seven hours a day, making a total of 25 amperes by seven hours by five days equals 875 ampere-hours. Here, again, when the charts are consulted, although the average speed is under 10 miles an hour, the following times occur when the mill will give out full power for charging: 6 a. m. to 4 p. m., November 30th, equals 10 hours; 10:30 to 11:30 a. m., December 1st, equals one hour; 6 to 10:30 a. m. and noon to 4:30 p. m., December 2d, equals nine hours; 10 a. m. to noon, December 3d, equals two hours; 10 a. m. to 4:30 p. m., December 4th, equals 6½ hours. Supposing a capacity of 360 ampere-hours be provided, and charging takes place at a rate of 30 amperes, on November 30th, the battery will be fully charged and 175 ampere-hours will be taken from it; 30 are put in and another 175 are taken out during the following day; on December 2d 270 ampere-hours are put in and another 175 taken out, leaving 135, to which are added 60 ampere-hours on December 3d, making 195 available, whereas only 175 are wanted. On the ensuing day charging can proceed for 6½ hours, which finishes the calm period.

The proposed battery capacity appears to be cut rather fine, but it must be remembered that ample allowance has been made in estimating the number of lamps in use at one time and to cover special evenings and lighting after 11:30. Moreover, at times, although the wind has not been sufficient to charge at full rate, it has been strong enough to provide a certain amount of charging current, also a comparison to be made later with an existing plant indicates that a battery capable of giving out 360 ampere-hours is large enough for the purpose in view.

The dynamo should be wound in such a manner as to give a gradually increasing voltage over a considerable range of speed. This can be done by winding a few series turns on the field magnets through which a current is passed in an opposite



GENERAL ARRANGEMENT OF WINDMILL ELECTRIC PLANT.

direction to that obtaining in the shunt coils, the result being that as the speed increases and the voltage rises, more current passes around the series turns and weakens the field. If a plain shunt machine be used without this device serious overloads are likely to occur, owing to the uncertain speed of the wind, the power from which rises very rapidly with an increase in velocity. If the windmill be large enough to give the full output of the dynamo with a 10-mile-an-hour wind, more than four times the power will be developed when the wind has increased to a speed of 20 miles an hour, and in gusty weather such conditions might frequently occur, in fact, very severe overloads have taken place in actual practice where a plain shunt dynamo has been used, resulting in the breakage of the gear.

Of course, all windmills are fitted with some means for running the wind power to waste when the speed would otherwise increase to a dangerous degree, but these governing arrangements are of a somewhat crude nature, and cannot be depended upon to act effectively in such cases as are being considered. The reason for this is mainly because a windmill used for ordinary purposes will only give out its full power with a 15 or 20-mile-an-hour wind, and the governor, which is dependent upon the wind pressure on the sails, only comes into action beyond this stage. In the case under consideration the full power is developed with a wind velocity of 10 miles an hour, which is too light a breeze to allow of governing by the ordinary methods; therefore, the mill will sometimes attain speeds which would damage the dynamo if the voltage increased in proportion to the number of revolutions per minute, as in an ordinary shunt machine. It may be contended that fuses or overload cut-outs can be used as an alternative, but if this course be adopted an attendant must always be present when the mill is at work.

Having now settled the size of the battery and the dynamo, the power of the windmill required to drive the latter may be gone into. An average charging current of 30 amperes has already been decided upon, and the mean pressure may be taken at 130 volts, therefore the output of the dynamo will be equal to 3.9 kilowatts. Allowing for an efficiency of 80 per cent., this machine will require about five brake horsepower to drive it, involving a mill with sails 24 feet in diameter, if the disk type be adopted.

Regarding the latter, careful experiments have demonstrated that the old-fashioned mill with four sails is rather more efficient in a moderate breeze of, say, 12 to 15 miles an hour, but it is not so easily started in light winds, and the appearance is less pleasing. However, the four-sailed mill is much the cheaper of the two types, and it will therefore be considered as an alternative in comparing the relative costs of oil and wind power. It is of great importance in dealing with wind power to eliminate friction as far as possible, and for this purpose at least one maker of disk mills employs ball and roller bearings throughout. Some advantage may also be gained by installing the speeding-up gear at the top of the mill, in which case a comparatively light vertical shaft is sufficient to transmit the power, as it runs at a considerable speed, and with this construction it is also feasible to drive the dynamo by bevel gear from the vertical shaft as shown in the accompanying drawing.

The governing of the mill is of some importance, and there are two methods of carrying this into effect. The usual plan is to hinge the vanes and connect them to a series of levers which tend to raise a weight as the wind increases and blows them further open. An alternative design allows the complete disk to turn on its vertical axis partially out of the wind against the pull of a weight, the mill being mounted upon a ball race to make it more sensitive in this respect. One distinct advantage of the latter type is that it cannot become back winded.

The plant described now consists of the windmill, the connecting gear, the dynamo and the ordinary type of battery switchboard with "cut-in-cut-out" switch, and in comparing the relative cost of driving by an oil engine or a windmill we need not carry the figures beyond this point, as the house wiring and lamps will be the same in either case.

The following initial costs are based upon actual quotations, and the running expenses have been estimated by the help of figures obtained from the practical working of such plants.

In the first place, a plant driven by a disk type of mill will be considered, the capital outlay being as follows:

Windmill complete down to lay shaft erected	$1,100
Foundations for same	50
Dynamo erected	300
Dynamo house	50
Foundations for dynamo	10
Battery	750
House and stands for same	100
Switchboard erected	150
Total	$2,510

The running expenses will consist of:

Attendance	$ 25.00
Stores	15.00
Battery renewals and depreciation at 15 per cent.	212.50
Windmill gear and dynamo repairs and depreciation	140.00
Interest on capital at 5 per cent.	125.00
Total	$417.50

This allows 2,000 hours of lighting with an average current of 25 amperes, at 100 volts equals 5,000 units at a cost of 8 cents per unit.

The alternative figures for a four-sailed mill will be reduced as shown below:

Windmill complete erected	$700.00
Foundations for same	50.00
Dynamo	300.00
Dynamo house	50.00
Foundations for dynamo	10.00
Battery	750.00
House and stands for same	400.00
Switchboard	600.00
Total	$2,110.00

The running expenses amounting to:

Attendance	$ 25.00
Stores	15.00
Battery renewals and depreciation	112.50
Windmill gear and dynamo repairs and depreciation	100.00
Interest on capital	105.00
Total	$352.50

The comparative cost of an oil-engine installation will be as follows:

Oil engine erected	$ 600.00
Foundations	25.00
Water piping, etc.	10.00
Dynamo erected	250.00
Foundations	15.00
House	100.00
Battery	750.00
House and stands for same	100.00
Switchboard	150.00
Total	$2,000.00

And the working costs:

Attendance	$ 50.00
Oil	165.00
Stores and lubricating oil	25.00
Battery repairs and depreciation at 15 per cent.	112.50
Repairs and depreciation on engine and dynamo at 10 per cent.	85.00
Interest on capital at 5 per cent.	100.00
Total	$5,37.50

1. This is the major part of an article taken from the London Electrician, in which the author, W. O. Horsnaill, considers the possibility of utilizing wind power for the electric lighting of country houses. Some account is given of actual installations, and the conclusion is drawn from estimates that a wind-power plant is cheaper in both first cost and in operating than an oil engine plant.

From the above figures it will be seen that wind power works out at less cost than a plant driven by an oil engine, but apart from the financial aspect of the subject a windmill installation does not require the occasional skilled attention essential to the satisfactory working of an oil engine. The latter is a delicate piece of mechanism and runs at a high speed, whereas a windmill is a very robust prime mover and revolves slowly, resulting in a very low cost for repairs and upkeep.

It will be noted that the same size of battery has been allowed for the oil-engine installation as for the windmill plant, and at first sight this basis of comparison may appear to unduly handicap the oil engine. Further consideration will, however, show that the battery allowances are just and reasonable in each case. Naturally the position and exposure of a windmill must affect the provision required for power storage, but in the example given above it has been already shown that the battery capacity is sufficient. With regard to the oil engine, allowance has been made for lighting through two nights, during the darkest season of the year, with the engine standing.

No consulting engineer or contractor would provide for less storage than this, for oil engines, which, as already indicated, are liable to breakdown, and new parts may have to be sent for from the makers, together with a skilled man to effect the repair. On the other hand, windmills very rarely break down, and many of them have run for years without any repairs whatever, and when such attention is required it is in the form of replacements for worn parts, which work can be done by an ordinary mechanic at any convenient time. It is very seldom, indeed, that any part of a windmill actually breaks and causes a stoppage.

The problem of electric lighting by wind power would appear at first sight to present similar difficulties to those encountered in train lighting, by means of a dynamo driven from one of the carriage axles, and a similar automatic plant could be used; but it is doubtful whether the additional cost would be justified, and some parts of the apparatus are of so delicate and complicated a nature that it would be necessary to apply to the makers when a breakdown occurred. Moreover, no appreciable reduction could be made in the battery capacity, owing to the possibility of charging during the whole of the 24 hours, as we have shown already that during calm periods any available wind occurs during daylight; therefore, the only advantage in adopting the train-lighting system would be the reduced cost of attendance, as the plant could be locked up for weeks together. But attendance only costs $25 per annum, which is scarcely sufficient to cover the capital charges and depreciation on the extra gear required to make the plant automatic, and if extra repairs be included, the installation would be more costly than the simple scheme put forward above.

The power of a windmill in any particular situation is rather difficult to estimate, but if records of the wind velocity for 12 months can be obtained from a meteorological station in the vicinity the problem is much more easily solved. The standard recording instrument gives the miles of wind passing it in a diagrammatic form, and from these records the average velocity per hour or per day may easily be read. Therefore, as the power of a windmill increases roughly in proportion to the square of the wind velocity, more power than indicated by the mean speed of the wind can always be obtained.

It is naturally important that the windmill should be erected in a more or less exposed position, and at such a height from the ground as to be above all obstructions likely to interfere with the free passage of wind to it. The illustration shows the wind-power installation described above, which may be some little distance from the house. A battery house is also shown, but in some cases the battery can be accommodated in the cellar of the house to be lighted.

Some reference will now be made to existing wind electric plants and the difficulties which have been encountered in running them. The first installation of this nature [in England] was erected 11 years ago for the purpose of lighting Mr. George Cadbury's house near Birmingham. The plant consists of a 35-foot disk windmill coupled to a 30-ampere shunt dynamo capable of giving out a voltage of 150 for charging the battery. The mill is mounted upon a 50-foot tower, and is some little distance from the house. The gear up to the dynamo begins with the usual bevel wheels at the top and base of the mill, connected by a vertical shaft. The bottom horizontal shaft runs at a comparatively low speed, and the latter is increased by introducing a countershaft between it and the dynamo, thus involving two belt drives. A considerable proportion of the power in light winds must therefore be wasted in friction.

The dynamo is a plain shunt machine running at 750 revolutions per minute, and the switchboard is of the usual type, with cut-in-cut-out switch, charge and discharge switches, etc. The original number of lamps was 200 of 16 candlepower, three motors aggregating five horsepower being also coupled to the mains. The lamp voltage is 100, and the ordinary lighting load is about 35 amperes, increasing to 50 amperes when entertainments are in progress. To compare this plant with the installation put forward above, we must increase 35 amperes in the proportion of 18 : 25, which equals 49 amperes, without the motors, for 2,000 hours per annum. The motors may be taken as running for 300 hours per annum at 10 amperes per horsepower equals 50 amperes; this multiplied by 300 and divided by 2,000 gives 7½ amperes; hence an output of 56½ amperes may be reckoned on for purposes of comparison. The original battery had a capacity of about 300 ampere-hours.

Comparing the two plants, we find that the battery should have a capacity of $360 \times 56\frac{1}{2} \div 25 =$ 820 ampere-hours; the dynamo should give out 68 amperes and the windmill should measure 30 feet in diameter, provided that friction be as far as possible eliminated by the use of ball and roller bearings and a single belt drive. In spite of this lack of proportion the engineer managed to keep the lights going on one occasion for six weeks without a break. Some trouble has been encountered from overloads on the dynamo, the governing arrangements on the windmill being not sufficiently sensitive for this class of work, and the cut-in-cut-out switch did not always act promptly, resulting in sudden overloads, which on one or two occasions wrecked the gear. Since the plant was originally installed a good many lights have been added, besides several motors, and it has been found necessary to put in a gas engine coupled to a larger dynamo, the battery capacity also being substantially increased.

A later wind power electric-lighting installation has been put down at West Ardsley, in Yorkshire, and consists of a 30-foot mill coupled to a specially wound dynamo which charges a battery of large capacity. The lamps connected number 109, the majority of them being of 16 candlepower. No auxiliary power is employed, the battery being of sufficient capacity to take charge of the lighting through any calms which occur. The windmill and electrical plant is in charge of a gardener, whose time is taken up to the extent of four hours a week in performing this duty.

The above particulars should be sufficient to convince those in doubt that wind power for electric lighting is not only quite feasible, but is a commercial success in exposed positions where the only alternative prime mover is an oil engine.

Production of Mica in 1906.

Of the minerals composing the group called mica practically but two—muscovite or potash mica and phlogopite or magnesia mica—are industrially important, and only one of these, the muscovite, is found in deposits of commercial value in the United States. This muscovite is widely disseminated in small plates and crystals, of no value, in crystalline igneous and metamorphic rocks, as well as in the sediments derived from them, but the commercially valuable deposits are confined to pegmatite—a rock closely allied to granite in composition, composed of feldspar and quartz, with more or less mica and other accessory minerals, but unlike granite in that its minerals are crystallized out in large masses. Among the coarser products of this crystallization is the mica, blocks of which more than a yard in diameter have been found.

The properties which give mica its value to the world of industry are its perfect cleavage, the toughness, flexibility and elasticity of its cleavage sheets and its transparency and non-conductivity of electricity. The three principal uses of the material are for electrical insulation, glazing, and decoration. The first-named used probably leads in present importance, but the other two uses date back to ancient times, mica antedating glass and also being early used to secure decorative effects. As an insulating material it occupies a place that cannot be filled, apparently, by any other substance. Recently the utilization of scrap and waste mica in the manufacture of lubricants for car axles has become a somewhat important industry in the West.

The increasing use of the material has largely modified the demand made upon the mining industry, for not only can sheet mica of small size now be utilized, but even more important is the extensive use that is now made of composite mica, molded mica, "micanite," and other varieties of built-up sheets. Scrap mica is also utilized in the manufacture of a superior quality of boiler lagging, and ground mica is used in somewhat increased quantities in mica bronzes and paints and as an absorbent for explosives. The finest ground mica, or mica flour, finds a considerable market with manufacturers of high-grade wall papers, the luster obtained by the use of muscovite dust having the advantage of both permanency and brilliancy.

In an advance chapter from the "Mineral Resources of the United States Calender Year 1906," Douglas B. Sterrett, of the United States Geological Survey, reports the production of sheet mica in the United States for 1906 as 1,423,100 pounds, valued at $252,248, and of scrap mica as 1,489 short tons, valued at $22,742. These figures show an increase over those for 1905 of 498,225 pounds in quantity and $91,516 in value for sheet mica, and of 363 tons in quantity and $4,886 in value for scrap mica. The eight states which shared this production are, in order of value of output, North Carolina, Colorado, New Hampshire, Virginia, Idaho, South Dakota, New Mexico and Connecticut.

The imports of mica into the United States in 1906 were the largest ever recorded, the value being considerably more than twice as great as in 1902 and 1905, the years that formerly held the record. According to Mr. Sterrett, the total quantity imported and entered for consumption in 1906 amounted to 3,066,738 pounds, valued at $1,042,608.

The total production and consumption of sheet mica in the United States in 1906 was 4,489,838 pounds, as against 2,519,445 pounds in 1905, an increase of about 78 per cent. A comparison of the import figures with those of the home production shows that there is a wide field for the extension of the industry in the United States, and indeed the industry is expanding rapidly to meet the demand. Deposits carrying mica in commercial size are found in many parts of the United States, from the Atlantic coast to the Pacific, and new developments are reported each year. Alabama and Georgia will probably appear in the list of producing states in 1907, and other states will doubtless show large gains in production.

Mr. Sterrett's paper, which is ready for distribution and may be obtained by applying to the director of the United States Geological Survey at Washington, D. C., contains much interesting and valuable information concerning the material and the method of mining and manufacturing it, and includes a list of publications dealing with the subject.

Telegraphers Continue to Hold Out in General Strike.

The appearance of the telegraphers' president, S. J. Small, at Chicago, the storm center of the present widespread wire strike, resulted in the promulgation of a general strike order legalizing the local walkouts that had already occurred and calling out all other operators despite the proffered services of U. S. Labor Commissioner Neill, President Gompers of the A. F. L., John Mitchell of the Miners and others who counseled arbitration. It is reported that the general strike order resulted in the walkout of few operators who had not already closed their keys.

Meanwhile business had been seriously interfered with and the boards of trade of a number of cities appealed for national intervention which President Roosevelt refused. The slogan of the strikers became "No arbitration," and President Small asked for a fund of $2,000,000 from organized labor to fight the battle.

The companies have gradually acquired a partial working condition again and have been able to transmit in a fashion most of the messages entrusted to them. As a result of this determined opposition by the companies and the Associated Press, which seemed steadily to improve their service the strike of commercial telegraphers has settled down to a contest of endurance.

The situation may still taken on a national aspect, as a notice was sent out to the officers of subordinate unions urging them to collect all evidence against the local telegraph companies with a view to bringing about a congressional investigation. This is the beginning of an active agitation in favor of government ownership of the telegraph lines to prevent the recurrence of another strike. In the next Congress there will be three members of the telegraphers' union—J. T. McDermott of Chicago, W. J. Carey of Milwaukee and A. J. Murphy of Rollo, Mo. Besides four other trade unionists will sit in the next Congress, and President Small hopes to be able through this contingent to cause a congressional investigation of the methods of the telegraph companies.

Radium as a Curative.

Thomas H. Norton, United States consul at Chemnitz, Germany, reports that the growing importance of radium as a therapeutic agent has led the management of the Imperial Uranium Works, in St. Joachimsthal, Bohemia, to construct a special laboratory for the industrial production of radium compounds. The consul continues:

"The uranium ores of this locality contain higher percentages of this mysterious element than any other known deposits thus far investigated. The ores and residues from the uranium extraction have hitherto been treated chiefly at Paris, where the method for isolating the minute traces of radium was perfected by Madam Curie and her lately deceased husband. There will be manifest advantages in carrying out the extraction at the place of origin, in view of the enormous amounts of rock required for the production of a tiny fragment of a radium salt. Interesting, likewise, is the fact that an extensive sanitarium is being erected in the same locality, where patients can take baths in the water pumped from the uranium mines. This water seems to be sufficiently charged with radium compounds in solution to exert a distinct therapeutic action, and physicians have already begun to prescribe its use."

ELEMENTS OF ELECTRICAL ENGINEERING.

By Geo. R. Metcalfe.

XXX.—Electric Lighting.

Special Lamps.

A number of special lamps have been devised within the last few years which give promise of considerable future usefulness. Some of these employ carbon in various ways, while others use special materials. Descriptions of the more prominent of these special lamps are given below.

Cooper Hewitt Lamp.

The Cooper Hewitt Lamp of the usual type consists of a glass tube of about one inch in diameter and 50 inches in length, in which the light is produced by the incandescence of mercury vapor. In one end of the tube is a metallic electrode, and in the other end is a small amount of mercury, and the interior of the tube is thoroughly exhausted. In operation the lamp is suspended with the mercury electrode lower than the metallic electrode, and when current is passed through the two electrodes some of the mercury is vaporized, and the vapor is highly incandescent.

The light is started in either of two ways. In one case the tube is mounted so that it can be tilted, thus causing a stream of mercury to connect the two electrodes, which permits the current to pass between them, and thus vaporize the mercury. The second method of starting is by using a very high voltage sufficient to pass from one electrode to another, and thus form a conducting vapor. This high voltage is obtained by means of a high inductance and a quick-break switch.

The light from a Cooper Hewitt lamp gives a greenish tinge to surrounding objects, on account of the entire absence of red rays, and for many purposes this peculiar color of light is objectionable, although it is extremely easy on the eyes. Its use has been limited principally to office and shop lighting, and for drafting rooms, and on account of the actinic properties of the light it has been adopted to a considerable extent in photographic work.

Nernst Lamp.

The Nernst lamp is a special incandescent lamp which has an efficiency higher than the carbon incandescent lamp, but not so high as the arc lamp. Its light is of a very desirable color, and the lamp gives a good light distribution. The incandescent part of this lamp is called the glower, and it is formed of a filament made of oxides of some of the rarer earths. The material of the filament is made in the form of a paste which is squirted through a die to form the filament. These glower filaments are then provided with platinum terminals, the ends of the platinum and glower being fused together.

The glower is a non-conductor of electricity when cold, and therefore it is necessary to provide some means for raising its temperature to a point at which it will conduct current. This is done by means of heater tubes, which are mounted on top of the glower. The heaters are formed of fine platinum wire, which is either wound over a porcelain tube or upon a porcelain rod and covered over with a special paste in order to prevent rapid deterioration. The heater is connected in circuit when the lamp is first turned on and is automatically cut out of circuit when the glower becomes warm enough to become a conductor. When the current passes through the glower it operates an electromagnet which cuts the heater out of the circuit.

In series with the glower is an iron resistance wire which limits the flow of current to a fixed amount. The conductivity of the glower increases with the temperature and therefore tends to take more and more current up to the point of destruction. To prevent this, iron wire, known as ballast, is used in series with the glower, and as the resistance of the ballast increases with increase of temperature, the circuit composed of the glower and ballast soon reaches a constant resistance which permits just sufficient current to flow through it. The ballast is enclosed in a small glass tube filled with hydrogen, in order to prevent the iron wire from being consumed.

The glower, heaters, cut-out and ballast are mounted in the case of the lamp, the whole being surmounted by a screw plug to fit an ordinary incandescent-lamp socket.

These lamps are made with either one or several glowers, according to the candlepower desired. They are built principally for 220-volt, 60-cycle alternating current, and their intensely white light, when properly shaded, gives a highly satisfactory illumination.

Moore Vacuum-tube Lighting.

Within the last few years the Moore vacuum-tube system of electric lighting has attained some commercial importance. The character of this light differs quite widely from all other electric lights, being a very white light, somewhat approaching daylight in appearance. This light is not made up of small separate units, but emanates from the entire length of a glass tube which may be 150 feet or more in length, and which is usually suspended from the ceiling or side walls of a room in any desired form. The source of the light is the incandescence of a gaseous substance enclosed within the tube through which the current is passed. By means of this arrangement the diffusion of light is extremely good, and at the same time the tube does not have to be run at a very high brilliancy, three to 3½ candlepower per foot being the usual intensity required.

The details of this system have been changed several times, so that the efficiency has varied somewhat with the different arrangements, but in some of the installations an efficiency of 2.6 watts per candlepower has been attained.

The two ends of the tube are connected to the high-tension winding of a raising transformer, and the low-tension winding is directly connected to the 110-volt alternating-current street mains. There are therefore no moving parts or complications of any kind when alternating-current supply is available. When direct current is used it is necessary to use a small motor-generator.

In installing the light, a room is piped with 1¾-inch clear-glass tubing. This tubing comes in lengths of about 8½ feet, and the lengths are hermetically sealed in position, so that the tubing becomes a permanent fixture of the building. These tubes can be fashioned into almost any desired shapes, to conform with the architectural features of a room or building. The tube is then filled with a gas and the two extreme ends of the tube are provided with electrodes for connection to the transformer.

Aside from the field of general illumination, this light, on account of its similarity to daylight, has been found very useful for matching colors, and its actinic properties have led to its introduction for photographic purposes to a considerable extent.

Metallic-filament Lamps.

A number of metals have been experimented upon with a view to their substitution for the carbon in the ordinary incandescent lamp. Osmium has been used for incandescent-lamp filaments and produces a very efficient lamp, but, owing to its low resistance, it has been found very difficult to make a filament of small enough section to give sufficient resistance for a high-voltage lamp. Twenty-five-volt lamps have been made with osmium filaments, giving an efficiency of about 1½ watts per candlepower, and having a life of six to eight hundred hours. Owing, however, to their low voltage, these lamps are not well adapted for use on ordinary commercial lighting circuits. Greater success has been achieved with tantalum and tungsten filaments, about which a great deal has been heard within the last three years.

Metallic Electrode and Other New Arc Lamps.

A number of arc lamps have been devised in which the usual carbon electrodes are replaced with metallic substances or modified by other substances of various kinds. Some of these, such as the Bremer arc lamp and the magnetite arc lamp, show a very high watt efficiency, but are still in the introductory stage, and have therefore not come very widely into commercial use. In the Bremer flame-arc lamp the electrodes are made of very slender carbons, the interior of which contain a core of refractory oxides of silica, lime or magnesia.

Residence Lighting.

For almost all residence lighting comparatively small-sized units of light are required, which consequently limits the choice to incandescent lamps or Nernst lamps. The largest units in general use for residence lighting are of about 32 candlepower and the smallest eight candlepower. For general lighting it is not desirable to have the intrinsic brilliancy of the lamp very high, and the reduction in brilliancy is generally accomplished by providing suitable shades.

The subject of illumination is one that has been scientifically studied by electrical engineers only of late, but it is generally recognized that considerable waste of both light and money frequently results from improper distribution of lamps, and consequently illuminating engineering has very recently been more carefully studied.

It is possible to locate lamps in a room so as to give a brilliant and practically uniform distribution of light over the whole room, but this is seldom necessary, and, moreover, is quite expensive. The more desirable as well as economical method is to supply only a rather weak general illumination, and to strengthen this with extra lights at special points, such as tables or desks, where a more intense illumination is desirable. It is also preferable to use lights of a uniform color in one room. If, for instance, a Nernst lamp is used together with an incandescent lamp, the very white light of the former makes the latter appear yellow and dull.

Lighting of Auditoriums, Offices, etc.

In the lighting of large interiors the same general rule holds good as for residence lighting, that is, to produce a fairly uniform general illumination of rather low intensity, and to add more intense illumination where necessary. Following this rule gives the most effective illumination with the least candlepower in lamps, and is therefore the most economical arrangement. For the use of large interiors, however, a larger choice of lighting units is available, as incandescent lamps, arc lamps, Nernst lamps of high candlepower, mercury-vapor lamps and others become available, depending on the use for which the illumination is required.

Where very steady light is required, incandescent lamps or Nernst lamps are best. For drafting rooms, offices, etc., properly shaded arc lamps or Cooper Hewitt lamps are desirable, although the latter are limited to places where the color of the light is not essential. Arc lamps are also preferable where various colored objects are to be illuminated. When used, they should be hung fairly high and should be well shaded and provided with reflectors.

Incandescent lamps for supplying general illumination may be arranged in groups, as in chandeliers and side lights, may be placed as a frieze around the side walls a short distance below the ceiling, or may be used as ceiling lights. In the latter case it is desirable to use reflectors.

[*To be continued.*]

Note.—This series of articles, intended to survey, briefly, the whole field of applied electricity for light, power and heat, was begun in the Western Electrician of February 2, 1907.

QUESTIONS AND ANSWERS.

Counter Electromotive Force of Electric Elevators.

P. S., New York: Are there any elevators so constructed that in their descent when heavily loaded they will generate sufficient counter electromotive force to reverse the direction of the current in the circuit and to cause the meter to register against the company? This statement was made at a lecture by a gentleman in an attempt to explain the effect of counter electromotive force in dynamos and motors.

Answer.

Elevators are generally counterbalanced for the average load. The current taken by the motor varies considerably and may for very short instants be reversed, that is, going back into the line, which means that the motor is for the instant driven as a generator. Most of the current is consumed in operating the elevator itself, the weight of the passengers being a small part of the total. No elevators are designed specially to return power to the line during their descent, as this would be very poor economy. It would mean practically no counterweight, thus requiring excessive energy during the up-trip, and the descent would have to be made rapidly. In any case the return of power would be a very small percentage of the excess current consumed in raising the elevator.

Illumination Required in Rooms of Different Size.

E. G. A., Mescalero, N. M.: Is there a simple rule for estimating candlepower of light needed for different sized rooms?

Answer.

Any simple rule that could be given would have to be modified by the position and character of distribution of the light as well as by the interior finish of the surfaces of the room. The number of lights necessary and sufficient to illuminate a brightly finished room will prove inadequate if the walls are later colored in dark shades. For this reason the illumination is best planned for the worst conditions. In ordinary rooms the height of the lights in the room does not appreciably change the resulting general illumination if the walls be bright, but if dark the difference will be very noticeable.

Without employing the technical terms and conceptions of the illuminating engineer an approximate rule for determining the candlepower required for small installations may be obtained in terms of the square feet of floor space per candlepower. Ascertain the number of square feet in the floor of the room and divide this by an appropriate value of the square feet per candle; the result will be approximately the required total candlepower required in the room. For very brilliant effects no more than two square feet per candle should be allowed. Other values estimated for usual conditions of absorption and reflection are as follows: Bright, dining room or library, about 3 square feet per candle; bathroom or hall, 5; reception room or bedroom, 7; fair illumination, 9.

Reversal of Current as Affecting Wattmeters.

P. S., New York: If the direction of the current in any circuit be reversed, will the direction of motion of any wattmeters that may be in the circuit be reversed also? By any wattmeters I mean any integrating meters, such as furnished or supplied by light and power companies.

ANSWER.

It is probably true that all forms of motor meters will record backward if the current is reversed, unless some mechanical detent or disengaging device is provided, so that the train will not record on such reversed current. Electrolytic meters will behave differently if the current is reversed, and, in fact, some forms will be seriously damaged by such reverse current if it continue for an appreciable length of time. Motor meters will not be injured by a reversed current, but the train will record backward unless provided with some mechanical device to prevent it.

Fire Protection of a Large Industrial Plant.

In modern manufacturing systems, where groups of buildings are often placed in isolated and exposed positions with respect to the fire protection of the community, owners have availed themselves of the proverbial "ounce of prevention," and equipped their plants with every known facility of fighting fire.

An excellent example of modern factory construction and the means adopted to prevent fire losses is furnished in the West Allis (Milwaukee) Works of Allis-Chalmers Company, which comprise nine principal structures, with an aggregate floor space in the shops alone, equivalent to 38½ acres.

Each building of the West Allis group is built of steel-skeleton construction, with end and curtain walls of brick. Roofs are covered with asbestos fireproof roofing. The pattern-storage building, in which all patterns are stored, is built with every possible view to the protection of its valuable contents from danger of fire. All steel columns are encased in concrete. Floors consist of concrete arches turned between steel beams and enclosing beams. Fire walls divide its length into relatively small units, and communication between them may be shut off at any time by means of automatic fire doors. The elevators and stairway are enclosed in brick walls. Doors and windows have steel lintels resting on brick walls. Windows are fitted with wire glass and automatic closing devices.

The water supply for all purposes is obtained from artesian wells located on the works property and pumped automatically by motor-driven deep-well pumps, through eight-inch pipes, to four cisterns built of concrete, each 100,000 gallons capacity. A pressure of 100 pounds is kept on the mains at all times, and it can be raised to 140 pounds if necessary. The automatic-sprinkler system is installed throughout the plant in conformity with the established modern practice. The source of water supply for this system is provided in the 100,000-gallon steel tank, which was built for Allis-Chalmers Company by the Chicago Bridge and Iron Company of Chicago. This tank is 22 feet in diameter by 28 feet high, and stands 164 feet in the air, supported by standards, which are set in a square, each side of which is 27½ feet.

When the West Allis works were extended recently, two new artesian wells were sunk to augment the former supply. The new wells were driven to a depth of 1,000 feet and the old wells deepened also.

Primary, Secondary and Working Standards of Light.

BY EDWARD P. HYDE.

We are living in an age of exact measurement. With what profound wonder would our forefathers have contemplated the marvelous precision of modern physical science. We compare resistances to parts in a million; we weigh weights to parts in a billion. Indeed, if it were not for photometry and a few kindred sciences, I am afraid that the term "per cent.," which for so many years has been the common unit in expressing accuracy, would soon become obsolete in that sense.

What, we ask ourselves, is the cause of this tardy development of photometry? Is it because our instruments are insufficient, or our standards inadequate, or is there some inherent difficulty that cannot be overcome? To be sure we shall always have the limitations of the human eye to contend with, because "light" by definition is subjective, but oftentimes the eye is made the scapegoat for faulty methods or inaccurate measurements. The accuracy of comparison of two luminous sources of the same color is well beyond that with which the intensity of either can be expressed in terms of our standards. The fault then lies ultimately with our standards.

It is my purpose to ask your consideration of a few very practical questions in connection with the relationship of primary, secondary and working standards of light. By a "primary" standard is meant any standard that can be set up from written specifications, such as the Violle platinum standard or the Hefner lamp, or the Vernon-Harcourt pentane lamp. By a "secondary" standard is meant a standard which, though not reproducible, will remain constant after having once been calibrated. The well-seasoned incandescent lamp is the best example of this. By a "working" standard is meant any lamp that is used as a standard in ordinary photometric measurements. It may be a secondary standard or even a primary standard, but it is not necessarily either. Though the three classes of standards are quite separate in principle they overlap in practice.

One quality which all standards must possess in common is a suitable color. This requirement is very indefinite, but it must needs be so. We cannot specify the actual spectral distribution, but we can exclude monochromatic sources. In other words, we can immediately eliminate some sources as being impracticable, whereas we cannot assign values of relative merit to those which fall within the wide range of acceptability.

The fitness of a primary standard depends upon the degree of accuracy with which it can be reproduced. It is not necessary that it should remain constant over a long period of use; the time at which the measurements are to be made can be specified, as is done in the case of the Violle platinum standard. Of course if a lamp can at the same time serve as a primary standard and also as a secondary or working standard, it is more valuable. If it is simple and inexpensive so much the better, but these are not necessary qualities of a primary standard.

In a secondary standard we desire other qualities. These are best seen by keeping in mind an example—the well-seasoned incandescent lamp. A secondary standard need not be reproducible—we cannot make two incandescent lamps exactly alike; but it must remain constant after having once been calibrated in terms of the primary standard. It should be portable, simple and inexpensive.

The working standards should be adapted to the particular kind of testing in which they are to be used. In testing incandescent lamps we want as working standards other incandescent lamps; in testing gas or oil we want flame standards. Working standards should be portable, simple and inexpensive, easy to manipulate and of suitable intensity, but they need not be reproducible. Having been standardized in terms of secondary standards, they should remain constant over a reasonably long period before having to be calibrated or replaced.

Let us inquire into the present conditions regarding the three classes of standards. First, is there a satisfactory primary standard of light? I think you will all agree with me that there is not. Many such standards have been proposed from time to time, and at present there are three or four such standards in actual use. This last fact in itself indicates that there is no one standard sufficiently superior to the others to warrant its general adoption.

The situation with regard to secondary standards is quite different. It is generally conceded that the well-seasoned incandescent lamp meets every requirement of a secondary standard of light. The objection that is occasionally raised, that it changes with the time of burning, is not, in my opinion, as important as the changes which seem to take place at times when the lamp is stored away. A four-watts-per-candle lamp, if properly seasoned, will not change appreciably, i. e., more than two or three parts in a thousand in 50 or 75 hours' continuous burning. Since it only requires several minutes to measure an incandescent lamp, the standard lamp could be measured 500 or 1,000 times before it would change appreciably in intensity. Since at the Bureau of Standards there are incandescent-lamp secondary standards that are only used once or twice a year, it is evident that if only the change in candlepower due to burning is to be reckoned with, the unit, in terms of which the secondary standards are expressed, could be maintained constant to within two or three parts in 1,000 for several hundred years.

On the other hand, there seem to be much larger changes in the lamps from time to time while the lamps are not burning. Occasionally a lamp develops a bad vacuum; at other times a change in resistance is noticed, indicating probably an altered contact resistance between the filament and the leading-in wires. But apart from these there are other apparent changes in intensity which are just over the limit of observational error, and for which we can offer no explanation. In determining the relative values of a number of incandescent lamps that have been intercompared before, one of the lamps may seem to be high or low in intensity, with respect to the mean of the remaining lamps by a half per cent. or more. In another set of measurements, some time later, the lamp may come back to its original value. These changes are small, however, and if a number of lamps are used the mean value should remain sensibly constant over a long period. The well-seasoned incandescent lamp is also an entirely satisfactory working standard in the photometry of electric lamps, but is not suitable for use in gas photometry. The consensus of opinion among gas engineers is certainly that the working standard for gas photometry should be a flame standard. Candles are still used to some extent in the United States and abroad, but recently there has been considerable advancement both in this country and in England in the adoption of the Harcourt 10-candlepower pentane lamp. In Germany the Hefner lamp is used now to a great extent in gas photometry, I believe, and in France the Carcel lamp continues to be used almost exclusively.

Another interesting fact in connection with the working standards in gas photometry is that, with the possible exception of the Carcel lamp, which, I believe, has been calibrated in terms of the Violle standard, all of the lamps used as working standards are at the same time primary standards. In the photometry of electric lamps the seasoned incandescent lamp soon came to be used as the working standard, since the primary flame standards were not convenient.

Is it not possible that a cheap and portable lamp which would remain constant in intensity after having been calibrated might be found which would be more convenient and more easily manipulated than the Harcourt pentane lamp, for example? It does not follow that the lamp which best satisfies the requirements of both a primary and a working standard will satisfy the requirements of a working standard alone better than any other lamp. In other words, the lamp which is best with respect to both constancy and reproducibility need not be the most constant lamp if reproducibility is eliminated. With authoritative testing laboratories available, where secondary stands are maintained, it is no longer necessary that the primary standards should be used in industrial photometry. The use of a primary standard as a working standard may, however, lead to a confusion of units between the gas and electric industries. This is exemplified by the situation in our own country at present. Both in the photometry of gas and of electric lamps the intention was to use the British parliamentary candle. The American Institute of Electrical Engineers recommends obtaining the candle through the Hefner by the use of the ratio one hefner equals 0.88 candle, which was supposed to be the mean value of the best determinations of that ratio. In gas photometry the sperm candle, or more generally in recent years the Harcourt pentane lamp, has been used. It is definitely known now that the candle obtained through the pentane lamp does not bear to the hefner candle the ratio of 1 to 0.88. From comparisons through electric lamps measured at the National Physical Laboratory in England and at the Physikalische-Technische-Reichsanstalt in Germany the above ratio is found to be in error by two per cent. From direct comparisons of Hefner and Harcourt pentane lamps the ratio appears to be in error by four or five per cent. If now both the gas and electric-lighting industries adopted the same unit, which could be maintained at a national laboratory, and in terms of which working standards for both gas and electric lamps could be calibrated, "candlepower" would have a single significance throughout the entire country.

The final step would be to agree with other civilized countries on the value of the unit adopted so that we might have in photometry, as in most other branches of physical science, an international unit. Although the German unit is so different from the others as to offer considerable difficulty to the realization of this plan, the units of England, France and the United States are sufficiently close to warrant a compromise. This compromise would not entail the abolishment of the present standards; it would merely necessitate assigning to the standards different numerical values. Thus the Carcel would no longer be 9.6 bougies decimals, but 9.5 or 9.4 international candles.

1. Abstract of a paper presented at the convention of the Illuminating Engineering Society, Boston, July 30, 1907. Dr. Hyde is connected with the Bureau of Standards, Washington, D. C.

Electrolytic Purification of Water.

An interesting application of electricity is its use for purifying water with the aid of filtering or separating devices. One of the fundamental chemical methods of purification has been the addition of some compound to the water to be treated, which combines with the dissolved impurity to form a new substance which is insoluble and may be separated out by filtration methods.

Broadly this is the idea of electrolytic purification, except that here under certain circumstances no extra chemicals need be added, the action of the current serving to form a new and insoluble compound out of the ingredients already contained in the water. Apparatus is provided to separate this undissolved foreign matter from the water by taking advantage of the difference in specific gravity of the two.

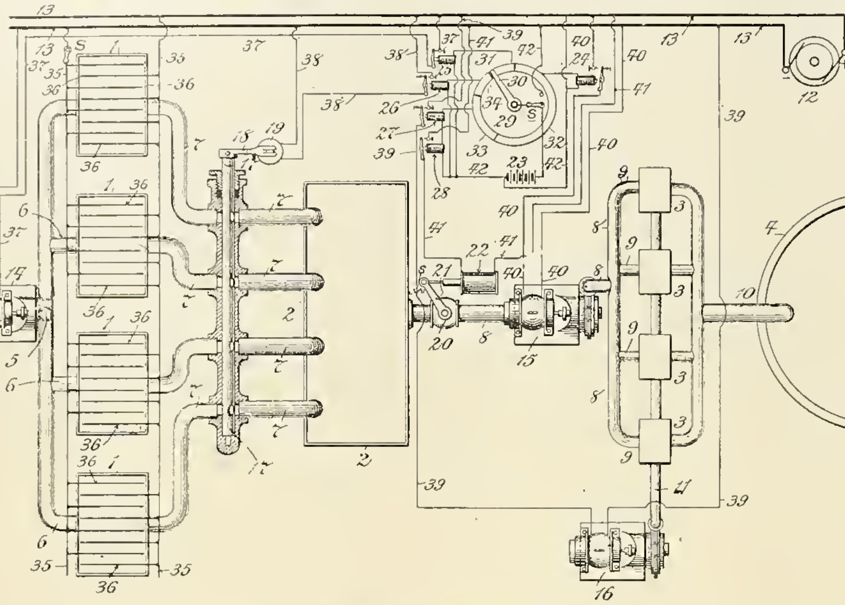


FIG I. PLAN VIEW OF APPARATUS USED FOR ELECTROLYTIC PURIFICATION OF WATER.

Attempts have heretofore been made in this particular by the use of electrolytic devices to effect the result sought, and while the separation has been effected in a manner there is doubt that it has been practically accomplished so as to make it possible to use large volumes of water. With a view of accomplishing this result in particular the present invention to be described was devised by Alfred O. Tate of Brooklyn, N. Y.

Fig. 1 is a diagrammatic view illustrating the apparatus complete, parts of the mechanism being shown in plan view. Fig. 2 is a side elevational view of the apparatus as seen looking at Fig. 1 from the bottom.

In Fig. 1 (1) (1), etc., represent four electrolytic tanks, each of relatively large holding capacity and at a common level, and (2) represents a storage tank at lower level and having an equivalent capacity to all four of the electrolytic tanks, (3) (3) etc., being wholly enclosed filtering tanks in which are located, respectively, filters of any desired form. The consumption tank from which the treated water is drawn for use is shown at (4), while (5) is the supply pipe running from the supply of untreated water through a force pump, the upper end of the pipe being divided into four branches running one to the top of each of the electrolytic tanks (1) (1), etc.

Outlet pipes (7) (7), etc., lead from the bottom of each electrolytic tank into the storage tank (2). A pipe (3) runs from the bottom of the storage tank to and through a second force pump and is connected at its upper end to four branch pipes (9) (9), etc., running to the bottom of the filtering tanks (3) (3). Four outlet pipes connected to the upper parts of the tanks (3) (3) are connected together to a single pipe (10) extending upward and into the top of the consumption tank (4).

A flushing pipe (11) is connected to a suction pump for flushing filtering tanks. A dynamo (12) supplies the entire plant through feeders (13) (13), and (14) (15) and (16) are electric motors for operating the respective pumps to which they are attached.

A rotary cock (17) has multiple ports for controlling the flow of the water through the pipes (7) (7), with the operating arm attached to a solenoid core (19). The cock (20) is operated by a controlling solenoid (22) and a restoring spring. At (23) is a storage battery, and (24) (25) (26) (27) and (28) are controlling magnets. The controlling device (29) has a conducting arm (30) connected with a time mechanism not shown, driven at a definite speed, so that the free end of the arm is rotated over contact plates (31) (32) (33) and (34) making connections to the electromagnets.

Branch feeders (35) (35) are connected in multiple with the main feeders (13) (13) by a switch (s) and two pairs of plate electrodes (36) (36) arranged as shown in the electrolytic tanks (1) (1), so that when the switch (S) is closed and the dynamo (12) set in operation the latter is connected with the tanks full of water. A branch circuit (42) is connected with the storage battery (23) and switch (s), its function being to connect the storage battery either to the contact arm (30) of the circuit-controlling device (29), or to the dynamo (12), so as to charge the battery when desired.

The operation may be described as follows: Suppose that the apparatus has been in operation to such an extent as to have partially filled the consumption tank (4) and that the time mechanism has rotated the arm (30) to the position shown. A circuit is closed from the battery (23) through

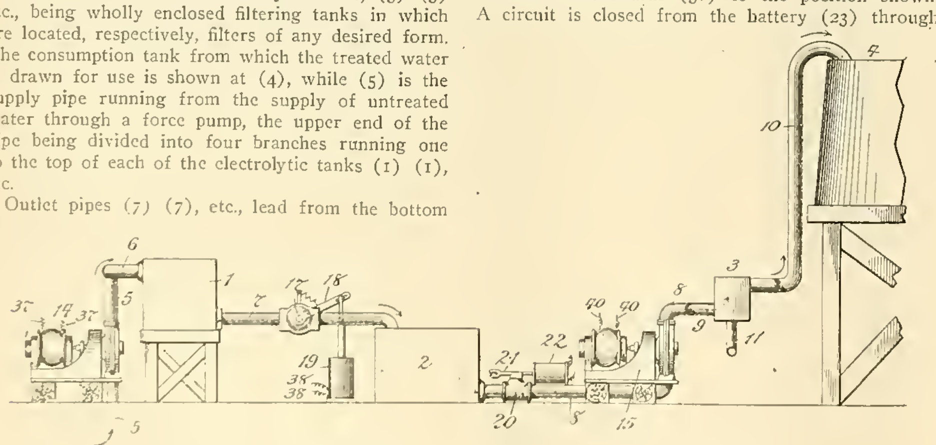


FIG 2 SIDE ELEVATION OF APPARATUS FOR ELECTROLYTIC PURIFICATION OF WATER.

the switch (s), contact arm (30), contact plate (31), through the magnet (25), to the other pole of the battery so that the armature of that magnet is drawn forward and circuit is closed from the plus pole of the dynamo (12) by way of the upper feeder (13), conductor (37), armature of magnet (25), conductor (37), electric motor (14), conductor (37), to the other feeder; consequently the pump operated by the motor (14) is set in operation pumping water into the tanks (1) (1), during the time that the arm (30) is moving over the contact plate (31), say for a period of five minutes, at the end of which time the tanks will be filled.

Electrolytic action is immediately set up in all of the tanks through the electrodes (36) and branch feeders (35), so that the water therein is subjected to treatment from the time that the pump (14) was set in operation. As the arm (30) advances it passes upon the contact plate (32), at which time a circuit is closed from the battery (23) as before through the switch (s), arm (30), contact plate (32) and electromagnet (24), causing the armature lever of that electromagnet to be drawn forward against the front contact stop and close a branch circuit from the positive pole of the dynamo (12) by way of branch conductor (40) through the motor (15), which controls the operation of the pump for pumping water through the filters (3) (3), the cock (20), and the pipe (8) being open at that time and the ports of the cock (17) being closed to the outlet pipes (7) (7) of the electrolytic tanks (1) (1); hence the motor (15) acts during the period that the arm (30) is passing over the contact plate (32), say for a period of 30 minutes, to pump the water out of the storage tank (2) and force it upward through the filters in the tanks (3) (3), and ultimately into the consumption tank (4).

At the end of 30 minutes the free end of the arm (30) moves upon the contact plate (33), disconnecting the motor (15) from the circuit, and circuit is now closed from the battery (23) in the manner before indicated through the two electromagnets (27) and (28) in series, causing their armatures to be drawn forward so that two branch circuits (39) and (41) are closed from the dynamo (12), one (41) to the solenoid (40), which acting upon its core through the arm (21) closes the cock (20), and the other (39), through the motor (16) controlling the operation of the exhaust pump, withdraws so much of the water as remains in the filter, and in the pipe (10) between the same and the consumption tank (4), backward with sufficient velocity to effectually flush the same.

This takes place during the period of say 10 minutes from the time that the contact arm (30) passes over the contact plate (33) and enters upon the contact plate (34), at which time circuit is broken to the two magnets (27) and (28), thus disconnecting the motor (16) and the controlling solenoid (22) from the circuit and permitting the spiral spring (S) to restore the cock (20) to its original position.

When the arm (30) passes upon section (34), however, an additional branch circuit is closed from the battery (23) through the magnet (26), so that the armature thereof is drawn forward and a branch circuit (38) is closed from the dynamo to the controlling solenoid (19), thus turning the cock (17) so that all of the ports are open and will allow the water which has been now fully treated for 45 minutes in the electrolytic tanks to flow therefrom into the storage tank (2). This discharge takes place for a period of, say, five minutes, or during the time that the arm (30) is passing over the contact plate (34). When arm (30) passes again upon the contact plate (31) the cock (17) is restored to its original position and the controlling solenoid having been demagnetized and the electrolytic tanks (1) (1) having been emptied, the motor (14) is again started up and the operation is repeated, and so on indefinitely, the entire operation being wholly automatic and continuous.

It is thought that this patent is broadly new in effecting the separation and disintegration of solid matter from water through the combined agency of electrolytic action and power-driven separating devices, and the inventor's claims are generic as to this feature.

Itinerary of the German Electrical Experts.

An Associated Press dispatch from Berlin says that the commission of German electrical experts and railroad officials appointed to tour the United States for the purpose of studying American city and interurban transportation facilities, sailed for New York from Genoa on August 12th on the Hamburg-American company's steamer Moltke. The commission will visit most of the United States, Canada and parts of Mexico in a trip that will last three months. The commission will sail for home from Vera Cruz, Mexico.

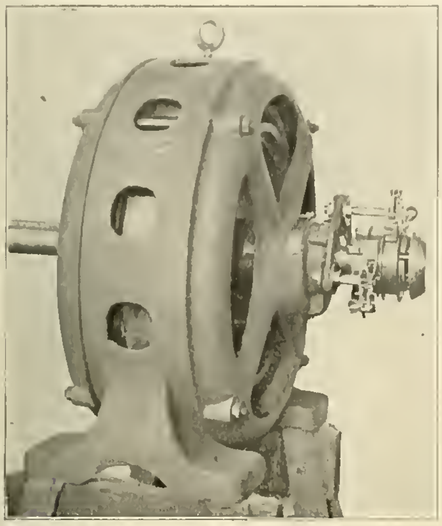
The experts will visit Salisbury, N. C.; Niagara Falls, Montreal, Canada; Madison, Wis.; Duluth, Minn.; Colorado Springs, and Spokane Falls, Wash.; and inspect the high-voltage long-distance transmission lines.

The second task of the commissioners is to examine the electrical transportation facilities of New York, Baltimore, Washington, Syracuse, Rochester and Chicago.

Allis-Chalmers Wound-rotor Type of Induction Motor.

The type of motor shown in the accompanying illustration is designed to meet conditions where the machine is required to start under load or where speed variation is required. It is manufactured by Allis-Chalmers Company, Milwaukee. This machine occupies the same position as the series and compound-wound types of direct-current motors, but has the advantage over this former type in that its speed is limited and cannot exceed the frequency of the circuit in which it is connected, therefore cannot run away as would the direct-current series motor. This type of motor is mechanically the same as the "squirrel-cage" type and has the same advantages over the direct-current type for certain classes of work.

In order to apply resistance the rotor is provided with a Y winding connected to slip rings, as shown in the illustration. A device is provided for short-



WOUND-ROTOR INDUCTION MOTOR

circuiting the collector rings after the motor has been started, so that the carbon brushes carry current only during the starting period. Type A (NY) motors, as they are called, are suitable for places where the motor must start under heavy load or where the starting current must be as small as possible in order to avoid voltage fluctuations, or to economize in current when the motor is started and stopped frequently.

BOOK TABLE.

Drahtlose Telephonie (Wireless Telephony). By Ernst Ruhmer. Berlin: Published by the author. 1907. Pp. (6¾ by 10 inches), 140, with 139 diagrams and illustrations.

This little book (written in German), giving a history of the efforts in the direction of achieving wireless telephony, has a timely interest now, when scientific attention has been directed to the solving of this problem, and several inventors seem on the eve of actually accomplishing it on a practical scale. The author, Ernst Ruhmer of Berlin, has been in close touch with experiments for the wireless transmission of speech ever since his own work on the Wansee several years ago, which attracted some attention when he succeeded in talking five miles over a beam of light.

This series of experiments, together with those of a similar character by other investigators, is fully described in the opening chapter on photo-telephony. The essential principle of these methods was to cause a beam to change in intensity following the spoken sound waves, and a selenium cell at the receiving station produced a corresponding movement of a telephone receiver diaphragm.

Another series of experiments was made with hydro-telephony, depending on the principle that a ground current between two points spreads over a large area, and that even far to one side of a line connecting the two, a receiver with widely separated grounded terminals will receive an appreciable current. Space telephony by induction, both magnetic and electrostatic, is explained in several circuit diagrams, and some figures are given of installations now in use.

Of course the greater part of the book is devoted to transmission by electric waves, to which the attention of all experimenters was turned following the success of wireless telegraphy with the Hertzian waves. The use of an alternating current of inaudible frequency on which the voice vibrations are impressed, has been the fundamental method of most of the inventors, and modifications of the principle, each apparently a step in the right direction, have been due to several diligent workers.

The circuits and apparatus of each of these systems are described very completely; in many instances the author has repeated the experiments at his own laboratory. A great number of oscillograph records of current waves are shown, and the character of the vibration in the primary is compared with the resulting electromotive force wave in the secondary of the transformer used to step up to the high frequency current. A list of high-frequency generators shows that apparatus has been constructed to reach a frequency of 300,000 per second, though the power involved was less than one thousandth of a watt.

The author is seemingly sanguine of the ultimate complete success of wireless transmission of speech over great distances, since, he points out, already by electric waves we have accomplished wireless telephoning up to distances of several miles.

Oklahoma Telephone Convention.

The semi-annual meeting of the Oklahoma Independent Telephone Association was held at the Lee Hotel, Oklahoma City, August 13th. The officers of the association are L. T. Hine of Purcell, president; J. W. Wilson of Oklahoma City, vice-president; L. D. Spencer of Pauls Valley, secretary and treasurer.

The business programme was as follows: "How to Help the Association," by E. D. Nims, Oklahoma City; "How Can We Raise the Standard of Help," by W. J. Steel, Kingfisher; "Collections and Rebates," by P. K. Higgins, Oklahoma City; "Freaks and Fancies," by Horace Turman, Geary; "Traffic and Operating Methods," by C. D. Edwards, Oklahoma City; "Maintenance," by W. M. Darnell, Foss; "Construction and Methods in Small Exchanges," by L. T. Hine, Purcell; "Standardization of Apparatus," by L. H. Spencer, Pauls Valley. Following this a question box session was held and the association adjourned until its regular meeting to be held at the same city in February, 1908.

Indiana Telephone Items.

The Cambridge City Telephone Company has advanced the rates for party-line service 25 cents, making the price $1.50 per month, effective at once.

The Cumberland Telephone Company has put a crew of linemen and electricians to work dismantling the exchange in Petersburg. All old lines will be connected to the Winslow and Oakland City exchange, while the switchboard will be sent to Chusney, where the Cumberland company recently suffered the loss of an exchange by fire. It is said the Cumberland company did not object so vigorously to the $500 asked for a new franchise as it did to the precedent it would set. It is believed that such a precedent would cost the company heavy expenditure for franchises in Indiana, as many of the 10-year franchises expire this year. Already similar demands are being made by a number of towns and cities.

A modern telephone system has been completed along the line of the Chicago, South Bend and Northern Indiana Railway line, and the service is giving complete satisfaction. The system enables the operator to know at all times the location of every car on the line.

The resources of the Indiana telephone companies are being taxed to the utmost to care for the increased toll business caused by the telegraph strike. The relay men in the long-distance service are kept quite busy with newspaper messages, while business men are said to be paying for the use of the lines at certain hours each day.

Independent telephone lines through Indiana may soon be equipped with the telepost. A. C. Lindemuth of Richmond, president of the Indiana Independent organization, and also of the Richmond Home Telephone Company, has received overtures from the officials of the company that is promoting the appliance. The telepost is now in operation between Kansas City and St. Louis, and its success has been demonstrated beyond the experimental stage. It provides for the transmission of far more words than either the present telephone or telegraph, according to the reports from St. Louis. The operation is by means of an apparatus not dissimilar to the telegraph instrument, and the only skill required is such as is necessary for the operation of a typewriter. S.

GENERAL TELEPHONE NEWS.

J. M. Rich has applied for a telephone franchise at Reno and Carson, Nev. He represents Salt Lake City capitalists, who wish to install local and long-distance lines.

The Farmers' Independent Telephone Company of Stella, Okla., has been incorporated by R. S. Wheeler, James Church, C. W. Wilson, J. L. Mays, J. A. Herring, A. V. Hulse and T. J. Whitten.

Columbus, Ohio, has contracted with the Gamewell Company of New York for the installation of an automatic police telephone system, at a cost of nearly $7,000. Forty boxes are to be installed.

About $80 per year is charged for an unlimited telephone service in Paris, but in addition to this the subscriber must purchase his own instrument, which may be any one of a number of different kinds.

CORRESPONDENCE.

Continental Europe.

Paris, August 6.—The Municipal Council of Paris has been engaged for some time in discussing the new measures which are to be taken in regard to the electric light supply, and as a result of the recent decisions there seems to be no doubt that the rates are to be lowered and at the same time the underground wiring will be increased to some extent. Following upon the reduction of the tariff, which is to take place on November 1st, it is expected that there will be an increased consumption of current, as heretofore the high rates prevented a large number of persons from using current. The municipality will be obliged to make a considerable outlay for the new wiring which will need to be installed, and the credit which is needed for this purpose is estimated at $1,000,000.

It is said that on account of the great interest which the German government is taking in the matter of electric railroads for local or trunk lines, the Department of Public Works is taking measures to collect all the most recent data as to the methods of operating and the different systems of electric locomotives which are in use. To this end a special commission has been appointed, composed of well-known experts, and presided over by Mr. Wipler, one of the chiefs of the department. The commission is to make a trip to America in order to study the electric-railroad methods which are in use, and expects to secure a great deal of useful information. This movement, it is to be remarked, is quite in line with the attitude which is taken by the heads of government departments in many of the countries on the Continent, especially Switzerland, Italy and Sweden.

I have already had occasion to refer to the work upon the Lötschberg Tunnel, which is one of the most important enterprises in Switzerland. At the present time the first kilometer of the tunnel has already been dug. The last monthly report states that on the 30th of June the advance galley measured 516 meters on the south end and 487 meters at the north. The rate of advancement, with the temporary drills which are now in use, is about five meters a day at each end of the tunnel, but with the new drills which are soon to be installed the rate will be increased to seven or eight meters. Should all go well, as is expected, at this rate the tunnel will be finished in 1911.

Engineers have arrived in the Aosta Valley in order to carry out the preliminary surveys upon the project for a new tunnel through Mont Blanc, and other parties are in the neighborhood of the Grand St. Bernard for the same purpose. These observations are being carried out by the Italian government.

On the occasion of the Maritime Exposition which is being held at Bordeaux during the summer, a number of congresses were held which aroused great interest. Among these may be mentioned the congress of the French chambers of commerce which are established in foreign countries. In the recent session, the congress adopted a series of resolutions tending to protect and facilitate the increase of French commerce in different countries in order to keep pace with the great activity which is being shown by some of the other European nations in this respect. The clauses point to the founding of independent commercial associations, including the leading business houses and manufacturing firms, also syndicates and export banks. The next congress is to be held at Brussels in 1910. A. de C.

Great Britain.

London, August 10.—One instance of the great necessity for the revision of our electric-lighting acts has been the uncertainty in regard to the legality, to put it bluntly, of using the maximum-demand system of charging for electricity supply. This system, of course, introduces what may be termed a preference toward certain classes of consumers, but the electric-lighting acts lay it down that all persons shall be given a supply, under similar circumstances, upon the same terms. The doubt has existed as to whether the qualifying words "under similar circumstances" really gives the power to do what the maximum-demand system does, viz., discriminate between classes of consumers. As a matter of fact, the act has been construed in this liberal sense by most central-station engineers, mainly for the reason that it was to nobody's interest—except the gas companies, and for them probably the expense would have been too great—to raise a point of law. A case in the Australian courts, however, has put the matter in a very clear light. In this instance, the Melbourne Gas Company raised the point against the municipal authorities, who supply the electrical energy, and after various decisions were given in Australia, a final appeal was made in London to our own Privy Council, which has decreed that a charge upon the maximum-demand system, as an alternative to a flat rate, is not against the meaning of the acts in Australia, which are based upon the wording of the English acts of 1881 and 1882.

Although they are not yet officially published, it is reported that the accounts of the Swansea municipal telephone undertaking are of an eminently satisfactory character, showing as they do a profit of $7,500 for the three years the undertaking has been in existence, after providing for interest, sinking fund and depreciation.

In Wolverhampton the corporation is extending the Lorain surface-contact traction system. A line six miles long upon the Dolter system has just been opened in Yorkshire between Mecborough and Rotherham.

After continual postponements from the commencement of the session, the bill promoted by the electric supply companies of London, with the object of facilitating a cheap supply of electricity, has had to be withdrawn, as the session closes in Parliament at the end of a fortnight. Meanwhile, it is interesting to note the progress which is being made while so many attempts have failed toward securing such a bill. The Stepney Borough Council has decided to erect a new power station rather than await the remote possibility of a "bulk" supply bill being passed; in addition, the South Metropolitan Electric Light and Power Company, an enterprising company dealing with a district in the south and southeast of London, has opened a large new power station—the first generating sets being two of 1,500 kilowatts capacity—in order to cope with the growing power demand. There will soon be no room for a paramount supply authority.

The Brush Electrical Engineering Company has had to reduce its capital by a considerable amount, owing to the large depreciation in the value of its patents, which have, hitherto, stood on the books at the figure at which they were purchased. G.

Dominion of Canada.

Ottawa, August 17.—The receipts of the Toronto Railway Company for 11 months of the city's financial year have exceeded $3,000,000. The city gets 15 per cent. on the receipts up to that figure and 20 per cent. on all over that amount. This is the first year that the city has enjoyed the privilege of collecting the highest rate on the gross earnings of the company.

The contract has been let for the electrical machinery that will be installed for the development of power at Galetta, Ont. It will consist of a 500-horsepower dynamo, with a 10-mile 11,000-volt transmission line, and the cost will be about $50,000. The development work is being pushed forward rapidly, and it is expected that it will be ready for service in about eight months.

The shareholders of the Canadian General Electric Company met at Toronto, and voted unanimously to increase the capital stock from $5,000,000 to $8,000,000. Mr. Fred Nicholls, second vice-president and general manager, states that the company has had an uninterrupted share of prosperity, and at present has $5,000,000 in work on hand. He says that he has an offer of $2,000,000 net cash, without any expense whatever, of the new capital-stock issue from England.

Within six weeks it is expected that work on an electric smelter for the reduction of all sorts of ores will be commenced in Ottawa. Machinery has been ordered in New Jersey. The plant in Ottawa will cost about $100,000, and skilled labor will be employed. The capitalization is $2,000,000, but not more than half the stock will be issued at first.

The Marconi Wireless Telegraph Company has announced that it will be prepared for wireless-telegraph service from Canada to England in September. The messages will be sent between Clifton, Ireland, and Glace Bay, Nova Scotia. The regular rate will be five cents per word, and the government and press rate 2½ cents. For some time past the company has had communication across the Atlantic, and exhaustive tests have been carried on. Now that these tests have proved satisfactory, the company intends entering the commercial field at once.

The Marconi company is now operating a complete intercommunicating chain of wireless-telegraph stations in the river and Gulf of St. Lawrence. These stations were built at the expense of the Dominion government, and are owned and maintained by the Canadian government. A contract was made with the company for the construction and operation of the chain of stations in the river and gulf, the government paying $10,000 for each of the high-powered stations, and $5,000 for the low-powered ones. There are 12 of the former and three of the latter. This includes all the stations excepting those at Camperdown and Sable Island, which are not owned by the government. For operating these stations the government pays annually $3,000 for each of the high-power stations and $2,500 each for the others, a total of nearly $50,000 a year. W.

Winnipeg, Man., August 17.—At the meeting of the Board of Trade, Nelson, B. C., a resolution was adopted appointing a committee to secure municipal telephones, owing to the inadequacy of the present system. F. Starkey is president of the Board of Trade.

Dirt will soon begin to fly on the British Columbia Electric Street Railroad Company's survey between New Westminster and Chilliwac, and an effort will be made to have the line in operation this year. The general superintendent is R. H. Sperling, New Westminster, B. C.

A. H. Morse, construction engineer, is starting work at Vancouver, B. C., on the government wireless-telegraph station. Five such stations will be erected on the Pacific Coast this fall, and arrangements are now being made to commence the work this month. The Vancouver station will be located at Point Grey.

Rural telephones are being discussed by the farmers of Swan Lake, Man., and it is expected a meeting will be called at an early date to arrange for building a system. G. A. Titmus, Kenton, Man., may be addressed.

Some of the big cattle ranchers south of the Cypress Hills are endeavoring to persuade the Alberta-Southeastern Telephone Company to extend its line to Havre, Mont. This would pass a number of big ranches, and as a line is now being built between Havre and Chinook, the Americans who are operating on the Canadian side of the international boundary would be placed in direct communication with their headquarters in these two cities. Those interested state they are willing to do much to finance the scheme. It is proposed to run the line along the mountain to Medicine Lodge, and from there a paying route through the valley could be taken across the border.

At the last meeting of the City Council, Edmonton, Alberta, a motion was carried reducing the price of electric power by 10 per cent., making a reduction of 30 per cent. within the last two years and putting Edmonton at the top of the list of cities where light and power is being successfully produced from the civic plant. During the last two years the surplus gain from the light and power plant of the city has aggregated $19,100.64. The light rates for the small consumer will be reduced, as well as for the larger. The lighting rates range from 11 to 8 cents and the power rates from 9 to 3½ cents a kilowatt-hour. R.

New England.

Boston, August 17.—The telegraphers' strike reached Boston Tuesday noon. At 11 a. m. the Postal company's operators went out, and an hour later the Western Union operators quit work. Enough operators remained at work to enable both companies to keep the business going, but they were obliged to close many of their branch offices. The telegraphing public helped the companies by filing as few telegrams as possible, using the telephone as much as practicable. This congested the business of the American Telephone and Telegraph Company and caused considerable delay to its customers.

The Atlantic Telegraph Company is preparing to enter the field as a competitor to the Western Union and Postal Telegraph companies. The Atlantic company was organized by the late John J. Donovan of Lowell, Mass., about 20 years ago, and it owns a telegraph line between Boston, Mass., and Portland, Me., via Lowell, Lawrence and other cities. It was leased to the Baltimore and Ohio Telegraph Company when that company was a competitor of the Western Union company, and when the latter obtained control of the former company's lines it took the lease of the Atlantic lines. That lease has now expired and the Western Union company's offer to renew was not satisfactory to the Atlantic company, which then decided to go into business on its own account. It is finding difficulty in getting its wires into this city, as it cannot obtain permission to use the present underground system, and overhead wires are prohibited in the part of the city through which it must come. The company has an office on Hanover Street, but the date of its opening for business has not been announced.

The Marlboro Electric Company of Marlboro, Mass., has been authorized to issue 1,700 shares of additional capital stock, to be offered to the stockholders for $100 per share. The proceeds are to be used for the payment and cancellation of its bonded indebtedness, the payment of some of its floating indebtedness, and permanent additions to its plant.

Milton J. Budlong, ex-president of the Electric Vehicle Company, has sailed for Europe. Before leaving Hartford, Conn., the company's employes presented him with a handsome silver cup suitably engraved.

The Rhode Island Company has completed plans for a car barn and repair shop in Woonsocket, R. I., to cost $125,000. B.

New York.

New York City, August 17.—The Central Railroad of New Jersey is removing the ballast from its tracks between Hampton's Junction and Skillman's Crossing, a distance of about one-half mile, because it interferes with the proper working of its block signals. An analysis was made recently of some of this ballast, and it was found to contain large quantities of magnetic ore, and it is stated that this was the cause of the failure of the signals.

At the invitation of Chief Engineer St. John Clarke, about thirty of the young engineers of Columbia College and four of their professors, attended by several of the staff engineers and a few press reporters, made a trip through the Belmont tunnel. Shortly before two o'clock the party descended shaft No. 2 at the foot of East Forty-second Street. Under the Grand Central Station and the Hotel Belmont the tracks are laid, the walls and roof of the tunnel are concreted, and the overhead wire by which the cars are to be driven is in position. This condition exists as far as Lexington Avenue station, where the platform is now in readiness, and workmen are putting the finishing touches on the moving platform which is to carry the passengers to the street. At the Jackson Avenue station on the Long Island side the station was found to be almost completed. The party crossed the river by the north tube and returned through the south tube. It will be about six weeks before the compressed air can be taken off the south tube, as some trouble has been found in the joining of the two shields. The tubes are constructed on the piston principle, being separated from each other; no difficulty will therefore be found in the question of ventilation, as at present in the subway, as the fresh air entering at one end of the tube will be pushed on and thrown out the other end by the moving train, without being used over and over again.

The new Public Utilities Commission is preparing to take up the work of the state inspector of meters, and to this end a meeting was held at which the New York Edison Company was represented. For a number of years the state inspector was in charge of the gas meters throughout the state, but no such legislation included the electric meters. The question of testing the electric meters was left largely in the hands of the several companies. The new law places electricity meters on the same basis as gas meters. It has usually been the custom that when a new meter is received it is tested out and adjusted to the maximum efficiency, and then sealed up and placed in stock to be used as occasion requires. In some cases no further tests are made other than those conducted by the manufacturer to keep the meter within the guarantee of from two to three per cent. efficiency, as the case may be. This question will bring a heavy burden to bear upon the commission, and just how and when it will be prepared to take up the question has not been announced. It is expected that shortly it will have to appoint a corps of inspectors to represent the commission. E. H. S.

Indiana.

Indianapolis, August 17.—The underwriting of the bonds in aid of the construction of the Nappanee-Syracuse section of the Fort Wayne and South Bend Interurban road has progressed to a point which insures the completion of the line.

The Common Council of South Bend has granted the Chicago, South Bend and Northern Indiana Railway Company the right to allow the cars of the Winona Interurban Company to come in over the local Murdock system. Within a week through service will be established between South Bend and Warsaw, and in the near future connections will be made with Wabash, thereby assuring through service between South Bend and Indianapolis by way of interurbans.

The big concrete stack at the power plant of the Indianapolis, Newcastle and Toledo Traction Company in Newcastle is now complete. Work on the various departments of the power house is being rushed. It is hoped to have cars running on the line by December 1st.

The Indiana Heat, Light and Power Company has purchased and taken charge of the Columbus Street Railway and Light Company, and Auditor E. C. Dearth of Paris, Ill., will manage the business for a few days, when John Crump, Jr., will accept the management of the company's interests temporarily. Conductors will be placed on the cars at once and the three-cent fare which has been charged since the line was built 17 years ago, will be raised to 4 1-6 cents. No money exchanged hands in this transaction. The new company will issue stock, and the owners of the local street-railway and light property will take stock in the new concern to the amount of the purchase price. The new company will expend $75,000 in improvements and extensions.

The City Council of Terre Haute has settled the dispute regarding the issuance of transfers to and from the Sullivan interurban line by passing an ordinance making it compulsory for any traction company operating cars within the city limits of Terre Haute to issue transfers to any line on payment of a five-cent fare, provided that the transfer shall not entitle the holder to ride over any part of the traction lines already covered on the same fare.

It is promised that by the middle of September a plant will be established in Peru, Ind., which will supply a liquid gas known as Dr. Littlefield's denatured alcohol gas. The new plant is to be built by home people, who have organized a company under the name of the Chemical Gas Company of Peru. The officers of the company are: President, James O. Cole; vice-president, Louis B. Fulwiler; treasurer, William H. Zimmerman; secretary, John T. Armitage. These men, with William Hart, form the board of directors. The company has incorporated with a capital of $10,000.

Seventeen electric delivery wagons have been installed in Indianapolis by the Adams Express Company. S. S.

Southeastern States.

Charlotte, N. C., August 16.—A new 10,000-spindle cotton mill at Gaffney, S. C., will be operated by power from Broad River, about 30 miles away.

The Southern Power Company is surveying transmission lines to Salisbury, which is close to the big Whitney development on the Yadkin River. The question of competition will be watched with interest, if both companies enter this field.

A South Carolina development is that looking to the building of an electric line from Greenwood to Edgefield. Several waterpowers are in course of development in that section, including Calhoun Falls, by Hugh McRae & Co., and the Ring-Jaw Shoals, probably by interests said to be allied with the Westinghouse company. These developments are considered as important factors in working out the trolley line from Edgefield to Greenwood, S. C.

Additional information regarding the Linville River falls development in North Carolina is to the effect that a 100-foot dam will be built, which will develop 22,000 horsepower. The power so developed is said to be ample to furnish the manufacturing and lighting needs of all towns in that portion of Western North Carolina, east of the Blue Ridge.

The Cannon, Cabarrus, Young-Hartsell and Franklin cotton mills at Concord, N. C., are to be operated by power furnished by the Southern Power Company, beginning about September 1st. Over 100 motors will be required in the operation of the four mills above named.

The Doubleday-Hill Electric Company, one of the well-recognized supply houses of the United States, is opening a southern branch at Charlotte, N. C., where a distributing house will be maintained. This is said to be the only strictly jobbing house in the Carolinas. The headquarters will be at 223 South Tryon Street. This point was selected over Atlanta and other southern cities considered.

Kings Mountain, N. C., has voted $50,000 bonds for a lighting plant, water plant and other improvements.

There has been a good deal of interurban development, prospective and actual, in the state of South Carolina during the last few weeks, enough, in fact, to attract the attention of electrical engineers generally. For instance, Mr. J. J. Hannon of New York, a few days ago, met a number of prominent local capitalists, to discuss a proposition to build an electric line 75 miles long, from Gaffney, S. C., to Charlotte, N. C. A committee of five was appointed at Gaffney, with T. B. Butler as chairman, to assist in pushing the movement, while an appropriate resolution was formally adopted, indicating the good-will of the people toward the projected development.

It is proposed to construct a 20-mile electric railway from Greenville, S. C., to Williamston, in a thickly populated section of the state, which would no doubt prove a good investment.

The Public Service Corporation of South Carolina, which proposed to build several hundred miles of electric railways over the state, and which has been mentioned before, is still at work, it is understood, and is looking carefully into the preliminaries. South Carolina seems to be on the eve of one of the greatest developments of the interurban electric lines to be found in the entire South today, millions of money being represented by the various lines under consideration and projected. L.

Illinois.

Peoria, August 17.—The Mississippi Valley Electric Railway Company has increased the number of directors from 7 to 11.

The stockholders of the Peoria Gas and Electric Company held the annual meeting here this week and elected officers for the ensuing year. H. D. Walbridge of New York was re-elected president, Emil G. Schmidt, who is the general manager of the Peoria and Springfield properties, was re-elected vice-president and general manager. W. H. Brown was again chosen as treasurer and secretary. The following were chosen as the board of directors: Col. Frederick H. Smith, Walter Barker, William H. Brown of this city, Emil G. Schmidt of Springfield, and H. D. Walbridge of New York. Mr. Walbridge attended the meeting, and before leaving for Springfield with Mr. Schmidt he inspected the local plants.

The Elizabeth Light, Heat and Power Company has been incorporated with a capital of $25,000. It will locate in Chicago to manufacture and distribute light, heat and power. The incorporators are Harry E. Murray, Frank M. Marvin, Rolla R. Longenecker.

The Sangamon Valley Interurban Company says that it has secured the desired right-of-way through Hillsboro, and that it will at once commence work on that part of the line. The company now has the right-of-way in the city of Springfield, and will operate the road as soon as it is built. The company has certified to the secretary of state of an increase of capital from $2,500 to $30,000.

The first purchase of ground for the new yards of the Peoria Terminal railway was recorded this week. The yards as planned will have a capacity of 6,000 cars. The Deming Coal Company will erect a transfer station on part of the ground, which will be used for grading the coal, and a series of buildings, 2,000 feet long and 100 feet wide, will be built to hold the machinery.

The Pekin Electric Light Company is building a new stack to take care of increased boiler capacity that is being installed. The old stack has the date of 1867 on it. The new stack is now up to a height of 100 feet. In building it the men have been using a wire for signaling from the top to the bottom. Lightning struck this wire and followed it to the ground, thus saving the stack from damage.

The Illinois Traction Company has certified to an increase of capital in two of the roads under its control; $5,000 to $500,000 was announced for the Springfield Belt Railway Company, which is the company that will build a cut-off around the city of Springfield to avoid the necessity of hauling all the freight and express through the city. The Danville and Eastern has certified to a similar increase. This company is incorporated to build a road from Danville to Terre Haute, Ind.

William L. Neal, formerly chief dispatcher of the Illinois Traction Company, with headquarters at Decatur, has been made superintendent of the Champaign-Decatur line of the company.

A new interurban railroad proposing to build from Chicago to Joliet and various points in Cook County is styled the Chicago Interurban Electric Railway Company. The capital stock is nominally $100,000 and the principal office is Chicago.

The Illinois Traction Company has shortened the running time between Springfield and Lincoln. The Lincoln-Mackinaw line is progressing rapidly, nearly one-half of the grading having been completed, and it is expected that the line will be in operation by the first of December. The road will cross three steam roads, none of which will be at grade.

A new electric locomotive has been built by the Illinois Traction Company at its shops at Bloomington and will be used here for general construction and repair work.

The Springfield and Clear Lake interurban will build a bridge over Sugar Creek. The line is being rapidly constructed between Hillsboro and Rochester.

The strike of the electrical workers in this city is still in effect. A gain has been made by the strikers, as the Mills Electric Company has signed the scale. It, with the Central Electric Company, is the only one that so far has signed the agreement.

In an electric-light plant built at Dallas City by a lumber company there, storage batteries will be used to carry the day load. V. N.

Pacific Slope.

San Francisco, August 14.—After a few weeks of work following the settlement of their original strike the Western Union operators in San Francisco and Oakland have just walked out again. The Western Union management claims to be in better shape than last time, saying that fewer operators left their employment than on the occasion of the preceding strike. The main fight is directed against the Western Union company.

Claus Spreckels, who is erecting a $30,000 power station adjoining the Spreckels Building Annex on Stevenson Street, has closed contracts for a modern electric power plant to supplement the one that now supplies light, heat and hydraulic pressure for both buildings. Hunt, Mirk & Co., the local agents, will furnish a large Westinghouse-Parsons turbo-generator to supply alternating current in place of the direct-current generating plant now in use. Everything will be renewed except the boilers, which are located in the basement of the annex.

Reports from Lodi, Cal., are to the effect that the Mopelumne River Mining Company purposes installing equipment for operating the mine with electric power from the American Electric Company's high-tension transmission lines.

The first wireless message from Eureka, Cal., was received by Prof. Alexander G. McAdie of the Weather Bureau in San Francisco a few days ago, through the new wireless station established by the Navy Department at Table Bluff. While these stations are not used for commercial business, they will be of great value for sending appeals for assistance in case of shipwrecks such as that of the steamer Columbia a short time ago.

C. B. Cooper, chief engineer of the United Wireless Telegraph Company, with headquarters in Denver, is in Portland, Ore., and says that the construction of a wireless station in Portland will be commenced very soon. A. V. Ragsdale is the Portland manager of the company, which has among its objects the installation of a chain of wireless telegraph stations extending from Nome to Panama.

The City Council of North Bend, Ore., has granted Seymone H. Bell a franchise for the construction of electric and gas plants in that city.

The Portland General Electric Company has installed a steam boiler plant in Portland for the purpose of distributing steam for heating purposes in the business district under a franchise which it holds. The plan is to furnish business houses with steam heat from a central station on a meter basis.

Good progress is reported in the financing of the latest project for developing electric power from the upper waters of the Sandy River, within easy transmission distance of Portland, Ore. An ultimate capacity of 25,000 horsepower and an investment of over $1,000,000 is talked of. Water rights have been secured and eastern capital is being interested in the project.

The City Council of Tacoma, Wash., has opened new bids for the installation of an additional steam plant for the municipal electric-lighting system. The Savage Construction Company was the lowest bidder on the proposed power plant as follows: Steam turbine plant, three 1,000-kilowatt units, $440,000; extra units, $95,000; vertical-engine plant of two 2,000-kilowatt units, $550,000; extra units, $125,000; horizontal engine plant of two 2,000-kilowatt units, $550,000; extra unit, $125,000; hydraulic plant on Upper Nisqually River, 10,000-horsepower capacity, $1,750,000.

The Thompson company proposes to condemn lands along the Nisqually River for waterpower purposes, the object being to build a plant at a cost of $2,000,000, with a capacity of 20,000 horsepower to furnish all the power used for the Pacific Traction Company controlling all the lines in Tacoma. Power not needed by the company will be furnished manufacturing concerns.

The Lewiston Clarkston Company, which has been working for several years toward the installation of a large power plant on the Grand Ronde River above Lewiston, Idaho, will carry its plans to completion within the next 18 months. A.

Michigan.

Grand Rapids, August 17.—That Trenton will sell its municipal lighting plant to the Detroit Edison Company was decided at a mass meeting of the citizens. The company is to furnish lights at the cost of $65 per year for each arc to burn all night long. The company is also to buy the present plant for $8,000.

Robert Oakman of Detroit, representing the interests of the Detroit United Railway, has obtained an option on the Pontiac, Oxford and Northern Railroad, running between Pontiac and Caseville, on Saginaw Bay. It has been understood the road would be extended to Bay City. The report now comes that the new management will try the third rail between Detroit and Pontiac. Mr. Oakman has made the statement that the road will soon be operated with electricity.

The copper country is to have an independent street-railway company before another year will have passed. It is said much depends upon the attitude taken by the Houghton County Street Railway Company. If the company now operating decides to make the extension from Wolverine to Mohawk there will be no occasion for the independent line. Otherwise another company will be organized, and it will either run its own system or lease the line to the Houghton County company.

In spite of protests that there was no provision for the expenditure and that the figures given were not large enough by half, the Common Council has decided to remove the East Side electric-lighting station to the west side of the river. Superintendent Fitzhugh said the proposed change would cost $30,000, with a saving of $5,000 a year in fuel and other expenses. L. W. B.

PERSONAL.

Mr. H. A. Moore, manager of the Dominion Engineering and Construction Company, Montreal, has resigned and joined the staff of the Canadian General Electric Company at Toronto.

A. Gartley, general manager of the Hawaiian Electric Company, has just sailed for Honolulu after spending three months in the United States. He purchased a quantity of electrical supplies while in this country.

Orrin F. French has been appointed to the position made vacant by Francis Dagger as superintendent of construction of Manitoba provincial government telephones. For the last seven years he has been connected with Independent telephone companies.

Many Chicago friends of Charles G. Burton, manager of the Peru Electric Manufacturing Company of Peru, Ind., will learn with great regret of the recent death of his wife. Mrs. Burton was a lady who was held in the highest esteem by all who knew her, and the bereaved husband and children will have sincere sympathy.

L. A. Osborne, the second vice-president of the Westinghouse Electric and Manufacturing Company, in charge of the engineering and commercial departments, is a remarkable young man, who, although he is but 35 years old, has demonstrated during his career with the company an engineering skill as well as a capacity for management which place him among the leading men of the industrial development of this country. He is familiar with every detail of the company's engineering and commercial work, and since Mr. Westinghouse, a year ago, placed him in the important position which he now occupies, he has won golden opinions for himself.

Leon Watts, construction engineer of the Allis-Chalmers Company, was guest of honor at a banquet given last week at the Hotel Blatz in Milwaukee. Mr. Watts has been with the company for about three years and has been superintending the erection of the Allis-Chalmers alternating-current power equipment at West Allis.

David E. Evans, president of the Maryland Telephone Company, died in Baltimore, Md., recently. He was born in Wales 57 years ago. Mr. Evans was prominent as a consulting engineer and as a builder of railways. While a young man in Wales he won the praise of Queen Victoria for his heroic rescue of a party of miners cut off below ground by a rush of water.

ELECTRIC LIGHTING.

The Canadian Light, Heat and Power Company of El Reno, Okla., has been incorporated for $100,000 by Henry Schafer, H. K. Schafer, J. W. Many, John Many and T. F. Blake.

The Valley Transit Light and Power Company of New Philadelphia, Ohio, was incorporated last week with a capital stock of $100,000. The company is to construct an electric road between Canton, Canal Dover, New Philadelphia, Newcomerstown, Coshocton, Newark and Columbus.

Following the announcement of Marshall Field & Co.'s installation of Nernst lamps in their great Chicago store, "The Glower," the monthly publication of the Nernst Lamp Company, Pittsburg, for August, reports that another important store, that of the Vandervoort-Barney Company, the largest dry-goods store in St. Louis, has contracted for 3,500 direct-current glower units.

Experts employed by state commissions to appraise the property of the Milwaukee Electric Railway and Light Company value the physical property of the Milwaukee Electric Railway and Light Company, the Milwaukee Heat, Light and Traction Company and the Milwaukee Central Heating Company at $14,864,849. They place the cost of reproduction at this figure. The last annual report of the company shows that the properties are capitalized at $32,107,230.83.

ELECTRIC RAILWAYS.

Work has been begun on the new Jackson-Lansing interurban line. The line will be 39 miles long and one of the best equipped in the state of Michigan.

The Evansville and Princeton Traction Company has decided to build an extension from Princeton to Patoka, and possibly from Patoka to Vincennes. It is the intention of the company eventually to have a line to Indianapolis.

Preparations are being made and active work will begin about September 1st on the El Reno (Okla.) street railway, as well as on the lines the same company will build to Fort Reno and the Darlington Indian Agency.

The Illinois Traction System has decided not to build the line from Springfield to Jacksonville. Six farmers near Springfield have held out for an exorbitant price for the right-of-way, and work has been ordered stopped until a new line can be run.

Timothy Maloney of Los Angeles has patented an electrical system of the third-rail type in which the power rail is placed between the track rails. The rail is not alive except beneath the car and is divided into sections consisting of each 30 feet of track. The new system is to be thoroughly tested on the Los Angeles Pacific.

Contracts will be let in a few days by the McKinley System of Interurban Railways on the construction of a steel bridge over the Mississippi River, which, it is said, will be larger than the Eads Bridge at St. Louis. The Central Illinois Construction Company is in charge of the project and Ralph Modjeska is the engineer.

The Chicago and Interurban Railway Company, with a capital stock of $100,000, intends to construct a road from Chicago south through Harvey, South Holland, Calumet, Thornton, Chicago Heights, Crete, to Joliet, Blue Island, Riverdale, Dalton, Hammond and other towns. The incorporators are J. W. McGill, John W. Humphrey, Claude E. Fitch, L. E. Eaton, J. M. Miller, H. D. Moreland and Fred F. Myers.

Announcement has been made at Newark, N. J., that a merger of the street-railway companies controlled by the Public Service Corporation of New Jersey, will be made in a corporation to be known as the Public Service Street Railway Company, with a capital of $38,000,000. Among the companies included in the merger are the New Jersey Street Railway Company; the Jersey City, Hoboken and Paterson Street Railway Company, the Paterson Central Electric Company; the Saddle River Traction Company; Palisade Railway Company; White Line Traction Company; Passaic and Rutherford Electric Railway Company; the Jersey City, Hoboken and Rutherford Electric Railway Company; the Paterson Horse Railroad Company; the Elizabeth and Raritan River Street Railway Company, and the Elizabeth and Plainfield Central Jersey Railway Company.

RADIO-TELEGRAPHY.

A wireless-telegraph outfit is being installed on the battleship Kansas, the approximate sending radius of which is said to be 500 miles.

The War and Navy departments are expected to co-operate in the maintenance of wireless communication between Nome and St. Michael, Alaska, and Seattle and San Francisco. The Signal Corps of the army has wireless stations at the Alaskan cities and next year will establish one at Fort Gibbon. A navy wireless station is to be erected at Valdez. The navy already has several stations in Alaska. The steel towers which the Signal Corps is to erect at Fairbanks and Circle, Alaska, to serve as antennæ, will be 175 feet high. The distance between the two places is 140 miles and regular wireless communication is to be maintained with them.

POWER TRANSMISSION.

The Turner Mills Company of East Monbo, N. C., has purchased a waterpower property, which will be developed to furnish 350 horsepower for operating its new proposed mill, which will accommodate 10,000 spindles.

The Thompson Company of Seattle is supposed to be behind a project to build a $2,000,000 plant on the Nisqually River, furnishing 20,000 horsepower, to generate current for the Felt trolley lines and to manufacturing plants.

Luray, Va., has been in total darkness for several days on account of a break in the dam of the Shenandoah River Light and Power Company. Soon after the dam was completed a small leak was found which has grown in size until a large volume of water is now going through the dam.

Assistant Engineer Charles Pohl of the Lyons (N. Y.) corps of civil engineers on the barge canal has resigned to accept an offer by the Chattanooga and Tennessee River Power Company as consulting engineer on a contract for building a 56,000-horsepower plant. It is a $2,000,000 contract for a concrete dam across the Tennessee River.

The syndicate that proposes to expend $600,000 in developing the power of Holston River at Fish dam for electrical purposes has obtained a 30-year franchise for lighting in Bristol, Va., and hopes to secure a similar franchise in Bristol, Tenn. About 7,000 horsepower will be produced, to be used for power and illuminating purposes.

A second one of the large wheels in the plant of the Niagara Falls Hydraulic Power and Manufacturing Company has been placed in operation. The big plant of the Aluminum Company of America, which adjoins the power company, is taking small loads to test machinery already installed. It is stated that the Aluminum company's new plant, which will be the largest of its kind in the world, will be ready for operation in a couple of weeks.

PUBLICATIONS.

The Palmer Monthly, the publication of the W. K. Palmer Company, engineers, Kansas City, Mo., for August has an account of the municipal waterworks and electric-lighting plant, Grand Island, Neb.

The Newport News and Old Point (Va.) Railway and Electric Company has prepared a folder which contains some of the most complete and reliable maps and other information concerning the Exposition and points of historical interest in the vicinity of Hampton Roads that has been published in such condensed form.

The Michigan Technic, published semi-annually by the University of Michigan Engineering Society, leads off its last number with an account of George Alfred Damon, managing engineer of The Arnold Company, Chicago, written by Prof. M. E. Cooley, which will prove an inspiration to the young engineer of high ideals. The other articles of the issue are well selected from the fields of civil, electrical and mechanical engineering.

The Chicago Pneumatic Tool Company is mailing two new catalogues, Nos. 23 and 24. The first is a book of more than 100 pages, and is devoted to Franklin air compressors. It contains descriptive matter and information relating to air compressors, and is embellished with halftone engravings of the machines and parts. Catalogue No. 24 is a book of similar size and elaborately covers the company's widely known lines of pneumatic tools and appliances, including both Boyer and Keller hammers, "Little Giant" drills, sand rammers and hoists. Both books are printed in colors, conveniently indexed and strongly bound, thus making them useful for references as well as catalogues. Copies will be forwarded upon request by addressing Chicago Pneumatic Tool Company, Fisher Building, Chicago, or 95 Liberty Street, Chicago.

A number of useful specialties securing interchangeable electric installations, built on the Hubbell system of "push" attachment plugs, are illustrated in a folder just issued by the manufacturer at Bridgeport, Conn. A multiple plug which supplies several cords from one source, and an angle plug enabling a lamp to be placed at right angles with the socket, are some features.

SOCIETIES AND SCHOOLS.

The National Corn Exposition will be held in Chicago during the two weeks from October 5th to 19th.

The Jesuit Fathers have established a technical school in Manila to teach electrical science. The course lasts five years.

On Friday afternoon, August 16th, Messrs. Roger and Dewitt Cregier entertained the Jovian Club of Chicago on the yacht Glad Tidings. The weather was all that could have been desired, and the Jovian Club had a most enjoyable sail.

MISCELLANEOUS.

A patent has been granted to Carleton Ellis, Boston, Mass., on a soldering composition for aluminum which consists largely of tin, zinc and aluminum, associated with a modicum of manganese.

It has been estimated that every person in the United States uses, annually, about seven dollars worth of electricity in some form. Trolley rides lead at $3 per capita; electric light is second with $1.50 per capita. Every man, woman and child buys $1.25 worth of electric apparatus and supplies, uses 75 cents worth of telephone service, and 50 cents worth of telegrams and alarms.

Trains on the Northwestern Railroad are now being controlled by the Hall automatic signal service, which has been in the process of installation for the past eight months. The system is now operating from Chicago to Marshalltown, Iowa. The signals are comparatively simple, the claim being made that trains not more than a mile or two apart may be operated with safety. Each train passing a signal bridge throws the signal to protect the train to the rear, until it has passed out of the block. The "blocks" are about a mile in length. As the engine passes under the bridge the large red signal which is the sign to trains approaching from the rear that the block is occupied, swings slowly into view and remains visible until the train passing out of the block releases it and shows in its place the safety sign that the block is unoccupied.

TRADE NEWS.

The Groton Light, Heat and Power Company of Groton, S. D., is contemplating installing a storage battery soon. J. D. Jones is secretary of the company.

C. L. Cory, consulting electrical engineer, has again opened an office in the Union Trust Building, San Francisco, Cal., where he was located before the fire.

The Electric Storage Battery Company, Philadelphia, has removed its San Francisco sales offices from the temporary location at 11 Hawthorne Street, San Francisco, to the Crocker Building, San Francisco, where the offices will be permanently located.

The McMun Electric Company, 602 Main Street, Peoria, Ill., has become successor to the contracting and retail business of the Mills Electric Company, located in Peoria. The Mills Electric Company has entered into the wholesale electrical business. The company is erecting a building at 311 South Washington Street and intends to carry a full line of everything electrical.

Tenders are invited by the commonwealth of Australia until January 8, 1908, for the supply and delivery of one common-battery switchboard and 3,000 subscribers' telephones. Full particulars, specifications, bid forms, etc., may be obtained from the office of the postmaster-general, Melbourne, Australia, or the commonwealth offices, 72 Victoria Street, S. W., London, England.

The Chicago Carbon Company, Thirty-first and Canal streets, Chicago, announces that it is now prepared to fill all orders for the highest grade carbon for various electrical purposes. The company claims that it is in a position to execute all orders promptly, having at its command unsurpassed facilities to meet any requirements. The company will be glad to hear from those in the market for anything in the carbon line.

Sealed proposals will be received at the office of the supervising architect of the Treasury Department, Washington, D. C., until September 24th for the construction (including electric conduits and wiring), of the United States postoffice building at Hamilton, Ohio, in accordance with drawings and specification, copies of which may be had at the supervising architect's office or at the office of the custodian of site at Hamilton, Ohio.

The flush receptacles made by the Manhattan Electrical Supply Company, New York and Chicago, are finished in any desired style, and their construction of high-grade material, as well as the ease with which they are wired, has made them a favorite outlet.

Albert L. Pope, vice-president of the concern, was appointed receiver for the Pope Manufacturing Company, automobile manufacturer, which has declared as its financial condition, liabilities of $1,972,826 and assets of $11,205,570. It was said that the receivership was due to inability to obtain accommodation at the banks. The company has plenty of assets and is doing an excellent business. It has three factories at Chicago, as well as plants at Hartford, Conn., Westfield, Mass., Hagerstown, Md., Toledo, Ohio, and Indianapolis, Ind. The last-mentioned factory manufactures the well-known Pope-Waverly electric vehicles, and is one of the largest makers of electric automobiles in the country.

Cecil B. Smith, civic power expert in charge of the $3,500,000 electric plant to be erected near Winnipeg, Man., states a large number of applications are being received for the specifications of the plant, and he expects that the competition will be very keen. So far, not many European firms have bid on the work. Several English firms have bid, some for the whole and others for only a part. Two Swiss and one French firm have asked for particulars.

BUSINESS.

The Durant Electric Supplies Company of Chicago calls attention to its "Ironite" wire as an economical substitute for copper for electrical transmission, particularly for telephone lines. The cost of Ironite Duplex is 25 per cent. less than for duplex copper wire, and is said to be twice as strong. The wire is made in three sizes Nos. 14, 16 and 18, and is said to be the ideal duplex drop wire. The insulation is rubber, covered with cotton braid. The Durant company also deals in dry batteries, brackets and pins.

F. B. Badt & Co., Monadnock Building, Chicago, western agents for the Excello flaming-arc lamp, say they are meeting great success with this well-known lamp. The Excello lamp, which is made for both direct and alternating current, seems to "fill a long-felt want," and those in the West who are using it have nothing but praise for it. Although F. B. Badt & Co. only recently took the agency for this lamp, a large number of representative concerns in Chicago and the West have already placed orders for it. Among them are the Garrick Theater, McVicker's Theater, Riverview Park, White City, Thomas Cusack Company and others. The American Steel and Wire Company's Waukegan mill and the Economy Light and Power Company of Joliet are among the recent new users. F. B. Badt & Co. will be pleased to mail catalogue and full information to those interested in this latest type of arc lamp.

ILLUSTRATED ELECTRICAL PATENT RECORD.

Issued (United States Patent Office) August 13, 1907.

862,871. Process of Reducing Metallic Sulphides. Edward L. Anderson, St. Louis, Mo., assignor of one-fourth to Thomas B. Harvey, St. Louis, Mo. Application filed February 23, 1907.

In a bath of electrolyte capable of dissolving the metal constituent of the sulphide and forming a salt with it, the current flow is continually reversed between two insoluble electrodes, decomposing the salt and depositing the metal upon the cathode.

862,882. Time Speed Indicator. Charles C. Coleman, Chicago, Ill. Application filed November 4, 1905.

This recording speed indicator for vehicles furnishes a tape fed at a constant rate by clock mechanism and marked at intervals corresponding to the electrical impulses transmitted from a cyclometer attachment on the wheel.

862,891. Trolley-pole Support. Hugh W. Fellows, Cahuenga, and Ira A. Cammett, Hollywood, Cal. Application filed April 13, 1906.

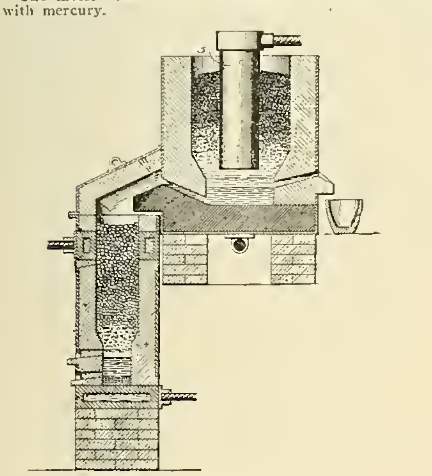
Accidental raising of the pole beyond the normal height of the wire trips the spring and allows the pole to drop to a non-operative position.

862,909. Receiver Holder for Telephones. Ezra B. Helman, Indiana, Pa. Application filed May 2, 1907.

The bracket consists of an articulated arm ending in resilient clips to hold the receiver.

862,916. Electricity Motor Meter. George Hookham, Birmingham, England. Application filed November 6, 1906.

The meter armature is contained in a chamber filled with mercury.



NO. 862,996.—ELECTRIC FURNACE FOR PRODUCING LOW-CARBON FERRO-ALLOYS.

862,934. Trolley Catcher and Retriever. Julian L. Perkins, Springfield, Mass. Application filed February 21, 1906.

On sudden movement of the reel, due to the trolley leaving the wire, pawls are thrown out, engaging ratchets so that the spring barrel and drum are locked together.

862,935. Apparatus for Winding Induction Coils. Carl A. Pfanstiehl, Highland Park, Ill., assignor to the Pfanstiehl Electrical Laboratory, North Chicago, Ill. Application filed December 27, 1906.

This device for simultaneously winding several induction-coil units consists of a holding reel carrying the supply coils, and a heating tank containing molten paraffine, and of a winding bead having a series of coil unit spools and adapted to be rotated.

862,938. Method of Making Complete Fuse Strips of Safety Fuses. Frank D. Reynolds, Hartford, Conn., assignor to the Sachs Company, Hartford, Conn. Application filed June 15, 1906.

The terminal wires are securely held at the ends to be joined to the fuse wire, which is then wrapped around the terminal wires, and the operation completed by soldering the wrapped ends of the fuse wire to the ends of the terminal wires.

862,951. Brush Holder. William L. Waters, Milwaukee, Wis., assignor to the National Brake and Electric Company, Milwaukee, Wis. Application filed December 5, 1904.

Pressure is applied by helical springs, which are adjustable by engagement with slots in the brush-holder.

862,965. Incandescent-lamp Shade. Henry D'Olier, Jr., Philadelphia, Pa. Application filed March 23, 1907.

The reflector projects the light at right angles to the axis of the lamp.

862,996. Process of Reducing Compounds and Producing Low Carbon-ferro Alloys. Edgar F. Price, Niagara Falls, N. Y. Application filed November 14, 1905.

Molten ferro-silicon high in silicon and low in carbon is first produced by electrically melting a charge containing silica, carbon and an iron compound, the silica and carbon being in relatively large amount. Then by heating a mixture of an oxidized compound of a metal reducible by silicon and alloyable with iron, and a basic flux, interposing the mixture as a resistance conductor in an electric circuit, and percolating molten ferro-silicon through the heated body low-carbon ferro alloys may be obtained. (See cut.)

863,008. Electrical Measuring Instrument. William E. Sumpner, Birmingham, England. Application filed October 19, 1905.

For measuring alternating currents the moving coil is supplied from a quadrature transformer with current proportional to the circuit current, and the field coil is energized proportionally to the line voltage. (See cut.)

863,041. Hoisting Device for Electric Arc Lamps. Justin Neu, Nuremberg, Germany, assignor to Elektr-Bogenlampen & Apparate-Fabrik Ges. M. Beschr. Haftung. Application filed November 9, 1906.

An arrangement of pulleys and springs locks the lamp rope in whatever position it occupies at the time it is released.

863,044. Method of Charging Electric Furnaces for Producing Carbide from Lime and Carbon. Albert J. Petersson, Alby, Sweden. Application filed October 30, 1906.

The lime and carbide are introduced into the furnace so that they continuously form separate upright columns in close contact. An electric current passed through the column of carbon heats the furnace.

863,046. Prepayment Mechanism. Ernest Schattner, Schenectady, N. Y., assignor to the General Electric Company, Schenectady, N. Y. Application filed August 24, 1905.

The circuit of a prepayment meter is completed by coin-actuated contacts, which continue closed until a predetermined number of revolutions of the meter have carried the coin-carrier to its discharging position.

863,089. Safety Brass for Motor Bearings. Christopher T. Powell, New Albany, Ind. Application filed March 30, 1906.

The cylindrical casing has a lining of soft metal.

863,109. Indicator for Electrical Measuring Instruments. Frederick G. Simpson and William M. Price, Seattle, Wash. Application filed April 29, 1904.

Transformers in each branch of the main circuit have their secondaries so connected as to balance each other through the coils of an electromagnet which operates an indicating armature when the current conditions in the primary leads become abnormal.

863,151. Automatic Spark Advancer. Benn P. Churchill, Milwaukee, Wis., assignor of two-thirds to Retta Pierce Davenport and Everett C. Rockwell, Chicago, Ill. Application filed July 28, 1906.

A link from the governor engages a switch which is connected to the sparking mechanism.

863,152. Hoist. John H. Clark, Schenectady, N. Y., assignor to the General Electric Company, Schenectady, N. Y. Application filed March 10, 1904.

A steam-engine driven generator has its output decreased as the load on the motor which it supplies increases.

863,163. Protective Device for Series Transformers. Charles E. Eveleth, Schenectady, N. Y., assignor to the General Electric Company, Schenectady, N. Y. Application filed November 12, 1904.

A local circuit supplied by the transformer includes an electromagnet which operates to short-circuit the transformer's windings when the impressed voltage rises to a dangerous value.

863,165. Circuit-control Apparatus. Richard Fleming, Lynn, Mass., assignor to the General Electric Company, Schenectady, N. Y. Application filed December 5, 1905.

A floating contact makes connection with a stationary contact at each end of its movement, operating electromagnetic means to cause the stationary contacts to approach each other.

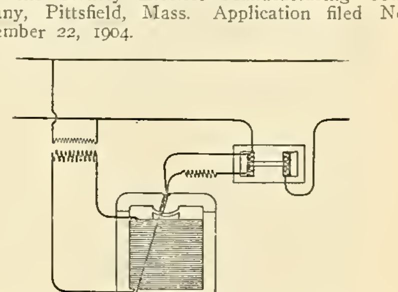
863,175. Induction Coil. John O. Heinze, Jr., Lowell, Mass. Application filed March 18, 1907.

Insulated pancake coils are wound of continuous wire from the bottom of one pancake space to the top of that space, through a slot, to the bottom of the next pancake space to the top of this next pancake coil space, and so on.

863,177. Automatic Tripping Safety Device for Electric Motors. Augustus Herath and Iver Hultman, Schenectady, N. Y. Application filed August 7, 1905.

The motor is thrown out of gear with the axle by the wearing of the armature of the motor.

863,185. Protective Device for Electric Circuits. Thomas I. Jeffries, Pittsfield, Mass., assignor to the Stanley Electric Manufacturing Company, Pittsfield, Mass. Application filed November 22, 1904.



NO. 863,008.—ELECTRICAL MEASURING INSTRUMENT.

Two solenoids controlled by the same winding are responsive to different overload current strengths, and either may operate a trip to open the switch.

863,201. Means for Protecting Dynamo-electric Machines. Charles T. Mosman, Schenectady, N. Y., assignor to the General Electric Company, Schenectady, N. Y. Application filed February 6, 1903.

The device is intended for use with a three-wire system, having a booster whose armature is in series with the neutral conductor of the system and provides means for diverting current from the armature when the current in the neutral becomes excessive.

863,207. Field-coil Terminal Connection. Edwin W. Olds, Milwaukee, Wis., assignor to the General Electric Company, Schenectady, N. Y. Application filed October 18, 1905.

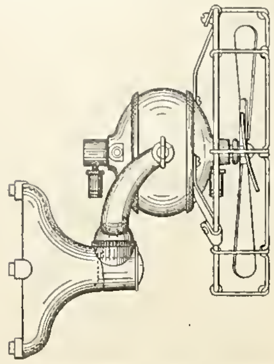
One conductor is formed with a socket and the other secured in a socket and the joint surrounded by insulating material and a guard.

863,211. Heating System. Andrew G. Paul, Boston, Mass., assignor to the Pakin Company. Application filed May 15, 1900.

The radiator valve is electrically controlled by a thermometer and a second thermostat device in contact with the radiator.

863,214. Supporting Base for Electric Fans. Walter F. Phelps, Dayton, Ohio, assignor to the Dayton Fan and Motor Company, Dayton, Ohio. Application filed March 9, 1907.

The base has two sockets, one at the end of the standard and one opening at right angles, either of which may hold the yoke which supports the fan-body. (See cut.)



NO. 863,214.—SUPPORTING BASE FOR ELECTRIC FANS.

863,224. Electric Meter. George A. Sawin, Swampscott, Mass., assignor to the General Electric Company, Schenectady, N. Y. Application filed January 8, 1907.

Details of case construction are given.

863,225. Prepayment Mechanism. Ernest Schattner, Schenectady, N. Y., assignor to the General Electric Company, Schenectady, N. Y. Application filed December 2, 1904.

Two parallel shafts turn in opposite directions with different velocities, making a contact once each revolution, but are held out of engagement by the presence of a coin.

863,230. Telephone Repeater Circuit. Herbert E. Shreeve, Newton, Mass., assignor to the American Telephone and Telegraph Company. Application filed May 4, 1906.

This telephone current reinforcing system comprises a main telephone circuit connecting terminal station telephone apparatus, a reinforcing circuit, and a balancing circuit, all of which are in inductive relation.

863,237. Machine for Controlling Power-operated Apparatus Connected with Railway Switches and Signals. John D. Taylor, Wilkinsburg, Pa., assignor to the Union Switch and Signal Company, Swissvale, Pa. Application filed October 26, 1905.

An interlocking machine for locking and releasing the levers is operated by an electric motor through shafts coupled to the levers and adapted to be rotated through a predetermined angle for controlling the movements of switch parts and for actuating a locking device.

863,238. Indication Apparatus for Switch and Lock Movements. Louis H. Thullen, Edgewood Park, Pa., assignor to the Union Switch and Signal Company, Swissvale, Pa. Application filed March 30, 1906.

The frog is operated by the power of electromagnets, and in either position makes suitable contacts in an alternating-current signal system. The locking device may be released only by an alternating current of the local proper frequency.

863,247. Method of and Apparatus for Transmitting Electrical Energy. Walter C. Yeatman, Chicago, Ill., assignor to the American Telephone and Telegraph Company. Application filed February 7, 1903.

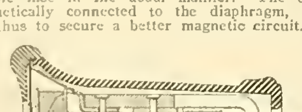
The method consists in impressing voice current potential upon a conductor consisting of a copper core inclosed within a continuous and contacting thin iron sheath.

863,252. Electric Signaling Device. John A. Baker, Galveston, Tex. Application filed November 30, 1906.

A signaling circuit is completed by the falling of a pivoted shelf.

863,253. Telephone Receiver. William R. Bankhead, Bremerton, Wash. Application filed November 17, 1906.

One pole of the receiver magnet is brought through the windings to the center of the chamber and ends in a pole face in the usual manner. The other pole is magnetically connected to the diaphragm, the idea being thus to secure a better magnetic circuit. (See cut.)



NO. 863,253.—TELEPHONE RECEIVER.

863,281. Recording Device. Carl L. Jaeger, Maywood, N. J. Application filed January 16, 1906.

For recording the position of the needle in a nautical compass, a spark may be passed from the end of the needle to pierce a record card.

863,293. Electric Resistance Device. Harry W. Leonard, Bronxville, N. Y. Application filed March 21, 1905.

A [illegible]tive conductor is covered by a layer of insulating material containing finely divided fluorspar and a suitable binding material.

863,296. Electromagnet. David L. Lindquist, Yonkers, N. Y. Application filed May 9, 1905.

The attraction of the magnet for its armature is opposed by a spring which may be given a variable tension.

863,320. Means for Securing an Electric Lamp Receptacle to a Support. Robert P. Schriver, Philadelphia, Pa. Application filed April 19, 1907.

The receptacle has a flange which is held between the support and a band soldered to it.

863,322. Electromagnetic Sounding Apparatus. William F. Seidel and Ernesto Sassenhoff, Elkhart, Ind. Application filed September 1, 1906.

Electromagnets attract a resilient armature having a hammer at its free end.

863,332. Electromagnetic Apparatus for Railway Purposes. Louis H. Thullen, Edgewood Park, Pa., assignor to the Union Switch and Signal Company, Swissvale, Pa. Application filed March 24, 1906.

This acts as an indicator for showing the approach, departure or presence of a train or vehicle on a track section or the condition of the signals.

863,334. Electric Installation Pipe-cap. Wheeler H. Vibber, New London, Conn. Application filed May 3, 1907.

The cap consists of two half-cones with the joints covered by aprons, and clips adapted to fit over and hold the cones in place.

863,335. Slow-speed Circuit Controller. Herbert A. Wallace, New York, N. Y., assignor to the Union Switch and Signal Company, Swissvale, Pa. Application filed December 13, 1906.

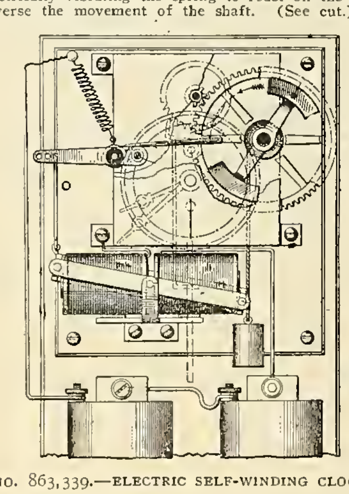
Two disks rotate connected together, each having a stop on its periphery, one slightly in advance of the other, which are engaged by pivoted arms connected to circuit controllers, the stops serving to allow the disks to turn in only one direction.

863,338. Telephone Trunk Circuit. Charles S. Winston, Chicago, Ill., assignor to the Kellogg Switchboard and Supply Company, Chicago, Ill. Application filed January 3, 1905.

For use with a cord having a third signaling strand, this trunk circuit has only one supervisory lamp. Signaling operations are otherwise similar to ordinary trunk practice.

863,339. Electric Self-winding Clock. Aloys Wirsching, Brooklyn, N. Y. Application filed November 28, 1905.

This may be described in brief as comprising a shaft with means for rotating it in one direction, an arm on the shaft, a spring in the path of the arm and means for electrically vibrating the spring to react on the arm and reverse the movement of the shaft. (See cut.)



NO. 863,339.—ELECTRIC SELF-WINDING CLOCK.

863,347. Storage Battery. Charles Berst, Cincinnati, Ohio, assignor to the Gamewell Fire Alarm Telegraph Company, New York, N. Y. Application filed April 16, 1906.

The feature of construction is the flange portion adapted to rest upon the upper edges of the cell, and engage the inner walls of the cell.

863,369. Sparking Device for Explosive Engines. Joseph S. Elverson, Catasauqua, Pa. Application filed February 6, 1907.

Inside the combustion chamber, an insulating disk, having a sector cut out, is provided to be rotated between the sparking points, permitting the spark to pass only at the time of passage of the open sector.

863,410. Dynamo Construction. Henry Leitner, Maybury, Woking, England. Application filed June 17, 1905.

A pair of fixed subsidiary brushes are connected with a winding of the field magnets, being so located and connected that at a low speed they add to the force of the field magnets and at a high speed they lessen the force of the field magnets.

863,418. Railway Signal. Nicola Mucci and Alfonso Celenza, New York, N. Y. Application filed March 23, 1907.

Contact devices at the approaches to a side track transmit signals to the opposite ends of the switch.

863,419. Cigar Lighter. Thomas B. Murray, Newport News, Va. Application filed April 24, 1906.

The spark is produced by a battery and kick-coil.

863,452. Safety Signal Device. Malcolm Salmond, Baltimore, Md. Application filed March 23, 1907.

Torpedoes are fired from a lever-operated magazine, and the operation reported by the ringing of an alarm bell.

863,454. Electric Heating Element. George J. Schneider, Detroit, Mich., assignor to the American Electrical Heater Company, Detroit, Mich. Application filed July 9, 1906.

The unit comprises a series of alternately arranged laminated conductors and insulators, the opposite ends of adjacent insulators being cut away for contact of alternate pairs of adjacent conductors at opposite ends so that a continuous circuit is formed through the series. The series is clamped tightly to bring all portions in mechanical contact.

863,455. Electric Sad-iron. George J. Schneider, Detroit, Mich., assignor to the American Electrical Heater Company, Detroit, Mich. Application filed July 9, 1906.

The heating element is insertible into the body of the flat iron through an opening and automatically couples with terminal connections.

863,478. Dental Engine. Wallace W. Williamson, Syracuse, N. Y. Application filed January 7, 1907.

An electric motor supplies the power.

863,509. Electric Railway Signaling System. Charles M. Cleavland, Wausau, Wis., assignor of one-fourth to Hiram Dunfield, Wausau, Wis. Application filed April 8, 1907.

The specifications call for a supporting rail having recessed sides and a pair of continuous bare conductors arranged in the recesses, insulated from each other. On the car a traveling contact secures connection with the track signal conductors.

863,531. Rail-bond. Marshall Hawkins, Gypsy, W. Va. Application filed November 7, 1906.

The bond comprises a drift pin having a longitudinal body tapered to a point at one end and with opposed cutting edges.

863,540. Train-controlling Apparatus. Joseph L. Jones, Kizer, Tenn. Application filed December 10, 1906.

In a wireless system of electric train control, the idea is to provide apparatus on the trains for propagating electric waves at successive intervals to constitute a danger zone radiating from each train and also receiving apparatus on each train sensitive to the propagated waves.

863,568. Electric Arc Lamp. Reinhold T. Felsch, Boston, Mass. Application filed February 21, 1907.

Core members at the upper ends of the rods are mounted in such position with relation to each other and to the magnetic field of the solenoid as to have similar poles adjacent each other.

863,569. Signal Mechanism. Ellsworth E. Flora, Chicago, Ill., assignor to the Zorge Safety Railway Equipment Company, Chicago, Ill. Application filed June 18, 1906.

A wheel-actuated lever serves to turn the switch-arm and break the circuit when the train movement is in one direction and to move idly without affecting the switch-arm when the train movement is in the other direction.

863,570. Electric Time Alarm. Jacob L. Grass, Walter K. Cook, Charles W. Fletcher and Frederich J. Arndt, Minneapolis, Minn., assignors to the American Bank Protection Company, Minneapolis, Minn. Application filed August 1, 1906.

A normally open electric alarm circuit sounds an alarm when closed, but the alarm is automatically checked by a clock gear after a predetermined time has elapsed.

PATENTS THAT HAVE EXPIRED.

Following is a list of electrical patents (issued by the United States Patent Office) that expired August 19, 1907:

434,427. Thermo-electric Battery. H. B. Cox, New Haven, Conn.
434,428. Thermo-electric Generator. H. B. Cox, New Haven, Conn.
434,429. Thermo-electric Generator. H. B. Cox, Hartford, Conn.
434,444. Secondary Battery. T. H. Hicks, Detroit, Mich.
434,457. Electrode for Batteries and the Method of Making the Same. D. Pepper, Jr., Philadelphia, Pa.
434,468. Method of Electric Welding. R. Robb, Boston, Mass.
434,488. Electric-power transmission. E. Thomson, Lynn, Mass.
434,489. Electric-power System. E. Thomson, Lynn, Mass.
434,500. Thermo-electric Generator. H. B. Cox, Hartford, Conn.
434,530. Process of and Apparatus for Forming and Welding Metals by Electricity. E. Thomson, Lynn, Mass.
434,531. Induction Discharge Protector for Welding Apparatus. E. Thomson, Lynn, Mass.
434,532. Process of Electric Welding. E. Thomson, Lynn, Mass.
434,558. Device for Measuring the Intensity of Magnetic Currents. R. Eichemeter, Yonkers, N. Y.
434,580. Apparatus for Transferring Electric Car Batteries. F. G. Corning, New York, N. Y.
434,581. Apparatus for Transferring Car Batteries. F. G. Corning, New York, N. Y.
434,582. Mechanism for Transferring Electric Car Batteries. F. G. Corning, New York, N. Y.
434,585. Telegraph Relay. T. A. Edison, Menlo Park, N. J.
434,586. Electric Generator. T. A. Edison, Menlo Park, N. J.
434,587. Thermo-electric battery. T. A. Edison, Llewellyn Park, N. J.
434,588. Magnetic Ore Separator. T. A. Edison, Llewellyn Park, N. J.
434,589. Propelling Mechanism for Electric Vehicles. T. A. Edison, Llewellyn Park, N. J.
434,590. Dynamo-electric Machine. J. B. Entz, New York, N. Y.
434,593. Galvanic Battery. W. M. Fink, Elizabeth, N. J.
434,614. System of Electrical Distribution. H. E. Walter, Schenectady, N. Y.
434,684. Electric-railway System. C. J. Van Depoele, Lynn, Mass.
434,685. Alternate-current Electric Railway Train System. C. J. Van Depoele, Lynn, Mass.
434,686. Electric-railway Train System. C. J. Van Depoele, Lynn, Mass.
434,687. Electric-railway System. C. J. Van Depoele, Lynn, Mass.

WESTERN ELECTRICIAN

EVERY SATURDAY

Vol. XLI. CHICAGO, AUGUST 31, 1907. No. 9

Electrification of the Great Western Railway (London).

[From the London correspondent of the Western Electrician.]

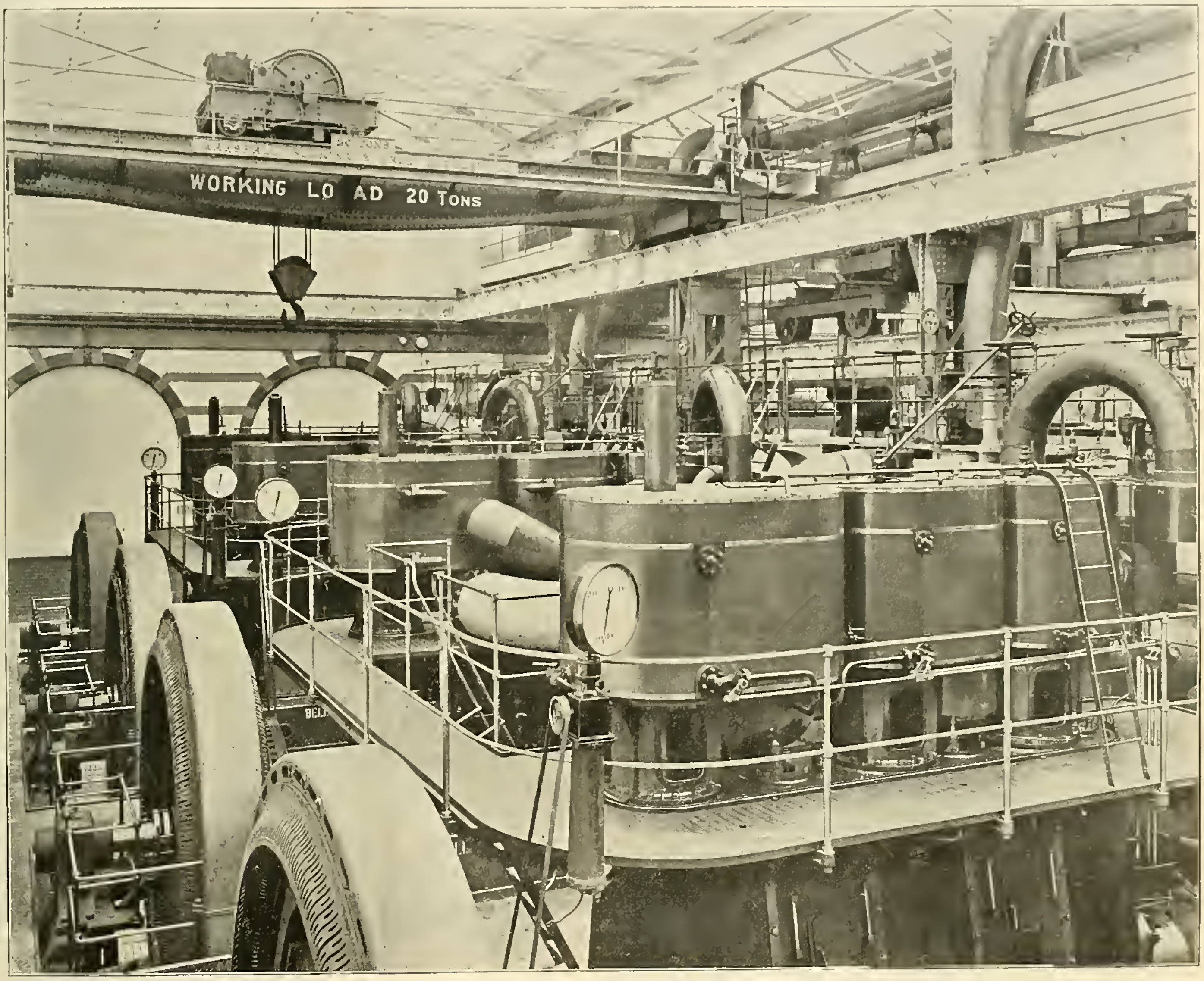
With the adoption of electric traction upon what are known as the Hammersmith and City Railway lines of the Great Western Railway Company, the scheme of the "underground" railway system of London, first seriously contemplated by the late C. T. Yerkes in 1900, has been completed. The arrangements in connection with the electrification of the "Circle" have been much complicated, due to the fact that three railway companies have running powers over it, and as each has an extensive system in addition, there is the spectacle of three separate power stations. There has been a good deal of description of that of the Metropolitan District Railway Company at Chelsea and of the Metropolitan company's structure at Neasden.

The generating station of the Great Western Railway Company is situated at Park Royal and is intended to supply the arc and incandescent lighting and small-motor work in the London system, in addition to providing the necessary energy for working the company's line between Hammersmith and the city, a portion of which branches away from the "Circle" proper. There are two points of interest in connection with these works. One is that hitherto the power for lighting purposes has been supplied from a very old station installed in 1884; the second is the adoption, in the new station, of reciprocating-engine sets of comparatively small size.

The new power station, which is shown in one of the accompanying illustrations, occupies only a very small portion of the available land, it being computed that there is space for five similar stations to be erected.

Electrical power is generated at Park Royal as three-phase alternating current, with a frequency of 50 periods and at a pressure of from 6,300 to 6,600 volts, and is transmitted at this pressure to the three sub-stations. In the sub-stations the greater part of the three-phase current is converted by motor converters from about 6,500 volts alternating to 600 volts direct current, and at this pressure the current is supplied to the conductor rails of the Hammersmith and City Railway, and the lines worked in connection with it, from the Royal Oak and Shepherds Bush sub-stations. These are shown on the next two pages. From Old Oak Common, Shepherds Bush and Royal Oak sub-stations, direct current at 600 volts is also distributed for sundry power purposes, and also for arc lighting to the Great Western company's locomotive sheds, carriage sheds, freight yards and offices and Paddington Station.

A certain part of the three-phase supply is distributed from each sub-station at the full pressure of about 6,500 volts to the distributing centers, where it is stepped down by static transformers to either 220 or 110 volts. At this pressure the alternating current is used for arc and incandescent lighting and small-motor work throughout the Great Western company's properties.



FOUR OF THE EIGHT GENERATING UNITS IN THE MAIN POWER HOUSE OF THE GREAT WESTERN RAILWAY AT PARK ROYAL.

Main Buildings.

The main building is a steel structure, filled in with brick and roofed with glass and slate, the wooden framework for the latter being lined on the inside with fireproof plaster.

The boiler house, at the east end of the main building, is arranged in three bays, and is 115 feet 6 inches long by 95 feet wide and 80 feet high to the peak of the roof of the center bay. The two side bays are for the accommodation of the boilers, leaving the center bay clear. A set of steel coal bunkers, built between the main stanchions, is provided over the center bay, with a total storage capacity of about 600 tons. Space is provided above the coal bunkers and in a basement underneath the stoking floor, for the coal and ash-conveying plant. The present chimney is 12 feet square, internal dimensions, and is 250 feet high. The main engine room is also arranged in three bays, the two side bays taking the engine sets, and the center bay the condensing plant, which is also above floor level.

Coal-handling Plant.

Coal is brought on to the site over a railway siding in connection with the new line to High Wycombe, in a special train of steel hopper wagons each of which has a carrying capacity of 20 tons and is provided with flap doors through which the coal is delivered from the bottom of the wagon into the coal silos. From the bottom of the silos coal is delivered to two tray conveyors, which feed it into two bucket elevators, which in turn raise the coal to a height of 50 feet above the boiler-house floor level, and feed it on to two bucket conveyors, for transmission to the boiler house. The buckets pass down into the basement at the west end of the boiler house, where ashes are fed into them by means of two traveling fillers. Each bucket conveyor is driven through worm gear by a 10-horsepower motor, while the tray conveyor and bucket elevator corresponding to each bucket conveyor are driven through worm gearing by a single 12-horsepower motor.

WATER AND STEAM FACILITIES.

Water is supplied from the canal at Old Oak Common, with an alternative supply from the Water Board, to a water supply tank in the yard outside the west end of the engine room. From this tank it passes to the pump-room basement in the boiler house. From this point the water is pumped, by means of a centrifugal pump, through two cylindrical drain-water coolers, into an overhead feed tank in the engine room.

EXTERIOR OF THE PARK ROYAL POWER HOUSE OF THE GREAT WESTERN RAILWAY.

The steam, after passing through the steam pipes and engines, may be exhausted to atmosphere, but normally passes through mechanical oil separators into surface condensers, from which the condensed water is drawn by air pumps, and delivered by force pumps to a height of 20 feet at the west end of the boiler house, to the inlet of an electrical oil-separating and filtering plant, and thence to the hot-well tanks.

The boiler house contains 10 Babcock & Wilcox double-drum water-tube boilers, the five boilers in each side bay being arranged in two batteries of two and one battery of one boiler. Each boiler has a heating surface of 5,764 square feet, has a normal evaporative capacity of 19,200 pounds of water per hour at a pressure of 200 pounds per square inch, and is equipped with a self-contained superheater, proportioned so that steam is delivered at a temperature of 550° F. at the boiler stop valve. The boilers are fitted with mechanical stokers of the chain-grate type.

The make-up water inlet to the softening plant is controlled by a valve worked by a ball in the hot-well tank below, so that the right quantity of make-up water is regulated automatically. After passing through the mixing chamber, the water is filtered first through wood fiber and afterward through sand, and finally passes down into the hot well, through a tumbling bay and settling tank and over a weir, to enable the quantity of make-up water to be measured if required.

The main engines are arranged in pairs with reference to the pipework, the separate engines of each pair being supplied with steam through eight-inch branch pipes connected to the separators on the engine bedplates, a by-pass pipe and valve being provided between the separators on each pair of engines, for use in case a section of the main ring has to be shut off.

The condensing plant is placed above floor level in the center bay of the engine room, and is divided into four sections, one for each pair of engines, each section consisting of a surface condenser, combined air and force pump, and circulating pump. Each surface condenser is designed to deal with 42,000 pounds of exhaust steam per hour. The cooling towers, which are of the Klein natural-draft wood type, are arranged in four towers, each of which can be divided into two sections.

MAIN GENERATING PLANT.

There are eight main generating sets, four in each side bay of the engine room, each set consisting of a Belliss engine, driving direct an alternator generating three-phase current with a periodicity of 50 cycles per second at a voltage of 6,300 to 6,600 volts, the normal output being 750 kilowatts, with an overload capacity of 25 per cent. One group of four units is shown in the illustration.

Each main engine is of the three-crank triple-expansion high-speed type, running at 250 revolutions per minute. The governor is controlled by an electric motor, from the main switchboard gallery, for adjusting the speed of the engine during synchronizing and for adjusting the load between the sets running in parallel. An emergency valve, electrically controlled from the switchboard, is also fitted to each engine so that steam may be entirely cut off under emergency.

The main three-phase generators are of the ordinary rotating field-magnet type, the total weight of the magnet wheel and flywheel being about 11 tons. The stationary armature is wound in open slots, and is star-connected, but the center point is not permanently grounded. Screws are provided for sliding the armature sideways for inspection when required.

AUXILIARY PLANT.

The auxiliary plant is divided into eight sections, each of 150 kilowatts capacity, four of which are normally used for supplying direct current at about 225 volts for excitation purposes and arc and incandescent lighting and for the overhead crane motors, the remaining four sets being normally used for supplying three-phase current at about 650 volts for driving the various three-phase motors throughout the generating station, including those for the stokers, coal conveyors, condenser circulating pumps and other pumps.

SWITCH GEAR.

The switch gear includes two main high-tension switchboards for controlling the 6,500-volt three-phase circuits, which are placed one at the west end of each of the main engine-room bays, an auxiliary switchboard for controlling the 650-volt three-phase circuits, placed on the same gallery as the main switchboard control panels, and two switchboards for controlling the 220-volt direct-current circuits, placed one at the west end of each of the main engine-room bays on the floor level, immediately under the front of the main switchboard-control gallery.

The high-tension part of each main high-tension switchboard extends from the basement to a total height of 33 feet and consists of a steel framework filled in with stone slabs. Each circuit runs from the bottom to the top of the board, and is separated from the rest by vertical stone partitions. The switches, transformers, etc., on each circuit are further separated from each other by four horizontal partitions which divide the whole structure into a set of fireproof cells. The control board is placed on a gallery about 14 feet above the engine-room floor, and slightly in front of the high-tension portion of the switchboard. Immediately in front of the control panels are placed the main generator field-regulating resistance columns, the engine governor and emergency valve switches, and also a set of signal columns and indicators by which the switchboard attendant can communicate with the drivers of the engines.

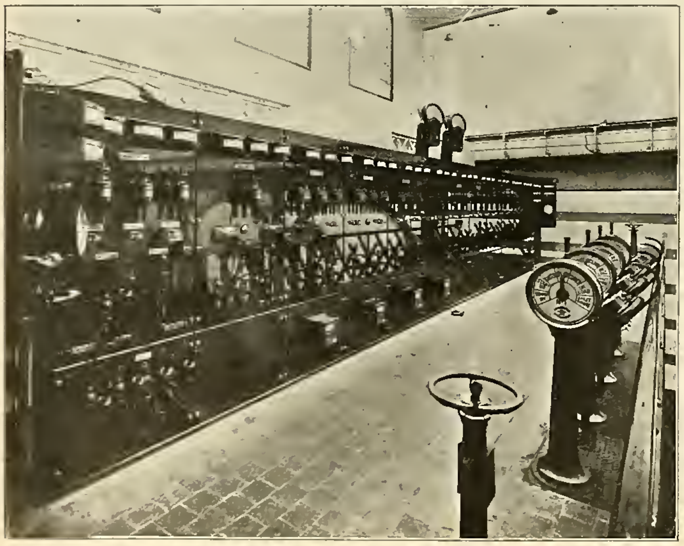
Each board has a duplicate set of main bus-bars and also a set of high-tension synchronizing bus-bars, which are used in connection with the testing and charging of the feeders, as well as for synchronizing the generators. Each set of main bus-bars is placed in a stone chamber with wire-woven glass sliding doors in front running the whole length of the switchboard structure in front of the switch cells.

Each main generator is provided on its control panel with a watt-hour meter, an indicating watt-meter, a power-factor indicator and an ammeter. By means of a system of shafting and cams at the back of each control board, a complete mechanical interlock has been provided in connection with the operating mechanism of the high-tension switches.

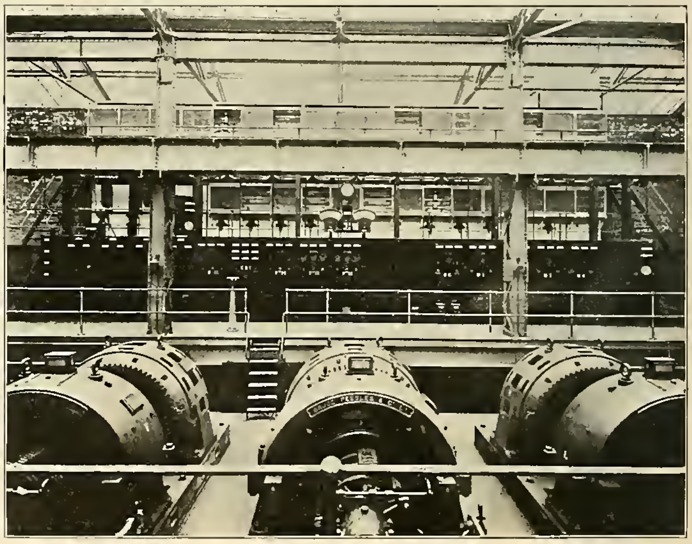
The auxiliary three-phase switchboard for controlling the 650-volt alternating-current circuits is placed in line with and between the control panels for the two main high-tension switchboards. The auxiliary board is fitted with two sets of bus-bars which can be coupled together when required. Each of the three-phase 650-volt generators and the low-tension side of each set of step-up auxiliary transformers can be connected to either set of bus-bars. The auxiliary feeder circuits which supply the various three-phase motors driving auxiliary plant throughout the buildings are connected to the top set of bus-bars through switches with overload releases. Synchronizers are provided on swing panels to enable synchronizing to be effected with either set of bus-bars.

The two direct-current 220-volt exciter switchboards can be worked separately or in parallel, and each controls one of the auxiliary direct-current generators, one of the storage batteries, three feeders for working the direct-current crane motors and the arc and incandescent lighting of the power house, and an excitation circuit for the main and auxiliary three-phase generators.

In a separate shed outside the engine room are two tanks supplied with circulating water, each of which forms an artificial load of the capacity corresponding to the output of one of the main generators. The electrodes for these tanks can be



Main Control Board in Park Royal Power House.



Royal Oak Sub-station, showing front of Switchboard.

ELECTRIFICATION OF THE GREAT WESTERN RAILWAY, LONDON.

raised or lowered by hand or by means of small three-phase motors, which can be run in either direction, and which are controlled by means of change-over switches placed in convenient positions on the main switchboard galleries.

The general lighting of the main buildings and also of the coal siding and the approach road is carried out by 40 "Oriflamme" arc lamps. The lighting installation also includes about 200 incandescent lamps.

Sub-stations.

The Royal Oak sub-station is equipped with four 400-kilowatt traction motor-converter sets worked in parallel with a battery having a one-hour discharge rate of 1,680 amperes, in conjunction with reversible boosters. The sub-station also contains two 200-kilowatt motor-converters for direct-current lighting and power purposes.

The Shepherds Bush sub-station is equipped with seven 400-kilowatt traction motor converters worked in parallel with a battery having a one-hour discharge rate of 840 amperes, in conjunction with reversible boosters.

The Old Oak Common sub-station is equipped with one 400-kilowatt and two 200-kilowatt motor-converter sets for direct-current lighting and power purposes.

From each of the three sub-stations high-tension distributor feeders are run from the bus-bars to the various distributing centers. All three sub-stations are designed so that they may be developed on the same lines.

The Peebles' La-Cour motor-converters consist of a high-tension motor arranged like an induction motor mechanically coupled to and also electrically connected with a direct-current generator, connections being made between tappings from the rotor and the direct-current armature. While the machines can be started up on the high-tension side in much the same way as if they were induction motors, they behave, when the direct-current machine is fully excited, like synchronous machines and are capable of being reversed so as to generate alternating current, exactly as in the case of synchronous motor-generators. This peculiarity is of special advantage in the present instance. The direct-current generators which are used for traction have compound windings.

The reversible boosters are of the well-known Highfield type, consisting of three machines, the motor, the booster and its exciter. These booster sets are in duplicate, the continuous capacity of each booster being 130 kilowatts.

The battery consists of 290 of the Tudor company's HZ, 35 cells contained in lead-lined wood boxes, the capacity being 1,680 amperes at the one-hour rate.

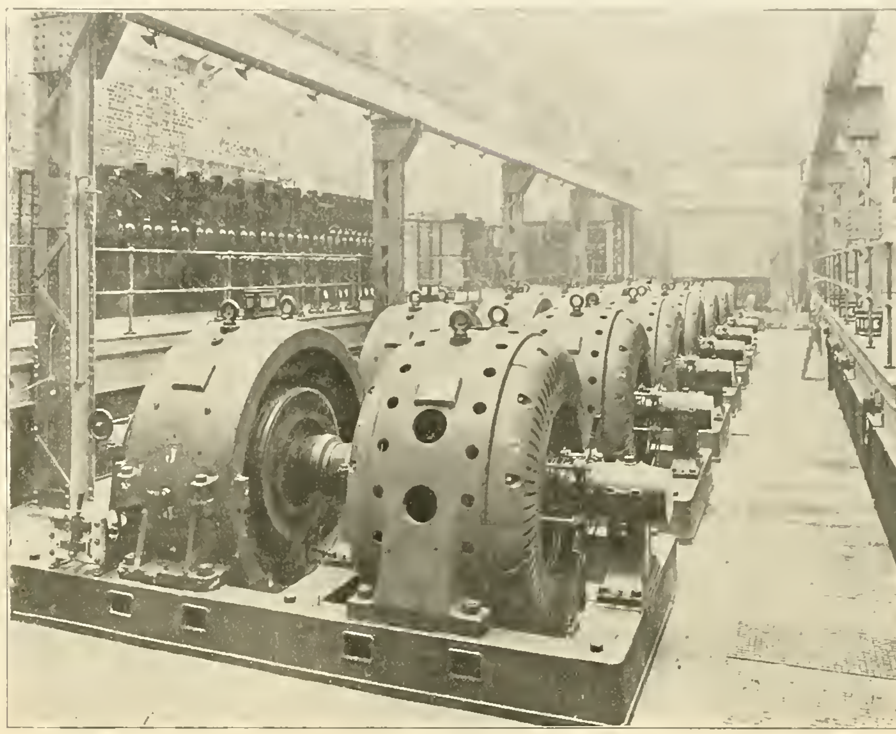
The high-tension switchboard is generally similar in construction and design to the Park Royal high-tension switchboards, which have been described above. The low-tension switchboards, placed on the opposite side of the sub-station, are divided into four sections, one for controlling the traction circuits, a second for controlling the lighting circuits, a third for a milking booster and its connections to the battery room, and the fourth for controlling the Highfield reversible boosters. The conductors between the machines and feeders and the terminals on the low-tension switchboards are bare copper rods, supported by porcelain insulators carried on steel racks.

A feature of special interest in connection with the sub-stations is the method of using the battery, not only to equalize the load on the motor-converters and therefore on the main high-tension generators by taking the peaks of the traction load, but also, in cases of emergency, for maintaining both the alternating and direct-current lighting supply. The battery is connected through one of the reversible-booster sets to the traction board, being connected between the positive bus-bar and the equalizer bar, with the result that the total current returning from the track to the generators and the battery passes through the generator series windings, which are provided with diverter resistances.

In the negative bus-bar a main diverter resistance is provided through which the total current returning from the track passes, and the series winding on the booster is connected across a variable proportion of the main diverter resistance.

Distributing Centers.

There are eleven distributing centers in which the 6,500-volt three-phase current from the sub-stations is stepped down to either 220 or 110-volt three-phase current for the lighting and power circuits.



SHEPHERD'S BUSH SUB-STATION OF THE GREAT WESTERN RAILWAY, SHOWING MOTOR-CONVERTERS AND DIRECT-CURRENT SWITCHBOARDS.

Cables.

Between the generating station, the sub-station and the distributing centers about 37 miles of high tension three core cable and about 14 miles of low tension concentric cable have been laid in addition to about four miles of single low tension cable used in the form of jumper cables in connection with the conductor rails. Each high tension feeder between the generating station and the sub-stations has three cores of 0.15 square inch sectional area, insulated with paper, lead-sheathed and armored with galvanized wire. The high-tension distributors are similar cables of 0.05 and 0.0125 square inch sectional area. The low-tension direct-current and alternating-current cables are concentric paper insulated, lead-covered cables, no armoring being provided on these cables, as was done on the high tension feeders in order to meet the requirements of the Board of Trade. All the high-tension three-core, low-tension concentric and telephone cables are laid in Howard asphalt troughing, a separate trough being used for each cable. These troughs are filled in with bitumen and covered with a layer of asphaltic concrete, ironed over all the troughs, which are placed side by side, so as to form a waterproof covering.

The usual method of jointing the cables after they are laid was departed from, as it was considered that a much better joint would be made if more space was given to the jointer than is possible after the cables are laid and where there are a number placed side by side. In making a high-tension three-core joint, the separate cores, each with its own insulation, are arranged in a vertical plane, the copper conductors being butt-jointed and connected by copper sleeves run in with solder. Each copper joint is then insulated with alternate layers of mica and paper, and bound with tape. The outer insulation is then applied over the three cores together, the whole joint being finally bound up with tape, spaces being left to allow the compound with which the lead envelope is filled to run in between the cores. The lead envelope is connected at each end to the lead sheathing of the cable by means of a plumber's wiped joint. The continuity of the armoring at the joints is maintained by copper strips clipped to the armoring beyond the plumber's wiped joint.

The conductor rails on the Hammersmith and City Railway and the lines in connection with it are fed by concentric cables from the sub-stations at Royal Oak and Shepherds Bush, four 1.25 square-inch cables being laid from the former, six 1.25 square-inch cables and two 0.75 square-inch cables being laid from the latter sub-station. The two 0.75 square-inch cables supply overhead conductors in the car sheds at Hammersmith as well as the conductor rails outside it.

Track Work.

The system adopted for supplying current to the train collecting shoes is the same as that already in use on the Metropolitan and District Railways. There are two insulated conductor rails, the positive being three inches above rail level and 16 inches outside the running rail, and the negative conductor being 1½ inches above rail level and in the center of the track. The two conductor rails are of an inverted channel section, resting at intervals not exceeding 10 feet on iron capped porcelain insulators.

The rails, which are 44 feet six inches long, weigh 102.8 pounds per yard and have a cross sectional area of 10 square inches. They are made of a special quality of steel having a conductivity equal to 15 per cent. of that of copper.

Electric Trains.

For the service between Hammersmith, Kensington (Addison Road), Aldgate and Whitechapel, 20 electric trains have been provided by the Great Western and Metropolitan railways. The cars are of the closed-vestibule type, with doors only at the ends and sides of the vestibules. Each train is composed of six cars, approximately 52 feet long by eight feet nine inches extreme width. Each car is carried on two four-wheel bogies, those of the front and rear cars each being equipped with two motors.

The electrical equipment is of the multiple-control type. The motors are of the GE-76 type, with two bearings on the main axle and supported from the outside of the fixed bolster of the bogie frame by a special nose cast on the motor frame. Each pair of motors when starting the train is connected in series with suitable resistances which are cut out in four steps until each pair of motors is connected direct in series across the full voltage supply. By an ingenious method of arranging the switches, each motor is then separately connected with a suitable resistance across the full voltage without any interruption to the supply occurring. The resistances are then cut out in four steps until the full parallel position is obtained. To effect this result 14 contactors with suitable interlocking contacts are required for each pair of motors.

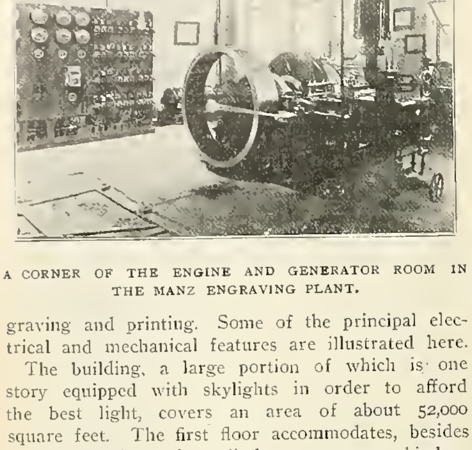
The eight motors are capable of accelerating a fully loaded train at the rate of 1.6 feet per second with a track voltage of 600, the momentary maximum current per motor not exceeding 320 amperes, while the average maximum is about 280. The motors are capable of attaining a train speed of 40 feet per second within 40 seconds of the start, and the energy consumed on the trip from Hammersmith to Aldgate and back does not exceed 75 watt-hours per ton-mile. Westinghouse air brakes are fitted throughout the train, as well as hand brakes in the motor cars.

The trains are lighted and heated throughout by electricity, and by means of a change-over switch each car can be lighted separately by flexible cables from the trolley wires in the shed, without making the shoes or other main circuits alive.

The consulting engineers for the whole of the works have been Messrs. Kennedy and Jenkins.

Electric Power and Light in a Large Chicago Engraving and Printing Plant.

The plant of the Manz Engraving Company, including the Hollister Press, has recently been completed in Ravenswood, a suburb of Chicago. With its complete electrical equipment the plant is in every way an excellent example of an up-to-date establishment for the production of high-grade engraving and printing. Some of the principal electrical and mechanical features are illustrated here.



A CORNER OF THE ENGINE AND GENERATOR ROOM IN THE MANZ ENGRAVING PLANT.

The building, a large portion of which is one story equipped with skylights in order to afford the best light, covers an area of about 52,000 square feet. The first floor accommodates, besides the power plant, the cylinder-press room, bindery and composing room, electrotype department, etching departments, blocking room, shipping and stock room, art department and general offices, while the photographic and colortype departments are located on the second and third floors.

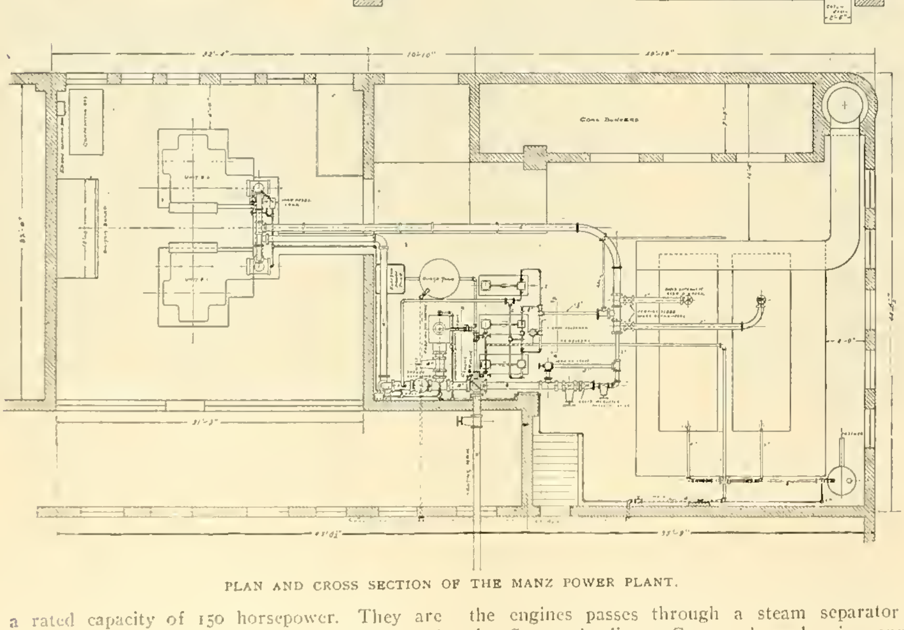
The boiler equipment consists of two Murray Iron Works horizontal return tubular boilers, each of a rated capacity of 150 horsepower. They are erected in suspension rigging in one battery and are equipped with twin arch furnaces and Twentieth Century rocking grates, installed by the Water Arch Company of Chicago. Complete combustion and consequently smokeless and most economical operation is obtained by this installation. The gases pass from the boilers through a short breeching into the Weber steel-concrete stack, which is four feet in diameter and 110 feet high.

A special feature of this power plant is the arrangement of coal handling, which is both simple and efficient. The coal, after having been weighed on the Fairbanks platform scale located in the driveway just outside the power plant, is unloaded from the wagon direct into the coal bins in front of the boilers, enabling the fireman to shovel it into the furnaces conveniently.

Two 5¼ by 3½ by 5 boiler feed pumps of the Platt Iron Works make supply the water to the boilers from the Loew open feed-water heater. The pumps are cross-connected, so that one may be used for pumping water to the house tank on the roof, while the other is feeding the boilers. In the boiler room is further installed a 5 by six-inch triplex electric-driven pump belonging to the sprinkler system, and a four-foot by 8-foot surge tank.

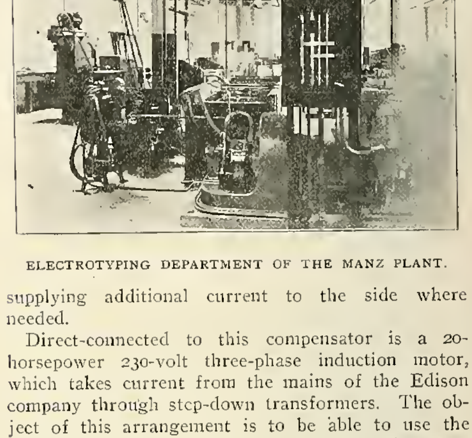
The boilers are equipped with Reliance water columns, American Steam Gauge Company's pop safety valves, Lunkenheimer Duro blow-off valves and Davis automatic stop and check valves. Jenkins extra heavy globe valves are used on all pressure lines and Kewanee ball-joint unions on pressure lines up to four inches.

The problem of heating the building, which covers a very large area in proportion to its height, and distributing the heat in the most economical way, from the power plant, which is located in the southeast corner of the building, and furnishing the desired temperature to the different departments, was solved by installing a direct radiating vacuum return system, containing as heating bodies coils and radiators. The Illinois Engineering Company's vacuum system was selected and installed by Gallaher & Speck, Chicago. Exhaust steam from the engines is used for heating during working hours. When the plant is shut down, live steam is taken direct from the boilers to the heating main through a Davis pressure-reducing valve. The two generating units consist each of a 13 by 15-inch Skinner automatic engine, direct-connected to a 75-kilowatt 230-volt direct-current Western Electric Company generator. Steam to the engines passes through a steam separator of the Steam Appliance Company's make, in connection with a Kieley high-pressure trap, discharging into the feed-water heater.



PLAN AND CROSS SECTION OF THE MANZ POWER PLANT.

A compensator set consisting of two five-kilowatt 110-volt Western Electric compound-wound generators takes care of the lighting on a three-wire 110-volt system in the following way: The two generators are mechanically coupled and electrically connected in series across the 220-volt generator buses. The entire lighting load is distributed between the outside wires of the compensator generators and a common neutral wire. The shunt fields of the generators are cross-connected, so that the one takes current from the side of the three-wire system, which belongs to the other generator. In case a heavier load is thrown in on the one side of the system than on the other, the difference in voltage will cause the generator on the side of lighter load to run as motor, driving the other as generator and supplying additional current to the side where needed.



ELECTROTYPING DEPARTMENT OF THE MANZ PLANT.

Direct-connected to this compensator is a 20-horsepower 230-volt three-phase induction motor, which takes current from the mains of the Edison company through step-down transformers. The object of this arrangement is to be able to use the compensator set as generator for supplying current for light when the steam plant is shut down.

The switchboard, built by Kohler Brothers, Chicago, consists of two generator panels, one compensator panel and three feeder panels. The generator panels are equipped each with one 400-ampere three-pole main switch, a Cutler-Hammer field rheostat and a Wagner ammeter and voltmeter.

The compensator panel contains, besides necessary switches, one Wagner ammeter and voltmeter on each side of the three-wire system, a field rheostat for each balancer and a Cutler-Hammer starter for the compensator set. On the compensator panel is further mounted a Duncan integrating recording wattmeter, which measures the total output of the plant. This meter, in connection with the coal scale and a water meter, furnishes a perfect check on the power plant and makes it possible to find out exactly how much it costs yearly to run the plant and what the price of each delivered horsepower is.

The feeder panels, of which one is for power and two for light, are equipped with the Switchboard Equipment Company's circuit-breakers.

The system of individual drive has been carried out throughout all departments, doing away with all line and counter-shafting. Fifty-eight motors, ranging from one-half horsepower to 15 horsepower, are installed at present; however, the final installation will cover more than 70 motors. The motors are of the Sprague Electric Company's make, except in the cylinder-press room.

Large Miehle cylinder presses, of which there are two No. 00000, six No. 0000, one No. 1 and one No. 4, are all driven by Western Electric motors belted to the machine. As variable speed and also the feature of reversing the press are desired, the motors are controlled by Carpenter controllers, Cutler-Hammer, No. 85.

The Colt presses, of which a number are installed, are belted direct to Jenney electric motors. The cutting and folding machines are driven by Western Electric motors.

Of special interest in the electrotype department are two electroplating outfits, one consisting of a 14-horsepower 230-volt Sprague motor direct-connected to a low-voltage dynamo for electroplating. The electrolyte in the tank belonging to this machine is kept in circulation by a small motor-driven pump. The other unit consists of a five-horsepower motor-generator set, arranged similar to the first.

Another machine of interest is a hydraulic press driven by a three-horsepower motor and used for making impressions in the wax or lead plates for electrotypes. Any predetermined pressure may be given the plates by setting an indicator on the pressure gauge. As soon as the desired pressure has been reached the press is automatically released and goes back to starting position.

Besides these machines, the department is equipped with a complete line of machines for turning out electrotypes, as foundry, planers, shapers, trimmers, etc.; all these machines are belted direct to their motors, and this is also the case with the different tools in the routing and blocking room.

About 800 incandescent lights and 40 arc lamps are required for the illumination of the plant, while 20 large arc lamps consuming from 15 to 35 amperes each are used for photographic purposes in the departments on the second and third floors.

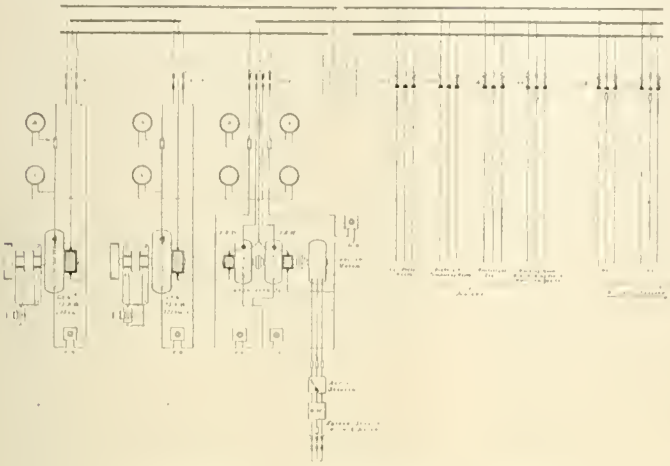
The feeders for power and light are carried in separate conduits in the concrete floor from the switchboard to the power and light distributing cabinets, of which there is one of each kind in each department.

The power distribution cabinets are equipped with open bus-bar work and enclosed fuses for the protection of each individual motor circuit, while the light cabinets are equipped with Perkins porcelain snap switches and plug cut-outs, except the cabinet for the control of the photographing arc lamps, which is equipped with knife switches.

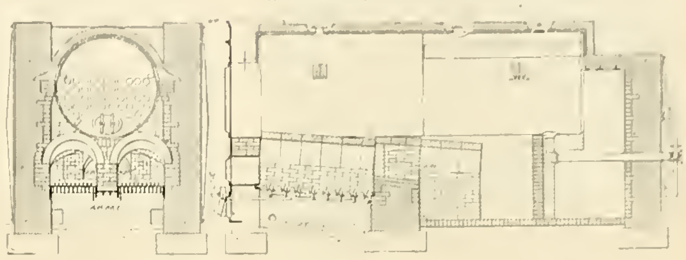
All the individual circuits are run to motors or light outlet boxes in conduits partially in the floor or exposed on walls and ceilings. Special care was taken of not having any exposed wires at all in the etching departments, where the wires would quickly be injured by the acid vapors. The wiring and distributing cabinets were installed by the Arthur Franzen Company, Chicago.

Adjacent to the engine room is the machine shop, equipped with electric-driven tools, and also a storeroom for machine and electrical supplies.

W. A. Blouck, Fisher Building, Chicago, was the consulting engineer for the installation of power, light and heating machinery. Huehl & Schmidt were architects of the building.



Wiring Diagram showing Lighting and Power Circuits.

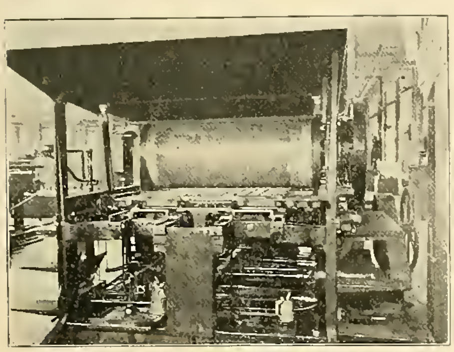


Tubular Boiler equipped with Water Arch Furnace.

ELECTRIC POWER AND LIGHT IN A LARGE CHICAGO PRINTING AND ENGRAVING PLANT.

Copper Tubes Made by Electrolysis.

A new process of forming copper tubes in an electrolytic bath has been brought out on the Continent. The bath is of copper sulphate, slightly acidulated, and the copper is deposited upon a form or cylinder of nickel-plated iron, from which it can be easily separated. The cylinder is rotated during the deposit, and bears upon a rubbing surface of infusorial earth, which prevents the formation of bubbles of oxygen. The anode is formed of 96.5 per cent. pure copper, free from arsenic, bismuth or lead, which might be thrown down along with it, but no harm is done by the presence of iron, nickel or zinc, as these metals are not similarly deposited. A speed of 20 revolutions per minute is the best to give to the tube in formation. The tubes made in this way are of a very good quality.



MIEHLE PRESS IN MANZ PLANT, SHOWING MOTOR DRIVE.

Michigan Electrical Association.

The Michigan Electrical Association held its annual meeting in Battle Creek last week. President William Chandler, who is at the head of the Chandler Dunbar Association at Sault Ste Marie, presided.

The officers elected for the ensuing year are: President, H. W. Hillman, Grand Rapids; vice president, J. A. Cavanaugh, Benton Harbor; secretary and treasurer, A. C. Marshall, Port Huron. Executive committee—A. E. Palmer, Kalkaska, W. P. Stevens, Kalamazoo. Finance committee—L. B. Schneider, O. D. Dodge and A. G. Noble.

Mayor C. C. Green welcomed the visitors to the city at the opening session. E. P. Phillips read the report of the insurance committee. J. B. Foote of the Grand Rapids-Muskegon Power Company gave a paper on "A Year's Operation at the Highest Working Voltage in the World, the Grand Rapids-Muskegon Power Company." The paper was a review of the experiences of the company which began to furnish power from its first dam a year ago. A second dam is now completed and a third is under way. With the three the company will be able to produce 60,000 horsepower.

H. A. Fee presented a paper on "Steam Turbines for Central Station Service, Especially in Small Units."

While the afternoon session was on the ladies of the party visited the postum cereal factory and the Kellogg Sanitarium under the direction of the entertainment committee. In the evening there was a theater party at the Bijou for all.

President Chandler gave a paper Wednesday morning on "Some Actual Experience with Tungsten Lamps at Sault Ste. Marie." E. A. Harris of the Westinghouse Company of Detroit gave a talk on prepayment wattmeters. G. S. Osborne of Chicago, representing the General Electric Company, spoke on "Recent Progress in the Manufacture of Tungsten Lamps."

At the afternoon session there was a paper by J. B. Foote of Jackson on "Recent Development in Lamps as Applied to Street Lighting, Magnetic Arcs, etc." A. P. Briggs of Detroit talked on "Factory Lighting."

During the day the ladies enjoyed a trolley ride to Jackson and an auto spin about that city, ending with a visit to the state prison. They returned to Battle Creek in time for luncheon at 3 o'clock, and at 4:30 the entire party was taken aboard special cars and went to Gull Lake for an outing. Dinner was served there at the Allendale Hotel, and the return to Battle Creek made late at night.

H. B. Gunnison read a paper Thursday morning on the "Operation of Centrifugal Pumps at Grosse Pointe Waterworks." It was followed by experiences in new-business campaigns in various cities by R. W. Hemphill, Jr., of Ann Arbor; Lawrence Manning of Owosso, S. E. Wolff of Saginaw, A. E. Palmer of Kalkaska and others. F. A. Beard read a paper on "Accounting for Small Stations." The election of officers was followed by the adjournment after the Commonwealth Power Company and the business men had been thanked for the entertainment and welcome provided the convention.

Traverse City has granted a 60-year franchise to the Carter Construction Company of Chicago to build and operate an electric road. The franchise calls for a five-cent fare throughout the entire period.

Monnot Copper-clad Steel Wire.

For many signalling purposes the sizes of copper wire used are much larger in cross-section than is necessary for simple electrical conductivity, since, on account of the low tensile strength of copper, the wire must be made large enough to give the requisite mechanical strength. The expense of copper and the comparative advantages of steel wire as a substitute have been recognized, but there has until recently remained difficulty in protecting the latter by a sheath of non-corrosive metal, such as copper. A method of welding copper to steel is the invention of Mr. J. Ferreol Monnot, a civil and metallurgical engineer of Paris, and by its aid the Duplex Metal Company of New York think it has succeeded in producing copper-clad wire with entire success.

The process is said to secure an autogenous union of the metals which are so perfectly welded together that an ingot of the joined metals can be rolled and drawn together just as a homogeneous metal. The wire product can be used to advantage in many cases as a substitute for both steel and copper, since it is proof against corrosion and has high tensile strength and elasticity. As a result of these advantages, poles may be placed further apart, or long spans successfully negotiated. The surface exposed to wind and sleet is smaller than for iron wire of the same conductivity. The danger of complete rupture of the wire from a small surface scratch or kink, so evident in hard-drawn copper wire, is avoided on account of the steel core. For telegraph and telephone purposes, where the mechanical strength of the wire rather than the electrical conductivity is a consideration, the advantages of a compound wire over copper or iron are evident. In power transmission where very long spans are necessary the application of a copper-clad steel wire is also indicated.

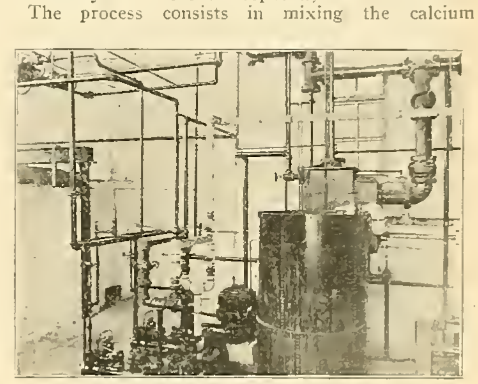
The wire is made in three grades, having, respectively, 30 per cent., 40 per cent. and 50 per cent. of the conductivity of the same size of copper wire. The first is recommended for telephone and telegraph purposes.

The welding principle may be applied to the manufacture of aluminum-clad, bronze-clad, silver-clad and other special wires.

A Non-hygroscopic Fertilizer from Calcium Nitrate.

A Norwegian patent has been taken out on a process of preparing from calcium nitrate an artificial fertilizer which contains more nitrogen and is free from the inconvenient property of hygroscopicity or the absorption of moisture. (Calcium nitrate, it will be remembered, is one of the salts that may be made from the nitric acid obtained electrically from the atmosphere.)

The process consists in mixing the calcium



PUMPING AND HEATING EQUIPMENT AND SURGE TANK IN MANZ PLANT.

nitrate with a proper quantity, i. e., about 40 per cent. of ammonium sulphate, and mixing them together either in the state of powder or by melting the calcium nitrate. The product is a double salt, or a mixture of calcium sulphate and ammonium nitrate which is stated to have the properties already mentioned. If the original calcium nitrate contains an excess of any base, it is advisable to add a corresponding quantity of superphosphate, or some other material, having an acid reaction.

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CORRESPONDENCE relating to electricity or any of its practical applications is cordially invited, and the co-operation of all electrical thinkers and workers earnestly desired. Clear, concise, well written articles are especially welcome; and communications, views, news items, local newspaper clippings, or any information likely to interest electricians, will be thankfully received and cheerfully acknowledged.

REMITTANCES.—All checks, drafts and other remittances should be made payable to the order of the publishers, the **Electrician Publishing Company**, and addressed to the offices of publication, Suite 507, Marquette Building (204 Dearborn Street), Chicago, Illinois, U. S. A.

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DEPARTMENTS.

DATES AHEAD.

Canadian Independent Telephone Association (annual meeting), Toronto, September 4th.

Canadian Electrical Show, Power Building, Montreal, September 2d to 14th.

Colorado Light, Power and Railway Association (annual meeting), Savoy Hotel, Denver, Colo., September 18th, 19th and 20th.

Central Electric Railway Association (regular meeting), Columbus, Ohio, September 26th.

New York Electrical Show, Madison Square Garden, September 30th to October 9th.

American Street and Interurban Railway Association and affiliated societies (annual convention), Atlantic City, N. J., October 14th to 18th.

CENTRAL-STATION men almost exclusively furnished the papers at this year's meeting of the Ohio Electric Light Association. Toledo, where the convention was held, is an attractive lake point, easily accessible, which may have had something to do with the success of the meeting, but the members generally feel that the numbers present and the interest manifest is proof of the wisdom of the new departure. The programme was an excellent one, full of topics pertinent to central-station management. Of special interest was the report on progress in high-efficiency lighting units. This report, with an abstract of the discussion, appears in this issue; it will be found valuable to all central-station men. Among the other subjects discussed were, factory lighting; electric heating devices; best forms of power for small stations; ways of selling day current; helps to a solicitor; wiring by central stations; meeting of gas and gasoline competition, etc. A full report of the convention is printed in this issue.

WHEN the manufacture of electric incandescent lamps was first attempted the problem of finding a conductor to lead the current into the lamp, whose coefficient of expansion was the same as that of the glass, was met in the metal platinum. Between the times of burning and extinction of the lamp the leading-in wires, which are in contact with the filament, undergo a considerable range of temperature. Being sealed into the glass stem their expansion and contraction would tend to crack the glass if they expanded more rapidly, or to shrink away from the glass, permitting leakage of outside air into the vacuum if the metal's coefficient of expansion were less than that of glass.

Curiously enough, platinum perfectly fulfills the conditions with an expansion coefficient of .00000479 for one degree Fahrenheit, that of glass being about .00000480. But platinum is a very expensive metal, ranking in the matter of cost along with gold, and seems to be increasing in price with the present large quantities used in electrical apparatus. The market quotations on platinum have mounted steadily until the present figure far exceeds that at which the precious heavy metal might be had before its large use in electric lamps and contacts. When incandescent bulbs were sold at the high prices which royalties and the costly experimentation which produced them required, the amount of platinum used in a lamp was a small factor in its expense, and it is indeed noteworthy that the platinum alone in some of the early lamps would bring half the price of the entire lamp of latter-day manufacture. With the increasing production and cheapening of incandescent lamps in other directions experiments were made looking toward the use of less platinum or its complete abolition for leading-in wires.

A step in this direction was the Siemans seal, in which a small amount of platinum is used simply to lead through the glass and connects two heavier pieces of a cheaper metal.

Now we have a new method of sealing-in which entirely does away with platinum and was developed after several years' experimenting by Mr. George Calvert. The metal used, it is surprising to note, is ordinary copper, which has a coefficient of expansion about twice that of glass or platinum. The method was described in the inventor's paper read before the electrical engineers in session at Glasgow a few months ago. A wire long enough to extend from the cap to the filament and of any desired cross-section is rolled flat for a length of about five-eighths inch to a thickness of three-thousandths of an inch. Then a length of soft enameled glass tube 10 millimeters long is slipped over the flattened portion of the copper and is melted on to it with a blowpipe flame, the enameled glass adhering to the flat portion of copper just as solder would adhere to it. The two substances seem actually to form a perfect joint as if they were amalgamated. The glass-coated metal may then be sealed into the stem of a lamp in the ordinary way. The seals, according to Mr. C. O. Bastian, in whose laboratory the experimental work was performed, have proved most perfect in practice and have successfully stood the most severe tests during a period of about a year.

WHEN considering the activities in the field of steam-railroad electrification, the New York Central and the New Haven equipments very naturally have come to be looked upon as the largest and most important of electric-railway installations. In the West, however, for the last three years there has been studied a problem which is considered by many railroad men as perhaps the most difficult and important in equipment and operation in the railroad world. This special problem is the increase of capacity of the Sacramento Division of the Southern Pacific Company, Harriman Lines, which extends over the Sierra Nevada Mountains at an elevation of about 7,000 feet maximum. It is over this division that the entire freight and passenger traffic of the transcontinental Union Pacific System, for Central California, is carried, and likewise the eastbound traffic. Some idea of the difficulties may be judged from the fact that in a distance of 83 miles there is a rise of nearly 7,000 feet, this section forming a part of the division between Rockland and Sparks on the west and east slopes, respectively. The distance between these two places is about 136 miles, nearly as far as from New York to Albany. It is single track, has very sharp curves, and over 31 miles of tunnels and snow sheds, the latter in winter being the equivalents of tunnels. The traffic while heavy is very irregular, and is made more difficult of maintenance in the winter by the heavy snows, often 15 to 20 feet deep.

This link of the transcontinental system is a throttle on the entire traffic, and increase of capacity is vital either by new construction with lower grades, perhaps tunneling the Sierra Nevadas, or change of motive power. This latter has seemed likely to be effective, and derives some special significance because of various published comments by Mr. Harriman to the effect that inasmuch as widening the gauge of railways was impracticable, electricity seemed the obvious general solution of the problem of increase of capacity of railroads. At present the motive power is steam, oil-burning locomotives of the highest type being used.

One solution, the electrical one, has been under consideration for some time by Mr. Allen H. Babcock, the electrical engineer of the Southern Pacific Company, and it is understood that various proposals have been made by the great electrical companies, whose engineers have been on the ground making a study of the situation. Unlike the eastern problems, neither the requirements of congested terminals nor the advantages of dense traffic on a plurality of tracks is present, and these facts, as well as the physical necessity of handling heavy trailing loads at increased schedules on continuous grades, equal at times almost to 2½ per cent., add to the problems of this great engineering project of the west.

Mr. Frank J. Sprague, who, as a member of the Electric Traction Commission of the New York Central for four years, is largely concerned with the electrical equipment of that road's terminals, has now been invited to co-operate with Mr. Babcock in a new study of electrical possibilities from all standpoints for the formulation of a report to a board, including, with themselves, officials of the railroad system, which board will make a final report and recommendations, reporting to Vice-president Kruttschnitt, director maintenance and operation, Harriman Lines. If these are such that electricity should be adopted, Mr. Sprague continues as consulting engineer during the period of installation, which would naturally be carried on by the railroad company's organization. It is understood that Mr. Sprague has already been over the system, and leaves soon for another investigation preparatory to a report. Inquiry of him affords no indication as to what system he believes to be available, if any, but rather a keen appreciation of the seriousness of the problem, and intention to first find out whether the present and future traffic, and alternative methods, warrant the adoption of electricity at all, after which, if it should be decided affirmatively, the details of a system should be determined. The appointment of Mr. Sprague at this juncture is not without some significance.

OHIO ELECTRIC LIGHT ASSOCIATION.

The thirteenth annual convention of the Ohio Electric Light Association, held at the Boody House, Toledo, on August 20th, 21st and 22d, in point of attendance went to high-water mark. If numbers and interest are proof of the success of the new departure in policy on the part of the association in the holding of its conventions its wisdom was amply demonstrated. Toledo being a lake point and easily accessible, having also ample hotel accommodations, naturally attracted a large local attendance, but aside from this many new faces were noticed by those familiar with the past meetings.

Contrary to the custom of former years, the makers of the programme decided to call upon central-station people almost exclusively for papers on topics pertinent to business management. It is believed that this policy is generally approved. During the last year also a very active campaign has been in progress for new members, and with most gratifying results. President Engel succeeded well in his endeavors to bring out the points desired in discussions. His efforts, together with those of President-elect Tait and Secretary-treasurer Gaskill and others, have aided much in the increase of membership.

New Members Elected.

The following-named new members were admitted into the association:

Active Members.—Wadsworth Light and Water Company, C. N. Oplinger, superintendent, Wadsworth; City Heat and Light Company, J. J. Cramer, vice-president and general manager, Fostoria; Theodore S. Garber & Son, proprietor Belleville Electric Light plant, E. G. Garber, manager, Belleville; Oak Harbor Electric Company, George C. Mylander, general manager; New Bremen Electric Light Company, F. H. Plaice, general manager; Kent Water and Light Company, A. B. Young; Manufacturers' Light and Power Company, H. O. Fisher, manager, Dunkirk and Forest; Franklin Electric Light Company, L. C. Anderson, secretary and treasurer; Delphos Electric Light and Power Company, H. L. Canfield, secretary and treasurer; Wilmington Water and Light Company, J. C. Martin, vice-president and manager; Loveland Citizens' Electric Company, H. C. Hubbell, secretary; the Electric Light Company, J. W. Row, manager, Ottawa; Lima and Toledo Traction Company and the Indiana, Columbus and Eastern Traction Company, Francis Alfred Healy, secretary and treasurer; Pomeroy and Middleport Electric Company, I. L. Oppenheimer, superintendent, Pomeroy; McConnellsville-Malta Electric Company, A. Durbin, secretary, McConnellsville; Tiffin Edison Electric Illuminating Company, C. B. Rodgers, general manager; Cambridge Power, Light and Traction Company, J. A. Middleswart, secretary; East Liverpool Traction and Light Company, J. H. Rothery, general manager; Hicksville Electric Light and Power Company; the Maumee Electric Company; West Liberty electric-light plant.

Associate Members.—Westinghouse Electric and Manufacturing Company, J. W. Schrantz, Cincinnati; Western Gas Fixture Company, E. N. Riddle, secretary and treasurer, Toledo; Toledo Chandelier Manufacturing Company, H. G. Boyers, manager, Toledo; Curtis Advertising Company, Charles A. Parker, secretary, Detroit, Mich.; New York and Ohio Company, R. E. Gorton, assistant manager; Electric Supply and Construction Company, Mark Siminton, treasurer; Glover Electrical Company, J. E. Swisher, general manager; Morman Gas Fixture Manufacturing Company, C. S. Brookins, vice-president, Cleveland; Babcock & Wilcox (Stirling department), Barberton, R. D. Crawford, chief electrician; Western Electric Company, F. A. Henderson, Chicago; John A. Stewart Electric Company, Paul Stewart, manager, Cincinnati; W. G. Woolfolk, Sanderson & Porter, New York; Cleveland Gas and Electric Fixture Company; Brilliant Electric Company, Cleveland; Toledo Electric Company; Excello Arc Lamp Company, New York city.

The first number on the programme was the address by President Engel, which gave special prominence to the thought that the present need of central stations is to foster the commercial side of their enterprise by cultivating the best relations with the public and energetically pushing a campaign of education along all lines. President Engel took it for granted that one of the best means to secure business is to furnish the very highest class of service, and, assuming that the central station is doing this, the next thing is to thoroughly acquaint the public with the merits of the service.

Factory Lighting.

Papers on "Factory Lighting" were read by A. P. Biggs of the Edison Illuminating Company, Detroit, Mich., and J. Kermode of the Cleveland Illuminating Company, Cleveland. These papers are both of value to proprietors of factories and will be found to contain useful suggestions looking to economy and efficiency. The conclusions arrived at are summed up by Mr. Biggs as follows:

"That an electric light company cannot afford to take on all factory lighting offered to it; that it is obliged to take a certain amount which is inherently unprofitable; that it should minimize this amount by (first) advising the customer how to reduce his demand by utilizing light to best advantage—that is to say, by good illuminating engineering; (second) advocating the transfer to daylight hours of any power load that can be dispensed with during the evening hours, and (third) by passing over to the gas company such factory space lighting as can be profitably furnished by gas arcs, retaining for electricity the long-hour localized lighting.

"It is worth while to note that the new metal filament incandescents may modify these conclusions. They will not change the rates of demand to sales, but they may make gas so comparatively expensive as to put it out of competition either partially or altogether."

In discussing the paper F. W. Willcox of the General Electric Company commended the points made, which need further emphasizing, namely, the necessity for proper engineering and proper education of the factory managers and workmen in the efficient use of lamps, as often more depends on the efficient use than upon the intrinsic efficiency of the type of lamp itself. The practice of using unshaded lamps is wasteful in the extreme in its failure to direct and confine the light where needed. A lamp in a shade is also better protected against soiling by dust or oil and grime than an unshaded lamp. It is also necessary to urge upon factory managements the need for more illumination, false standards having arisen as to the quantity of light necessary. Mr. Willcox said that owing to the low price of gas and the efficiency of the gas mantle the present incandescents cannot always compete, at present rates, with gas arcs; but that is not the case with the ordinary electric arc or the Nernst lamp. Gem units have demonstrated their ability to match the ordinary arc and Nernst lamp in effective illumination, and in many cases results have been secured as high as 1½ to two foot-candles per watt per square foot, a very good ratio of illuminating efficiency. The essential thing in most illuminating work is to get a uniform result by the more frequent distribution of small units, distributed in such a way as to secure better illumination with the same energy.

Prof. F. C. Caldwell of the Ohio State University thought that the matter of keeping lamps clean is one that should have special attention in the case of factory lighting; the actual cost to a manufacturing company of keeping lamps in use free from grease and dirt, as mentioned in the paper, would be very small and would very greatly add to the effectiveness of the light and to the satisfaction of those working in the shop. The conditions in this respect are deplorable in ordinary shops and there is no place else where a like condition prevails.

Luminous Arcs from the Central-station Viewpoint.

The first business of the afternoon session was a paper by H. P. Grabill of the Ashland Gas and Electric Company on "Luminous Arcs from the Standpoint of Central-station Operation." Speaking from the experience of a central station that was one of the first in Ohio to adopt magnetite or luminous arc lamps, the writer summarizes their various advantages as follows: To the public—improved distribution, better quality of light and fewer outrages; to the central station—economy of energy, lower maintenance cost, ease of adjustment and trimming and lower repair and renewal cost. On the whole the system is pronounced by the writer as coming fully up to expectations and as the best in operation at the present day, and should appeal to any central station contemplating a change.

President Engel commented that there was a general feeling that the new magnetite lamp is working wonders where introduced, and there are few stations that are not desirous to change their street-lighting lamps when offered something that they can depend on.

J. C. Rothery stated that two features in the magnetite arc, as far as inspected by him, might be improved. One is the clouding of the globe by sediment forming therein, possibly due to insufficient ventilation; the other is irregularity in the lighting due to the formation of some substance on one of the electrodes interfering with the feed, causing flickering as if dying out. Mr. Grabill explained that the flickering was due, he thought, to improper centering of the electrodes, and that if properly adjusted the lamp will give a steady light. The formation of film complained of does not cut off more than two or three per cent. of the light and is negligible.

C. R. McKay said that with the first 200 or 300 lamps they experienced some of the difficulty complained of. He invited the members to visit the Water Street (Toledo) power house during lighting hours and see the rectifier board. Twelve circuits are in operation of 50 lights each. The speaker said they were at present going through a period of construction; the lights are taking about 45 to 40 amperes at about 80 volts. The rectifiers in operation are all on air tube, supported in air on switchboard panels; use induction motor blower set, which maintains an air blast on each tube continually during the time the tube is in operation.

Electric Heating Devices.

M. E. Turner was unable, by reason of an attack of typhoid fever, to be present. His paper on "Electric Heating Devices" was read by Mr. Kermode. The progress of manufacturers in the production of electrical cooking and heating devices is being keenly watched by central-station people generally, and it is quite generally conceded that it is the part of enterprise to keep up with the improvements being constantly made. It is only by experiments conducted by users of such devices and central-station people who are competent to conduct such experiments in an intelligent and critical manner that suggestions will come to manufacturers from which further development may be looked for. The stations who will make the small investment necessary to interest intelligent users to experiment with the devices will later reap a full return. That this situation is fully realized was evidenced by the discussion awakened by the paper.

Mr. Rothery stated that he could readily see how an electric device would be preferred in the shape of an iron that dispenses with the inconvenience of heating up the room while the housekeeper is ironing on a hot summer day, but he wished to be fully satisfied as to whether the cost of other devices would not deter people from using them, in préference to present methods in vogue.

Professor Caldwell thought that the cost of cooking and heating devices for the kitchen especially must be reduced, as there is no place where a greater desire is felt to retrench than in kitchen appliances. The question of better lagging, or heat insulation, is one of the important things that ought to be improved. This is the more important with all apparatus that is intended for short periods of use, and at intervals, as would usually be the case in cooking. The speaker suggested that good results might be obtained by double-jacketing an oven and establishing a vacuum between the jackets, to be secured by a small air pump attached, upon which a few strokes could be taken daily sufficient to maintain the vacuum.

In many instances, President Engel stated, the iron that gave the best service had proved the quickest to give out. The iron with the copper strip placed in a coil close to the bottom of the iron, he thought, had been the quickest heating and gave most satisfactory service. Some irons are too hot for the hand, and dissipate the heat too fast.

Mr. Selig did not think it safe to recommend some of the apparatus too strongly at present, fearing dissatisfied customers may lose revenue in other directions.

Mr. Kermode of Cleveland reported that the only trouble they had had with flatirons was with the large tailoring iron. One factory had 98 irons of this kind in one room, 115 volts. On going over to the 220-volt, to save cost of inside wiring and also to get the flatirons on the same meters with the power, in order to get the benefit of the best possible arrangement on the power contract, they encountered trouble with the irons. Different causes were looked into as possibly producing the trouble; first, the size of the copper; next, fluctuation on the power circuits were suggested, and the irons were put over on the lighting circuits, but the trouble continued; the irons kept on burning out in large numbers. Finally it was discovered that the pressers in dampening the cloth were putting on too much water, and the evaporation of the water into steam would condense on the irons back of the handle, and the condensed steam was sucked into a lodgment place where the cord and the connecting post came together.

Mr. Martin, in a town of 700 customers, including 600 resident customers, has put out some 100 irons. Twenty-five or thirty of these were put out a year ago and proved quite satisfactory, and during the year the additional 75 were put out. Estimate that for a family of six the iron is worth $1 a month to the station, it is one of the best current consumers the station has; it furnishes full 24-hour service with the exception of Sundays. Mr. Martin has a device which is of local invention, a welder. He thought that heating and cooking devices are clear gain to a central station, as proved by his experience.

President Engel commented on one feature as especially desirable in electric irons, namely, the meeting thereby of competition along other lines.

Mr. Plaice stated that they started in his town in 1905 with 12 irons placed on a flat rate charge of 75 cents for a family of five, and five cents for each additional member. Lost 10 irons the first year out of 12, and concluded it was bad business. The second year, however, placed everything on meter basis, and put out last year about 50, losing but three out of that number. Have 80 this year, and so far have not lost one. Eighty per cent. of these irons are rented; balance maintained by the central station. The speaker thought the manufacturer should give a better cord for the iron; it breaks off close to the iron, causing some annoyance in being repeatedly called to make the same character of repair. The iron should be connected up at both ends.

The sentiment of nine out of ten station men is that heating devices are a good thing, and all that is necessary is to get the manufacturer to keep on improving them.

Mr. Grabill stated that in cases where two or three families live in one flat and perhaps use one laundry in common, it has been found advantageous to furnish one iron wired in such a manner that a separate circuit would be brought upon the individual meters by using a key switch, or a padlock over the switch, so that each tenant can use the flatiron off their own meter.

L. W. Cady explained, in regard to the life of the iron when left on circuit, that the irons are so designed as to give out their intended heat at a given voltage; if the voltage increases, the iron actually becomes hotter, and if the heating elements do not properly conduct away the surplus heat some weak part is likely to give way. No iron should give out while in use, as the surplus heat is dissipated by the wet goods as fast as it is generated. The manufacturers of electrical heating devices heartily urge that all small electric heating apparatus shall be used on low-voltage circuits. It is very hard to find a durable resistance material which can be made small and yet have a long life on a high-voltage circuit.

Co-operative Commercialism.

The first thing on the programme of Wednesday was the subject of "Co-operative Commercialism in the Electrical Field," on which Mr. J. Robert Crouse was to give a paper. Being compelled to leave the city, Mr. Tait, manager of the Dayton Lighting Company, gave an abstract of the paper presented by Mr. Crouse at the Washington meeting of the National Electric Light Association in June last.

Best Forms of Power for Small Stations.

Prof. F. C. Caldwell of the Ohio State University read his paper on "The Best Form of Power for Stations of 500 Kilowatts Capacity or Less." In the discussion following the paper Professor Caldwell said, in answer to a question that, as he understood the steam economy in the case of small turbines, it is not materially different from the same size reciprocating engine. Where the engines are new, the speaker thought the saving in fuel is not such as to be much of a factor in determining the use of the turbine over the reciprocating engine. There is a great deal to be said in favor of the turbine on account of its simplicity; the fact that it is not so likely to get out of adjustment; the absence of reciprocating motion with its vibration and tendency to tear things to pieces, so to speak. The paper was intended more as an outline to be filled in from the experiences of those who are using the apparatus. With respect to the saving of fuel, Professor Caldwell suggested that the engineering interests of the country should consider the possibilities of exhausting our fuel supplies by too wasteful an expenditure of them, and having this in view, if the gas engine only uses half as much fuel as the steam engine, it is certainly a matter of grave public interest to encourage its use. Economizing fuel should therefore receive careful attention.

Mr. Adams said his company is now operating two gas engines of 280 horsepower each, and is installing one of 250 horsepower. Should a break occur in the gas mains they have ample holder capacity which would take care of their needs until the break could be repaired. They also have a holder with a water tank, and utilize the water over and over again, so that they pay no water rent.

Mr. Plaice stated that gas engines will operate on a scant supply that would put stoves out of business. He had operated in his town with a suction as low as 16 ounces. When it gets that low the gas, instead of coming out of the stove burners, sucks air in through them; so that a gas engine will run long after everybody else has quit. In 14 years they have not had any trouble through not having gas enough to run on, although the lines have been off at times.

Mr. Gwynn referred to Professor Caldwell's statement as to absence of vibration in the turbine, and inquired whether they did not have some vibration in the municipal plant that shook the plaster off the building at Columbus. Secretary Gaskill suggested that you could hardly expect anything else from a municipal plant, which provoked considerable amusement in the audience.

Mr. Seman of Winchester, Ind., stated that they had operated for the last seven years a plant, both water and light, with gas engines, and had found same very satisfactory. The cost of operating is estimated as about half what it would be with coal, that is, the fuel expense. One of their gas engines had been in operation for seven years without having had the cylinder rebored. They notice no variation in their alternating-current and very little in the direct-current service. It cannot be noticed on the voltmeter at all on the alternating current. The direct current is direct-connected, and you can notice a little variation in the light.

Mr. Rothery asked the gentlemen who have been operating gas plants to say what is the cost of operation per kilowatt-hour. Also whether it is not necessary to provide additional units to take care of overload? The speaker understands that a gas engine will develop simply its rated capacity, and positively no overload, the rated capacity being based upon the highest number of heat units in the gas which is to be used in that locality. If there is any deficiency in the heat units the capacity of that engine is reduced pro rata. Thus there must be considered (1) the number of units required in order to produce a given amount of power; (2) what reserve is it necessary to have on hand? and (3) what is the actual operating cost per kilowatt-hour? With the fixed charges what is the cost on the bus-bar? We know what it is by a reciprocating engine and by steam turbines from actual experience; but with the gas engine there seems to be the broad statement that they can operate so much more cheaply than they can by steam.

Mr. Adams replied that he had not the data in hand, but would send it in to the secretary. His company measures everything off the switchboard. They had difficulty in getting the full rated capacity out of the gas engines, but nevertheless think so much of them that they are still putting them in. In Elyria during the last 18 months various factories there have installed about 1,500 horsepower in gas engines running electrical equipment.

Ways of Selling Day Current.

Aside from the regular programme, the subject of ways of selling day current was discussed by Messrs. Gwynn, Bechstein, Russell, Townsend, Rothery, Conkling, Martin, Lockwood, Adams, Selig, Plaice, Rust and others, and it developed that, owing to local conditions, such as difference in cost of fuel, and other causes, there was a wide divergence of rates charged for day-power load.

High-efficiency Lighting Units.

At 2 p. m. the joint paper by Messrs. C. C. Collins and A. N. Cope of Columbus was taken up, the former being superintendent of the Columbus Railway and Light Company, and the latter of the Columbus Public Service Company. The paper was in the nature of a report, showing results in the use of lights in tabulated form as obtained by various central stations in Ohio and elsewhere. The paper in full, with an abstract of the discussion, appears elsewhere in this issue.

Helps to a Solicitor.

J. D. Kenyon of the Sheldon School, Chicago, addressed the convention on the general subject of "Helps to a Solicitor," outlining the elements of scientific salesmanship. His address was much appreciated and the subject of a good deal of favorable comment privately among the members.

A. S. Miller of the Dayton Lighting Company read his paper on "Helps to a Solicitor, and what Fifty Cents' Worth of Electricity Will Do," full of practical suggestions to the solicitor.

Professor Caldwell emphasized the great convenience of many household appliances in the electrical way, saying that the suggestion as to drying in the laundry by electric fan was much appreciated and used in his own household. The great convenience is worth all the cost. President Engel gave a like illustration.

Mr. Bechstein referred to the opportunity for putting out motors to run refrigerating plants. The time is coming when private ice plants run by electric motors will supplant the ice man at $6 a ton. One installation in his city was giving good satisfaction, and has been in operation since last December, on a meter basis. Mr. Adams reported several refrigerating plants on a meter basis, experiencing no trouble. It was not so desirable if the peak is overloaded. Mr. Tait stated that by the use of a modern equipment such a plant can be run, with current at four cents per kilowatt-hour, to compete successfully with ice at $6. An automatic regulator is very essential.

Wiring by Central Stations.

At the suggestion of Mr. Gwynn the rest of the afternoon was given over to a discussion on wiring, and the advisability of the central station undertaking same. It seemed to Mr. Gwynn that turning wiring over to outside contractors does not encourage new-business getting. This department can be made a profitable one.

In Massillon, a town of 15,000, there are no wiring contractors. Here the plan of Mr. Russell's company is to offer free wiring, provided the houseowner will pay a minimum bill of $1.50 a month for two years; that is, figuring that it will cost $9 to wire the house; the ordinary minimum being $1, this allows 50 cents monthly to pay for the wiring. If he does not want to pay $1.50 for two years he can have the option of $1.25 for four years. In this way the company has taken on 120 new customers of this kind in the last two months and a half.

Mr. Martin bought a municipal plant in his town and has built up a good business. There is only one local contractor, and the speaker never bids against him. He has two forms of wiring applications to choose from. The customer pays for the material, which in schedule A includes everything that is properly chargeable to the wiring, beginning at the fuse plug and the wires down to the point where the wires come through the ceiling. Switches are charged extra in schedule B, covering all switches, drops and everything that is in the way of a chandelier or lighting device. If the aggregate of A and B is $25, of which A is $15, and B, $10, the customer pays the $25, and the collector receipts for same; at the bottom the collector certifies that, having paid his bill, the customer is entitled to a credit of $15, to apply against all future light bills.

The meter is read monthly, but no bill presented until the customer has exhausted his credit memorandum, schedule A. In the meantime the family has contracted the habit of using electricity. The customer is urged to take irons and as many devices as possible that consume current, something that under a different introduction plan would require two or three years to educate him to.

Mr. Kermode reported that in Cleveland the company had arrived at an average unit price per outlet on wiring and a separate price for all switches, receptacles and drop lights installed. Contractors were asked to furnish bids covering what they would wire old houses for. It is easy to get new houses, but hard to get old ones, where the fixtures are already in for gas. A company can always get business by extending its lines, whether profitably or not, but it is hard to increase the business on old lines; for that reason a liberal policy is desirable on old-house wiring. The Cleveland office is allowing 15 per cent. of this wiring cost to apply on light bills. It takes about three months to take up that allowance. Are now gradually taking off company solicitors and paying contractors so much for each house added; the contractors have some ten men in the field soliciting, on a commission basis. As to furnishing free-lamp renewals, many customers do not appreciate anything you give them; in Cleveland lamps are sold at 15 cents, and about 185,000 handled annually.

Meeting Gas and Gasoline Competition.

On Thursday morning papers were presented on the subject of "Best Ways to Meet Gas and Gasoline Competition" by the following: F. H. Golding, Dayton Lighting Company; Samuel Rust, Greenville Electric Light and Power Company; W. E. Russell, Massillon Light, Heat and Power Company; Arthur Pomeroy, Cleveland Illuminating Company; E. T. Selig, Mount Vernon Electric Light Company, and W. C. Anderson, Canton Light, Heat and Power Company. Many valuable suggestions were offered.

In the discussion following, Mr. Beil said that small current-consuming devices, negligible themselves as to their effect in increased revenue, were often the means of introducing electricity and securing patronage that otherwise would not have been secured. He instances renting fans for the summer months, particularly to those who had sickness in the family, as one of the ways of inducing patronage that would extend to lighting, etc.

Mr. Kermode stated that in 600 houses wired in Cleveland on the installment plan, the contractor had made no investigation as to the man's standing, but took his order for wiring his house and took chances on getting the money on the installment plan. The central station pays the contractor a bonus as compensation to him for carrying the account 8 or 10 months. Out of the 600 houses only two failed to pay. The company does not guarantee any account, neither is there anything in the contract that is in the nature of a lien or mortgage. Are not now paying the contractors a bonus, but making property owners a rebate of 15 per cent. to apply against lighting bills.

Secretary Gaskill stated that an electric central station that does its wiring has always the statutory provision in regard to mechanic's lien to fall back on, and can file said lien any time within four months from date of the last item of the account.

Mr. Custar said he was rather prejudiced against a central station doing wiring, as tending to interfere with proper attention to other business. The gas company does not do any plumbing in his town, and why should the electric-light company do wiring? People will run to the office for small repairs and alterations, which they will want done for nothing, and if not done free bad feeling is created. Better have a private contractor do the wiring, and encourage him in this as much as possible. People will think you are making money out of the wiring.

In response to query by the chair as to how many stations do their own wiring, 12 responded in the negative; 21 stations reported that they did wiring.

Mr. Martin reported that at first they let somebody else do the wiring, but unsatisfactory work done by wiring contractors had opened their eyes to the necessity for doing this work themselves. They accordingly bought out the local contractors with the exception of one. By reason of the fact that they do the wiring they hear of troubles promptly and can as promptly correct and remedy them. Mr. Townsend reported that the only wiring his company does is of arc lamps. They work in conjunction with the contractors and get better results that way than if doing own wiring.

Mr. Selig said that a great many stations are probably staying in the wiring business simply because they cannot get a good wiring contractor; but in many cases they can make a better man out of a contractor by proper inspection. The people in the inspection bureau ought to be encouraged. The farther a company stays away from doing wiring and the less responsibility they have, the better for them. If they will encourage this inspection by the regular insurance inspection bureau they will relieve themselves of a great deal of liability. Did some wiring when there were no good contractors to be had, but are now fortunate in having two good firms, who do business in five different towns in the state, and there is enough competition between them to insure moderate prices. Do not like to do the inspection ourselves, but prefer to escape that liability when we can place it on the inspection bureau. At present the inspection bureau has arranged to put one inspector in our territory, who takes care of four towns. The charges for inspection are very moderate and are added to cost of wiring, so that the customer pays for same.

At this point there was a long discussion on the subject of theft of current, in which Messrs. Adams, Bechstein, Kermode and Golding took part

Closing Business.

Secretary-Treasurer Gaskill submitted his report, which was duly audited and found correct. The report shows the association in good financial standing. A recommendation to increase the salary of the secretary was approved. The secretary recommended that the dues of associate members be increased to $10 a year, which recommendation, on motion of Mr. Hanley, was adopted.

Election of Officers.

The nominating committee, Messrs. Hanley, Rust and Hubbell, submitted its report, which was unanimously adopted, the officers elected being as follows:

President—F. M. Tait, Dayton.

Vice-president—E. H. Beil, Youngstown.

Secretary-treasurer—D. L. Gaskill, Greenville.

Executive committee—W. P. Engel, Defiance; M. E. Turner, Cleveland; D. W. Low, Alliance; W. F. Hubbell, Wauseon; J. C. Rothery, East Liverpool.

Advisory committee—Samuel Scovil, Cleveland; C. R. McKay, Toledo; D. L. Gaskill, Greenville.

Publicity committee—W. J. Hanley, Cleveland; Samuel Rust, Greenville; J. T. Kermode, Cleveland.

Finance committee—W. E. Miller, Mt. Gilead; T. D. Buckwell, Toledo; G. N. Clapp, Middletown.

President Engel paid a high compliment to the work of the secretary. He recommended that central-station men not only come to the meetings of the association with their ladies, but to see that their directors come also, as they can learn much that will be of benefit.

Secretary Gaskill, by request, read a communication inviting the convention to come to Cleveland, signed by a number of those in attendance on this meeting. The matter of choice of the next meeting place will come up at the January meeting of the executive board.

President Engel extended thanks to the active and associate members for valued assistance rendered during the year. Out of some 180 central stations in the state there are now but 50 that are not members of the association.

A suggestion was made by Mr. Golding of Dayton that it is important to secure legislative control of the use of gasoline. Mr. Canfield of Delphos spoke along the same line, and on his motion a committee of three was authorized to be appointed by the incoming president, to consider the matter of gasoline, and suitable measures for its control, and the committee was given power to act, or to report at next meeting at its option.

Entertainment Features.

The amusement features of the convention were worthy of notice and consisted, for the evenings, of a theater party at the Casino, supper at Toledo Beach, a boat ride on the Greyhound, with the usual accompaniments of music and dancing, and the various ladies' contests scattered throughout the afternoons and evenings. The dinner at Toledo Beach, in charge of Douglas Buckwell, was an especially enjoyable affair.

The winners in the various contests arranged for the ladies were as follows, the beautiful prizes having been presented by the associate members and others:

Informal euchre contest—Mrs. George Williams, Cleveland.

Formal euchre party—First prize, Mrs. F. C. Colwell, Cincinnati; second prize, Miss E. McKnight, Bowling Green; third prize, Mrs. W. B. Wilkinson, Columbus; fourth prize, Mrs. W. S. Meeker, Greenville.

Riddle contest—First prize, Mrs. A. B. Pyke, Cleveland; second prize, Miss Esther Gaskill, Greenville; third prize, Mrs. Z. T. Dorman, Greenville; fourth prize, Miss Helen Gaskill, Greenville.

Peanut contest—First prize, Miss Elmina McKnight, Bowling Green; second prize, Miss Letha May Engel, Defiance; third prize, Mrs. E. A. Bechstein, Sandusky; fourth prize, Mrs. G. H. Porter, Chicago.

Euchre—First prize, Mrs. A. A. Serva, Fort Wayne, score 67; second prize, Mrs. H. S. Cook, score 65; third prize, Miss Elmina McKnight, score 63; fourth prize, Miss E. R. Martin, score 62.

Pedro contest—First prize, Mrs. C. B. Rodgers, Tiffin; second prize, Mrs. A. G. H. Jennsen; third prize, Mrs. W. P. Engel, Defiance; fourth prize, Mrs. Folsom.

Ladies' bowling contest—First prize, Miss Quail, score 155; second prize, Mrs. Haring, score 150; third prize, Mrs. Rogers, score 139; fourth prize, Mrs. Jennsen, score 130.

Convention Notes.

The Oneida galvanized chain for suspending arc lamps was exhibited in parlor N.

The W. G. Nagel Electric Company of Toledo entertained in parlor I, represented by W. G. Nagel, H. E. Adams, R. G. Kendrick, A. L. Carney and J. P. Thompson.

The Western Gas Fixture Company hung a chandelier in the convention hall with five two-glower Nernst lamps attached. The company was represented by Edward N. Riddle.

The Westinghouse Electric and Manufacturing Company was in parlor C, represented by G. E. Miller, manager, Mr. Wagenhorst, C. P. Billings, Mr. Beebe and G. S. Vail of Cleveland, Mr. Hughes of Pittsburg and J. C. McQuiston.

J. Robert Crouse of the Co-operative Electrical Development Association, Cleveland, showed three sets of mounted photograph display cards, illustrating the work of the companies of Dubuque, Lincoln, Neb., and Providence, R. I.

The Electric Appliance Company, Chicago, represented by F. J. Alderson, Chicago, and George H. Porter, Columbus, exhibited in the lobby Sangamo direct-current and alternating-current integrating wattmeters. Souvenir pocket mirrors were distributed.

The John A. Stewart Electrical Company, Cincinnati, Paul Stewart, treasurer and manager, kept open house in parlor 64, and gave away souvenirs in the shape of a combined paper-knife and letter-opener. The mission was to buy second-hand machinery.

Parlor K was reserved for the Allis-Chalmers Company, Milwaukee, showing electrical apparatus and steam turbines, five-horsepower induction motor, 7.5-horsepower direct-current motor and samples of turbine blading. Representing the company were George A. Williams, Cleveland, and F. C. Colwell of Cincinnati.

Nernst-lamp people had parlor C, distributing handsome and up-to-date printed matter, including photographs of typical Nernst installations. A six-glower Nernst hung in a canopy housing. The convention hall was beautifully illuminated with Nernst lamps; one hung in front of the Westinghouse exhibit. Charles H. Davis and G. R. Clover, both of the Chicago office, represented the company.

The W. J. Barr Electrical Manufacturing Company, Cleveland, Ohio, was represented by W. J. Barr, president, and Lawrence W. Cady, electrical engineer. The company showed in parlor J an interesting line of electrical heating devices and exhibited for the first time the Barr ventilated stand, which will carry a heavy overload without scorching or burning.

The Western Electric Company, Chicago, in parlor H, was represented by H. D. Haring, Indianapolis; D. G. Guest, Chicago, and F. A. Henderson, Cleveland. The company showed multiple and series arcs, a full line of high-tension porcelain and electrose insulators and new indestructible coil arcs. An interesting feature of the display was the discovery by visitors that they could light a cigar by short-circuiting the new indestructible coil arc and applying cigar to the resistance coils.

H. P. Folsom of the Universal Pole and Post Preserving Company, Circleville, Ohio, was in Parlor L, expounding the merits of his new method patented December 4, 1906, which can be applied to poles at any time after erection by digging down around the pole about 16 inches, placing a layer of cement immediately around the pole, then setting a sleeve or jacket about 16 inches high in the cement, and filling in between the pole and the jacket with a specially prepared chemical, which is a germicide and insecticide. A cement cap is put on top, coming down to the ground line, which protects the chemicals from the action of rain and snow and at the same time excludes outside infection. The cement cap is reinforced by wires embedded both laterally and perpendicularly. The method has been applied to poles that were partially rotted for about an inch or more at the ground line, and after seven years the poles were found still in the same condition, no further decay having taken place.

The Cleveland Electrical Supply Company, represented by L. Griesser, manager, W. C. Marker, secretary, Warner Jones, salesman, and H. H. Cudmore, distributed watch fob souvenirs and celluloid statistical cards. Warner Jones sat up a whole night inventing the striking menu, that had in it everything electrical, and nothing to eat.

Parlor A was the headquarters of the Fort Wayne Electric Works, and was illuminated by the smiling countenance of Tom Ryan, district manager, and George B. Edgar of Cincinnati, flanked by A. A. Serva, assistant sales manager, of Fort Wayne. The company exhibited fan motors, a new wattmeter calibrator just being put out on the market, a line of literature, etc. Mr. Ryan was highly pleased with the practical nature of the papers read at the convention.

The Wagner Electrical Manufacturing Company of St. Louis was represented by N. Emerson of Cincinnati, who is a regular attendant at these meetings, and T. Richards of St. Louis, showing alternating-current single-phase variable-speed motors with auto-transformer control, having all good points of former direct-current machines, with many of the bad points eliminated. When the motor comes to full speed it runs as an induction motor, the brushes being cut out. Another new device was in the shape of a portable lamp-testing voltmeter and wattmeter, eight instruments in one.

The Excello Arc Lamp Company, New York, represented by G. W. Armstrong, hung two 10-hour Excello flaming-arc lamps at the Superior Street entrance of the Boody, and two 17-hour flaming arcs on the St. Clair side entrance. The latter is used principally in factory lighting, on account of the long-hour burning. This concern has put in some large installations this year, notably with the National Tube Works, Mester Machine Company, United Engineering and Foundry Company, General Casting Company and Pennsylvania Steel Company.

The General Electric occupied parlor B, with a host of good entertainers, H. C. Houck, manager, Cincinnati; F. W. Willcox and G. C. Osborn of Harrison, N. J.; A. E. Alley, Cincinnati; A. S. Hertz, Cleveland; Percy Worth, Indianapolis, and the old reliable in Ohio state association work, W. J. Hanley, now of Cleveland. Exhibited were the new type high-efficiency units, tantalum in 50 and 80 watts; new street series lighting, tungsten; 25-watt 20-candlepower tungsten for use four in series in commercial lighting, and 100-watt 80-candlepower multiple tungsten lamps; a five-light fixture hung on the stairway.

Another Los Angeles Power Project.

Although the primary purpose of the city of Los Angeles in building the Owens River Aqueduct is to obtain a large supply of water and make provision for the great increase of population that is inevitable, the development of electric power is an important feature of the project. In the estimates of the aqueduct no provision was made for power plants, but the engineers have so planned the conduit that the water may be used to generate power whenever the city determines to install the necessary plant.

At present the average amount of electric power used in the locality of Los Angeles is about 40,000 horsepower. During the hours of heavy load this increases to 67,000 horsepower, and only a little more than half of that is derived from water-power, the rest being supplied by steam plants. In addition, there are small private steam and gas plants supplying about 25,000 horsepower, which could be replaced if cheap electricity were available. The demand for power is now in excess of the supply, and at the present rate of increase it is estimated the demand will be more than doubled in five years.

Three-fourths of the total available power along the conduit can be developed in San Francisquito Canyon, 40 miles from the city, where there is a drop of 1,475 feet.

The cost of power plants, transmission line and receiving sub-station, including extra hydraulic work incident to development of power, is estimated at $4,500,000. There are other power sites along the aqueduct, and from all of them combined 93,000 horsepower could be delivered in the city.

Rails have been ordered for the electric road between Mason and Lansing which is to run to Jackson and is being built by the Northern Construction Company, a subsidiary company of the Michigan United Railways. There are to be 1,800 tons delivered by October 1st.

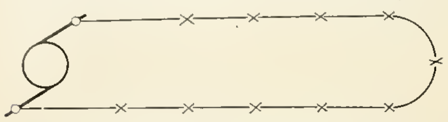
ELEMENTS OF ELECTRICAL ENGINEERING.

By Geo. R. Metcalfe.

XXXI.—Electric Lighting.

Street Lighting.

Arc lamps are used almost exclusively for street lighting, although incandescent lamps used in series are found occasionally in some locations where the density of foliage is too great to permit the use of arc lights. Except in narrow streets with tall buildings there is little reflection to aid the general illumination, and therefore it is quite necessary to utilize reflectors for throwing downward that part of the light which is naturally projected above the horizontal plane. If the distance to which the light is to be thrown is known, together with the distribution curve of the lamp to be used, the illumination in candle-feet can be calculated. This, however, does not give the actual quality of the proposed lighting, for the reason that a street lighted with very high candlepower units appears considerably better lighted than one having the same minimum value of illumination but using smaller units more closely distributed.

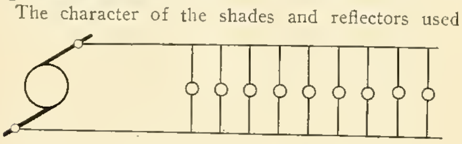


SERIES SYSTEM OF DISTRIBUTION.

In studying the distribution curves of different types of arc lamps it will be found that one type will be superior to another for a short distance from the lamp, whereas for longer distances the same lamp may be inferior. For example, the open arc will give a superior illumination close to the pole, but at a little distance from the pole the enclosed arc is superior. The latter, moreover, does not offer such strong contrast of bright and dimly lighted zones, and consequently the dimly lighted sections appear brighter than when in contrast with a very brilliantly lighted section.

The enclosed arcs give a very steady light and almost total absence of shadow cast by the rods holding the carbon, while the open arc is subject to considerable fluctuation of light, and parts of the lamp itself cast very dense shadows. All things considered, the enclosed arc is very much superior to the open arc of the same watt consumption. There is but little difference between the direct-current and alternating-current enclosed arc lamp. The former gives slightly more light, while, on the other hand, the latter gives a better light distribution.

The character of the shades and reflectors used in street lighting has a marked effect upon the general illumination. The subject of illumination, however, forms a considerable study in itself, and only a few of the salient points have been mentioned here.



MULTIPLE SYSTEM OF DISTRIBUTION.

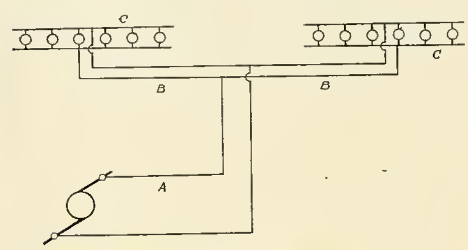
Distribution of Current.

In supplying power to either incandescent or arc lamps, two general methods are employed for the distribution of current. These systems are known as the series system and the multiple or parallel system. In some cases these systems are combined to a certain extent in what is known as the series-multiple system.

Series System.—The accompanying diagram illustrates the series system of current distribution in which all of the lamps are connected in series, that is to say, the negative terminal of one lamp is connected to the positive of the next throughout the circuit, so that the entire current of the circuit passes through each lamp successively. This is the most simple system of distribution, and is used to some extent for both arc and incandescent street lighting. It has the advantage of being very economical, as only a small wire is necessary; one of sufficient size to carry the current required for a single lamp.

The series system has the disadvantage of requiring very high voltages, and it is obvious that if any one lamp of the series has a broken connection so that current cannot pass through it, the circuit of the entire series will be broken, unless some means is provided for short-circuiting the defective lamp. The number of lamps which can be used in series is limited by the voltage for which the generators can be insulated. The open arc lamp requires about 50 volts and a little less than 10 amperes to operate. If, therefore, we have 100 lamps in series the circuit will require 100 times 50, or 5,000 volts. From 5,000 to 6,000 volts is as high a potential as is used, on account of the difficulty of insulating the generators.

The series system is used to considerable extent for alternating-current arc lighting. By the use of a special transformer a number of circuits can be operated from one machine. These transformers are called constant-current regulating transformers and they are built in various capacities up to 100 lamps. The regulating transformer has fixed primary coils and movable secondary coils. The primary coils are connected to the generator circuit and the secondary coils to the lamp circuit. The secondary coils, which are free to move, are repulsed by the primary coils, and this repulsive force is balanced by weights. When the current is on both circuits, therefore, the secondary coil takes such a position that only its rated current will flow through it. In starting the transformer the coils are brought close together and the transformer is short-circuited. The short-circuit is then

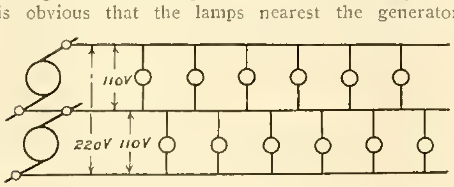


MULTIPLE DISTRIBUTION WITH FEEDERS, MAINS AND DISTRIBUTING LINES.

removed and the coils take a position according to the load on the transformer. These transformers operate at an efficiency in the neighborhood of 95 per cent., and give very close regulation from one-quarter to full load. The power factor is about 75 per cent. at full load, but falls off quite rapidly as the load decreases. For this reason it is desirable to run the circuits as fully loaded as possible.

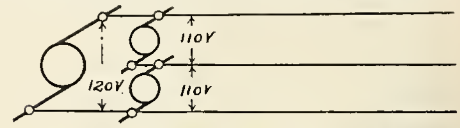
Multiple System.—The multiple system of distribution is the system which is in use for the great majority of lamps. In this system a constant voltage is maintained, and the current varies with the number of lamps connected in multiple. The great advantage of this system is that each lamp is independent of all the others, and so may be turned on or off at will without affecting any other lamps in the system. A multiple system of distribution is far more expensive to install than a series system, as the wiring must be of sufficient size to carry the combined current of all lamps connected to the circuit. Its advantages, however, in the way of regulation, and the ability to use any part or all of the lamps connected in the circuit, has made this the almost universal system of distribution.

An accompanying diagram represents the simplest arrangement of multiple connection for lamps. It is obvious that the lamps nearest the generator



THREE-WIRE SYSTEM WITH TWO GENERATORS

will burn at a higher potential than those farther away, and at the end of a long line the drop in voltage would be very apparent, as this drop is equal to the product of the amount of current flowing in the circuit, and the resistance of the conductor. This drop in potential is a serious difficulty in the multiple system, and in order to make the potential as nearly equal as possible in all parts of the system, methods of wiring are used which make the distance of each lamp from the generator as nearly equal as possible. One of the diagrams shows, in an elementary way, how this is accomplished. In this illustration the wires marked (A) correspond to the feeders which run directly from the generator or central-station bus-bars. (B) represents the wires known as mains, and (C) the distributing wires from the mains to the lamps. In a central-station distributing system the mains running through the different streets are preferably interconnected wherever possible, so that the voltage over the whole system tends to



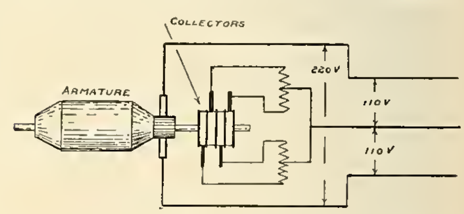
THREE-WIRE SYSTEM WITH BALANCING SET.

equalize itself. This system of mains does not run directly to the generator, but is fed at various points, determined by the load, by feed wires running from the station bus-bars to the various load centers on the mains.

The multiple system of distribution so far considered includes only distribution by two parallel wires, that is, the outgoing or positive wire, and the return or negative wire. This two-wire distribution at the usual commercial voltage of 110 volts is far too expensive for general use on account of the very large size of copper wire which it requires. Its use is therefore limited to isolated plants, in dwellings or industrial establishments, where the distances to which the wires are run are very short.

For direct-current distribution over areas of larger extent, what is known as the three-wire system is now universally used. The three-wire system was developed in the early days of electric lighting on account of the economy in copper which it effects. An accompanying diagram shows the connections of a three-wire system, from which it will be understood that current is distributed at double the voltage of the lamps, and the middle wire, which is called the neutral, only carries an amount of current represented by the difference in the loads on each side of the system. By thus doubling the voltage at which the current is distributed, nearly two-thirds of the cost of copper is saved, compared with a two-wire system of the same capacity.

The diagram previously mentioned shows the oldest and most common arrangement of the three-wire system. In this arrangement two generators are connected together in series, each generator being wound for the voltage of the lamp. The two outside wires of a three-wire system are led out from the two outside brushes of the generators, and the neutral wire is led out from the connection



THREE-WIRE SYSTEM WITH BALANCE COILS.

between the two machines. With this arrangement two machines must always be used together, but later modifications were introduced which permitted the three-wire system to be run from a single generating unit. There are two methods of doing this. One is by the use of a generator having double the voltage of the lamps, and across the leads from this generator is connected a small motor-generator known as a balancing shaft. This consists of two small machines connected in series across the lines. The neutral line is led out from the connection between the two parts of the balancing set, thus forming the third wire of the system.

The operation of the balancer is as follows: When there is a difference in the load on the two sides of the system the voltage of the side having the least load is highest. This higher voltage drives the side of the balancer connected across it as a motor, which in turn drives the other side of the set as a generator, and the latter supplies current for the unbalanced load on each side of the system. The balancing set is of very small capacity, just sufficient to take care of the difference in load which may occur on the system. The other type of three-wire generator is made by placing collector rings on the shaft of a direct-current generator in addition to the commutator. A two-phase connection is made between the armature windings and the collector rings, and a pair of balancing coils

Note.—This series of articles, intended to survey, briefly, the whole field of applied electricity for light, power and heat, was begun in the Western Electrician of February 2, 1907.

are also connected across the collector rings. The balancing coils are similar to transformers with only a single winding. The general arrangement of the system is shown diagrammatically in the accompanying sketch. The middle points of the balancing coils are interconnected, as shown, and the neutral wire is led out from this connection.

[*To be continued.*]

QUESTIONS AND ANSWERS.

Static Converter.

A. A., Chicago: What is a static converter and what is its use?

ANSWER.

"Converter" is a name which is sometimes given to a transformer. Static converter, then, is another name for the ordinary static transformer, or the device usually known simply as a transformer and used for transforming an alternating current to another of a different voltage.

Star Connection and Voltage.

J. H. O., French Gulch, Cal: (1) How may a plant be starred to increase the voltage? (2) Does the starring affect the transformers, and in what way? (3) Can transformers be starred as well as generators? If so, how?

ANSWER.

The word "starred" as used is not a generally accepted term. The questioner probably refers to a three-phase Y connection, often called "star" connection. In the delta connection the high-voltage coils of the transformers are connected so as to form an equilateral triangle or delta. By changing these connections so that one end of each coil is tied to a common point and the other ends one to each line wire, a "star" or "Y" connection is obtained. The voltage between wires in the second case is 1.732 times that in the delta connection of coils. With the Y connection the strain on the insulation to ground is, of course, increased for the section of coils at the line end.

Resistance of Telegraph Relays.

W. T. H., Hammond, Ind.: Please state the difference in the resistance of a telegraph relay connected up in a circuit in series and one connected up in multiple.

ANSWER.

The resistance of a relay does not differ with the manner in which it is connected in the circuit, the resistance being an individual physical property of the instrument just as its length, weight or any other physical attribute. All commercial telegraph circuits are worked as series lines and the multiple connection of sets is practically unknown. The resistance of the relays designed for taps off the wire at a number of stations on a line of any length would necessarily be very high in order to divide the current among all the stations. The exact value would depend on the resistance of the line and the number of stations. In order to take advantage of the small current the relay winding must consist of a great many turns and varying adjustment would be necessary. On account of these and other difficulties attendant upon parallel connection the series arrangement has been found much more efficient and is the one in general use.

The Biggest Electric Sign.

C. F. W., Evanston, Ill.: Can you tell me where the biggest electric sign in the country is located?

ANSWER.

Perhaps, all things considered, this distinction belongs to the well-known sign, consisting of the single word "Butterick," on the western side of the Butterick Building in New York city. It is pretty certain that the sign has larger letters than any other electric sign, and possibly it covers a greater area. Whether it contains a greater number of lamps than any other is more doubtful. The initial B is 68 feet high, about the height of an ordinary five-story building. The smaller letters are 50 feet high and 5 feet wide. About 1,400 electric lights are used for the illumination. It practically requires all the time of one man to watch the sign and replace burnt-out lights. On account of the fact that the western side of the Butterick Building has more than 300 windows and double rows of fire escapes, considerable ingenuity was required to design the sign so as not to block the windows.

Electrification of Chicago Steam Roads Again Broached.

It is the wish of Mayor Busse of Chicago, who was in New York several days last week, that Vice president W. J. Wilgus of the New York Central Railroad visit Chicago and make an exhaustive report on the practicability of electrifying the terminal lines of Chicago's trunk system, embracing in all 23 lines. The main object of the proposed electrification is to do away with the smoke nuisance in Chicago.

It is likely that Mayor Busse will make a recommendation to that effect to Chicago's City Council when that body meets.

Mayor Busse was accompanied on his inspection trip by a party of Chicago city officials. While in New York they took a trip over the New York Central electrical zone under the guidance of Mr Wilgus, who gave them every opportunity to witness the practical working of the newly installed system. The resignation of Mr. Wilgus as vice-president of the New York Central, which will take effect on October 1, leaves him at liberty to entertain any proposition which Chicago may have to offer.

"It is quite probable that Mr. Wilgus, by reason of his experience here, will be employed to make an engineer's report of the matter should the council decide to have a report made," said Mayor Busse. "It seems to me that this would be desirable in any event, so that we would have something tangible before us."

State Inspection of Meters.

In New York state the new Public Utilities Commission is preparing to take up the work of the state inspector of meters. For years past the state inspector has had his seal placed on all gas meters. After they have been inspected and tested for accuracy by him or his assistants the law makes it a misdemeanor for any person to break the seal. The purpose of the law has been to prevent tampering with the meters by the consumers on the one hand or by representatives of the gas companies on the other.

The case of the electric companies is very different, however, and while the new law will mean work for representatives of the people rather than an increase of work for the employes of the companies, it will place the electric meters used for measuring the amount of electricity supplied for light or power to consumers on the same basis as the gas meters, which has not been the case in the past. No state testing of electric meters has heretofore been in order. When new meters are received from their makers local experts adjust and test the meters until they have them as near perfectly correct as it is possible to make them. Then they are sealed by the company and are installed as the demand for them arises.

The new law makes it obligatory that the representatives of the Public Utilities Commission shall also test these meters and that the seal of the commission shall take the place of the seal of the company. This proposition seems to be entirely satisfactory from the standpoint of the electric companies, as it will operate to remove any doubts in the minds of consumers as to the accuracy of the meters. The companies feel, as the consumers undoubtedly will, that the latter will be better satisfied to know that the meters have been tested by men employed by the state rather than by men employed by the companies, so that the new plan will afford some relief to both the producers and consumers of electric power and heat.

COMMUNICATION.

To Prevent Crystallizing in Gravity Cells.

To the Editor of the Western Electrician.

I have always had considerable trouble with crystallization in my gravity cells, the copper forming on the plate increasing its size until it is almost impossible to renew the cell without breaking the jar. I have made different experiments to eliminate this trouble, and have now found a scheme which I am using in my batteries with the best results. The copper plate lasts longer and the cell stands twice as long at full strength under the same conditions.

Following is the way I set up the cell:

Take an ordinary three-ply copper as used in telegraph work and twist it on the rivet into a rosette shape so it will sit on the bottom of the jar. If the copper is large turn up the ends slightly to fit the jar. Put in about 3 or 3½ pounds of medium-sized copper-sulphate crystals and add water and solution in the usual way. Then allow the cell to stand until the zinc solution separates and comes to the top, when the zinc plate can be put in and the cell connected up. To secure longer life and prevent evaporation or the solution creeping out over the sides of the jar, I add paraffine oil, but common coal-oil will do equally as well.

This style cell lasts as long again and is easier to renew than anything I have tried yet.

W. T. HOLDEMAN.

Hammond, Ind., August 21st.

Progress in High-efficiency Lighting Units.[1]

BY C. C. COLLINS AND A. N. COPE.

In order to secure data for this report the committee sent out circular letters to practically all of the electric-lighting companies in Ohio. Some 65 such letters were sent out, but only 19 replies were received, and some of these replies were so meager as to be of very little value in compiling a report such as the committee had wished. It is very evident that the information asked for was not at hand and possibly not even considered necessary for economical operation. We are unable to account for the lack of interest shown, as the committee feels that this report ought to be representative of the progress made by the state organization and not of a few individually. The members of this committee know of some that are using high-efficiency units, but have reported none, and others that are using them that have not reported at all, so that it is to be hoped that those who have reported are representative of users of high-efficiency units.

The questions asked included the following subjects:

1. Flaming Arc Lamp.—Number in use, make, amperes, volts.
2. Magnetite Lamp.—Number in use.
3. Cooper Hewitt Lamp.—Where used (class of service).
4. Moore Tube (feet of).—Number of installations.
5. Gem Filament Lamp.—Number in use (100 to 250 watt), number in use (50 watt).
6. Tantalum Lamp.—Number in use.
7. Tungsten Lamp.—Number in use.
8. Helion Lamp.—Number in use.
9. Nernst Lamp.—Number glowers in use, number lamps in use.
10. Others not named above.
11. What do you find the average life in hours of each kind of unit used?
12. On what basis do you put the units on your lines? (Sale, with profit or at cost. Free. On rental.)
13. What is your renewal cost per kilowatt-hour? Do you consider it excessive as compared with your 16-candlepower lamps? What is the wattage per candlepower of your 16-candlepower lamps.
14. How do these units affect your revenue?
15. Where do you find these units best adapted?
16. Would you favor a unit more highly efficient than any now known? Where would you use such a unit?
17. Will high-efficiency units be of any aid in meeting the demand for lower rates for current?
18. Will they assist in quieting the public sentiment toward municipal commercial lighting?
19. Have high-efficiency units improved your regulation? What is your regulation at point where units are used?
20. Have you noticed a reduction in incandescent-lamp renewals due to improved regulation?
21. Have high-efficiency units improved your load curve? Give sketch if possible.
22. How do these units please the public?

The committee thinks that high-efficiency units would be far more generally used if the matter were more carefully looked into and such information obtained, under existing conditions, that the heads of the various companies could deal intelligently with such questions that must come up in this day of progress.

It is to be hoped that central stations are taking more interest in securing new business and furthering the use of their product than they have shown in reporting to this committee. If their progress has not been all they could have wished, we hope that by the perusal of this incomplete report they may be able to decide in their minds whether or not they should adopt high-efficiency units.

We know from personal observation that consumers are becoming more liberal from year to year in the use of current, which means an increase of burning hours, or an increased revenue from the same investment.

The committee fears that in some cases high-efficiency units are condemned for high renewal cost when the fault is entirely with the central station's regulation, though they be loath to admit it. Central stations using the 3.1-watt incandescent report low maintenance cost, so that if maintenance costs are high it must be due to poor regulation, which makes it very expensive to operate any type of lamp.

On the data sheet attached the names of the companies are signified by the letters A, B, C, etc., and the answers by each company to the questions can be read horizontally across the sheet. Under the number of each kind of unit used has been put the equivalent kilowatts, also, opposite the name of each company the total kilowatts connected of high-efficiency units is given. At the bottom of the sheet is given the total kilowatts represented by each type of unit. This compilation covers only 10 companies, but we consider it a fair sample of what the majority are doing.

1. Report of a committee read before the Ohio Electric Light Association, held at Toledo, Ohio, August 20, 21, 22, 1907.

Taking up the questions in their order, it will be noted that the flaming arc lamp is used by five of the 19 companies, but its use is very restricted, being equal to only 38 kilowatts. This goes to show that not only must a unit be efficient but also must fill many other requirements.

The magnetite lamp is used by two companies for street lighting. Its adaptability is shown by the satisfaction which it is giving and by extremely low rates secured by cities using it.

The Cooper Hewitt lamp is used by five of the companies, but its use is limited to photograph galleries, printing offices and machine shops.

No Moore tubes are in use.

Twelve companies are using the Gem lamp. It is regretted that three of them, two being among the largest cities in the state, gave no record of the number on their lines. This unit seems to be in very general use. The connected kilowatts of the 11 companies replying being 834, nearly 90 per cent. of which is in lamps of 100 watts or more.

Two companies are using the tantalum lamp. This restricted use is no doubt due to the first cost of the lamp and its failure on alternating current.

One company is using the tungsten lamp, and from its reply to question No. 14 we judge it was found necessary to use this extremely high-efficiency unit to outdo a competitor. The committee understands, however, that this lamp for use on constant potential circuits of 100 volts or more has been found so extremely fragile that its use is practically prohibited. Its cost is also excessive.

No Helion lamps are in use.

The Nernst lamp, like the Gem, is in very general use; 11 companies are using it. The connected kilowatts are 1,334. The average number of glowers per lamp is three, which indicates the demand to be for high-efficiency units of moderate size; also that its use is limited to the sphere of units of less than 250 watts.

The above-named lamps seem to cover all the various high-efficiency units on the market, as no company has reported as having any not named.

The replies to question No. 11 indicate that we may expect a life from the magnetite lamp of 180 hours, the Gem lamp of 500 to 600 hours, the Nernst lamp 600 to 700 hours. One reply of "low" was received, but this was not used in our compilation since the short life obtained is no doubt due to local conditions.

Answers to question No. 12 indicate that the units are generally put on the lines at cost and free renewals given. The Nernst lamps are in some cases loaned, but this is found to run up a very large investment.

The cost of renewals, as indicated by answers to question No. 13, is not very well known. It can only be arrived at by keeping records of installations consisting of one kind of units only, and it is apparent that very few, if any, of the companies have done this. However, taking a sort of average of the replies we may expect under fair conditions a renewal cost of ½ cent on the Gem and Nernst lamps.

This cost is not considered high as compared with the carbon filament lamp.

No less than seven companies are using the 3.5-watt carbon filament lamp, which is due, in a majority of cases, to poor regulation of voltage.

The answers to question No. 14 are indeed satisfactory, every company replying stating that an increase in revenue has been noted after introducing high-efficiency units. The effect on its revenue has been the first question asked by the central station when considering the introduction of these units. It is very evident that business has been secured which could not have been gotten in any other way.

The replies to question No. 15 indicate that the adaptability of the unit is beyond question.

As indicated under question No. 16 a unit more highly efficient than any now known would be welcomed. A number of these replies come from the gas belt where natural gas at extremely low prices is a competitor. One reply contains the modification that the units should be of 50 watts or more. This is hardly consistent with his reply to question No. 14, where he states he has noted a "marked increase."

With only one exception the replies to question No. 17 indicate that these units will assist in meeting the demand for lower rates. It is also generally believed that they will help quiet municipal ownership agitation.

It has been found that an improved regulation is not necessary, although desirable, where these units are used. The replies in regard to regulation are very vague and indicate that sufficient attention is not being given this most important factor.

At the end of the accompanying table are given replies received from four of the largest electric-lighting companies in the United States. Their replies coincide very closely with those from Ohio central stations, except that they have evidently had better success in the introduction of these units. This may be partly due to better conditions, but we think no mistake will be made if the smaller companies follow their lead wherever conditions will permit.

CENTRAL STATIONS IN OHIO.

Companies	No. 1 Flaming Arc.	No. 2 Magnetite	No. 3 Cooper-Hewitt	No. 4 Moore Tube	No. 5 Gem	No. 6 Tantalum	No. 7 Tungsten	No. 8 Helion	No. 9 Nernst.	No. 11 Life	No. 12 Basis of Installation	No. 13 Renewal Cost, etc.	No. 14 Effect on Revenue	No. 15 Adaptability	No. 16 Still Higher Efficiency	No. 17 Prevent Lower Rates	No. 18 Quiet Municipal Ownership Agitation	No. 19 Improve Regulation	No. 20 Reduction in Renewals	No. 21 Improvement in Load Curve	No. 22 Satisfaction	K. W. per Company
A	0	0	0	0	300L 31.65kw	0	0	0	21 .43kw	—	At Cost	—	Increase	—	Yes	Yes	Yes	—	Yes	—	Good	32.28
B	—	—	—	—	—	—	—	—	1067 238.94kw	—	Loaned	.007 High	Increase	Long hr. burners	Yes Ev'ywh're	Yes	Possibly	No. 3¢	No	No	Pleased	238.94
C	6 3.3kw	—	—	—	233 44.35kw	—	20 2kw	—	456 124.7kw	Gem-500 Ner-600	Gem Free Tung. sold Nernst List-15%	—	Increase	—	—	—	—	—	—	—	—	174.45
D	—	—	1 .35kw	—	50 9kw	—	—	—	79 23.3kw	Nernst 700-800 Hrs.	Nernst Free, Gem at Cost	Nernst .002 No. 3.5w	—	Store Lighting	—	Yes	Yes	2¢	—	—	Well Pleased	32.7
E	—	172 51.6kw	—	—	—	—	—	—	—	180 Hrs.	—	—	—	—	—	—	—	—	—	—	—	51.6
F	-	—	—	—	—	—	—	—	12 3.06kw	—	—	Charge 3.5w	—	—	—	Yes	Yes	—	—	—	—	3.06
G	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	
H	—	--	—	—	600 81.2kw	—	—	—	—	—	Cost +10%	Free	Marked Increase	Long hr. burners	Yes 50w or more	Yes	—	—	—	—	with Favor	81.2
I	0	0	0	0	200 10kw	0	0	0	12 3.06kw	—	Free	No. 3.5w	Increase	Every-where	No	No	Yes	5¢	—	—	Fine	13.06
J	2 1.1kw	165 49.5kw	3 1.15kw	0	Exten-sive	Few	0	0	0	—	Free	½c No. 3.6w	Increase	General Use	Yes	Yes	Yes	Not Good	No	No	very satisfactory	51.8
K	0	0	0	0	0	0	0	0	0	—	—	—	—	—	—	—	—	—	—	—	—	
L	0	0	1 .39kw	0	300 75kw	0	0	0	15 3.32kw	—	Free	No 3.5w	Increase	Commer-cial use	—	Yes	Yes	—	—	—	good satisfaction	78.71
M	54 16.5kw	0	2 .77kw	0	0	0	0	0	0	—	Free	3.1w	—	where desired	—	—	—	—	—	—	—	17.3
N	—	—	—	—	—	—	—	—	—	500 to 600 hrs.	Free	3-4c No.	Increase	Every-where	Yes	Yes	Yes	No. 2¢	—	Yes	Pleased	
O	0	0	0	0	1400 131.2kw	438 16kw	0	0	833 212.5kw	—	Cost	3.1w	Increase	In com-petition	Yes General	Yes	No	Not good	—	No	Well Pleased	359.7
P	0	0	0	0	600 44.4kw	0	0	0	very few	—	Cost	1c 3.5w	Increase	Commercial	—	—	Yes	Yes	Yes	—	very much	41.8
Q	19 10.45kw	0	14 5.4kw	0	1990 399.73kw	0	0	0	0	500 hrs.	Sale at cost	.004 No. 3.1w	Increase	Commercial	Yes General	Yes	Yes	No. 2¢	No	No	very well	415.55
R	11 6.05kw	—	0	0	50 8.37kw	0	0	0	2340 722.42 kw	—	Ner. loaned inc. Cost Free reo.	Less than .005 No. 2-1 & 3-5	Increase	Commercial	Yes Factory	Yes	No	2 to 5¢	Yes	Yes	Pleased	735.34
S	0	0	0	0	3 .15kw	0	0	0	20 2.55kw	—	Sale	—	—	—	—	—	—	—	—	—	—	2.7
Totals	37.4 kw	101.1 kw	8.3kw		823.95 kw	16 kw	2 kw		1334.28													2332.84 kw

LARGE CENTRAL STATIONS NOT IN OHIO.

W	254 127.5kw	0	Considerable Number	2 or 3 small	--	—	--	—	2674. 618.8 kw	—	100 250w lamps free 10w.-5c tant. 35c	3.1w	Increase	Stores	--	Yes	Yes	—	No	No	with favor	756.3
X	6 3.2kw	0	0	0	1433 261.93 kw	0	0	0	100 24.65kw		Free	Yes	—	Stores	Yes	Yes	—	No	-	Yes	Improvement	233.68
Y	--	0	100 28.1kw	0	15000 1673 kw	6000 264.kw	0	0	602 102.3kw	—	free exc'pt Gem-5c tant. 30c	½c No. 3.1w	Increase	--	—	Yes	-	—	-	—	very much	5050.
Z	12 6.44kw		20 3.2kw	—	—	—	—	-	2000 510kw	—	—	½c.	—	Amusem't places on competit'n	Yes Comm'l.	Yes	Yes	2c	Yes	—	Increas'g demand	124.3
Totals	397.0		44.2		3730.93	264			1233.95													7191.68

PROGRESS IN HIGH-EFFICIENCY LIGHTING UNITS.

DISCUSSION (IN ABSTRACT).

Numerous questions from members of the association concerning various new lamps brought out some lengthy answers, of which the following is an abstract:

H. O. Dutter of Bucyrus, Ohio, quoted a case in his city where a merchant ran 10 lamps in each show window, putting them on averaging two nights a week; these have been replaced by four tantalum lamps in each window, and these are being used until 10 o'clock every night, paying the central station more money and giving the patron more satisfaction. Both the Gem and tantalum are pleasing people. The result of the 400 installed by this station has been to broaden the peak. The speaker had found the tantalum lamp more successful on a 110-volt direct-current three-wire system for window lighting and more advantageous than incandescent 16 candlepower.

F. W. Willcox of the General Electric Company said that the new units had the advantage that there is no antiquation or writing-off depreciation considered; the lamp renews itself; there is no depreciation of the renewal cost. The Gem lamp costs so little more than the ordinary carbon lamp that the majority of stations can afford to furnish them on the same liberal basis of renewals as the ordinary lamp. The tantalum is a different proposition, as it is a more expensive lamp. Central stations that are furnishing free renewals of ordinary lamps on a rate of two cents per kilowatt-hour can furnish the tantalum for three cents or 2½ cents to cover the additional cost of renewals. A similar course can be pursued with regard to the introduction of tungsten lamps, the renewal cost of which would be still higher than the tantalum. Another plan would be to adopt the practice of the gas companies and charge a fixed maintenance charge. On the tantalum a charge of five cents per month would amply cover it. At present there is no complete data as to the life service of the tantalum lamp. The problem of how best to introduce the new lamps and how to meet conditions as established with the lower efficiency lamps formerly in use is a very interesting one to the central-station manager. In some way or other the central station should maintain the control of the lamp, because the ordinary user does not know how and will not take proper care of the maintenance of his lamps. The service should be kept up to standard by intelligent care on the part of the station. Mr. Willcox stated that the actual number of tantalum lamps sold in this country has been probably 250,000 or 300,000. More could have been sold if supplied faster. The life of the Gem filament lamps has been materially improved the past year as the result of steady and careful work. If possible to produce a Gem filament of an efficiency of two watts per candle, you would have a lamp which, by reason of its other advantages, cost, flexibility and strength, would perhaps be a very serious competitor with the metal-filament, such as the tungsten and the tantalum. Tests made of some series tungsten lamps have shown that the candlepower is practically maintained to the end of the life. The multiple tungsten has a very good life; just how much cannot yet be stated. The life seems to be in the neighborhood of 1,000 hours. Tungsten lamps are produced in similar sizes to the present Gem units. Perhaps the lamps of 100 watts give about 80 candlepower mean horizontal; lamps of 50 watts give about 40 candlepower, mean horizontal; 40 watts, about 32 candlepower mean horizontal. The tungsten has not been as yet listed, but will probably be higher than the tantalum lamp. By using the lamp in the large size the cost will not be so great as in the smaller sizes. It costs pretty nearly as much to make a small candlepower lamp as a large one.

Otto Foell, chief engineer, Nernst Lamp Company, Pittsburg: Viewing the situation from an engineering point, I feel that there is no immediate need for a higher efficiency lamp than the multiple-glower type of Nernst lamp. In the endeavor to secure new business and to meet competition successfully there has been a tendency on the part of the central-station managers all over the country to reduce rates for current, and it is only a question where does the higher efficiency lamp help the central-station manager to check the reduction in rates. Undoubtedly what a customer wants is light; and he wants plenty of it, and not current. On the other hand, he wants a light which he can maintain with advantage to himself, for should the central station maintain the lamps, same must be done on a basis to insure a profit on the business.

Taking, for example, the 40-candlepower 50-watt tungsten lamp which is listed at $1.50, and which may be obtained in large quantities, at, say, $1.10. This lamp, according to the manufacturer's statement, has an average life of 1,000 hours, which is equivalent to a current consumption of 50 kilowatt-hours, that is, the maintenance cost per kilowatt-hour for such a lamp amounts to 2.2 cents, which, in the case of free renewals, must be added to the price of current to insure the same net revenue on the connected load. Two of these lamps are equivalent to the new 110-watt higher efficiency Nernst lamp, which can be maintained, according to the inquiries of your committee, at one-half cent per kilowatt-hour.

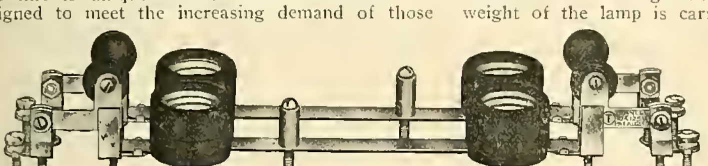
Bringing both types of lamps on the same candlepower basis, and for 1,000 hours' use, you have a renewal cost for the tungsten lamp of 4.4 cents against 0.55 cent for the Nernst lamp, while the current consumption is 100 kilowatts, against 110 kilowatts; that is a slight increase in current consumption against a considerable saving in maintenance. At the present time, however, the tungsten lamp is in its infancy, and personally I do not believe that it can be manufactured commercially now or in the near future. I will admit that by employing the same principles which govern the construction of the 110-watt lamp, lamps of the multiple-glower type may be obtained of still higher efficiency. We are working along these lines, and while I cannot say when such lamps will be perfected, we can hope for them in the near future.

A. N. Cope of the Columbus Public Service Company stated that an important factor in maintenance of the illuminating power of the new lamps is the matter of keeping them clean; they should be as frequently cleaned as the Nernst lamps in order to secure cleanliness of the globes. Many complaints come to him from the customers who are located near the markets of the condition of their globes and glassware. The cost from Nernst trimming, including labor in the laboratory and on the customers' premises, means about 40 per cent. of total cost. The speaker gave results of a careful account of material and time of seven store installations, from January 18th to March 29th, amounting to $78.09, yielding 18,089 kilowatt-hours, or an average of 43.436 cents per kilowatt-hour.

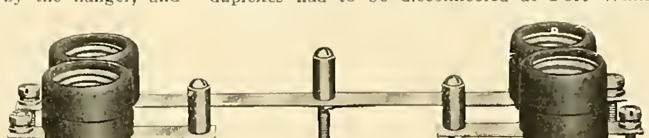
C. H. Davis, Nernst Lamp Company, Chicago: A comparison of the cost of one system which is furnished to the consumer in toto, as in the case of the Nernst lamp complete, should not be made with the cost of the renewable element only of another system. If to the cost of the Gem lamp we add the cost of the necessary shade, shade holder and socket, the investment per kilowatt connected will not be materially less than with the Nernst lamps. If the central station recognized no advantages in the free-lamp policy with reference to the Nernst lamps, they can just as consistently and just as readily require the consumer to purchase that portion of the Nernst equipment which is permanent; that is, the lamp body and the globe, as to require the consumer to purchase the reflector and holder for the Gem lamp. The two systems should thus be placed on a parity before comparisons in cost are made. Again, the central stations desire, of course, to keep their investment in load installation as low as possible in order to secure and hold the business, and it would seem more consistent to compare the investment with the amount of illumination required. On this basis the one-glower and two-glower Nernst lamps cost about the same as the Gem lamps with their necessary equipment, while the larger sizes of Nernst lamps cost materially less, that is, per candlepower of light produced.

A New Line of Panel Circuits and Switch Parts.

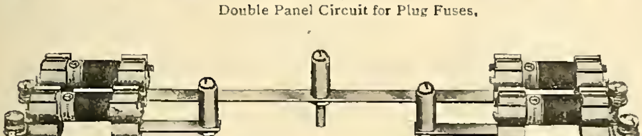
The Trumbull Electric Manufacturing Company of Plainville, Conn., has recently put out a complete new line of panel circuits and switch parts. The line is unique in the market and has been designed to meet the increasing demand of those



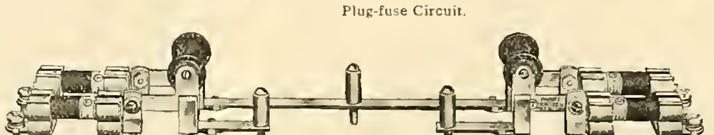
Double Panel Circuit for Plug Fuses.



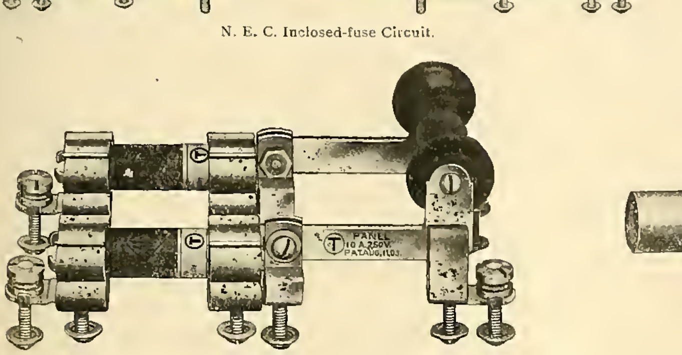
Plug-fuse Circuit.



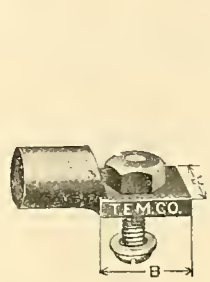
N. E. C. Inclosed-fuse Circuit.



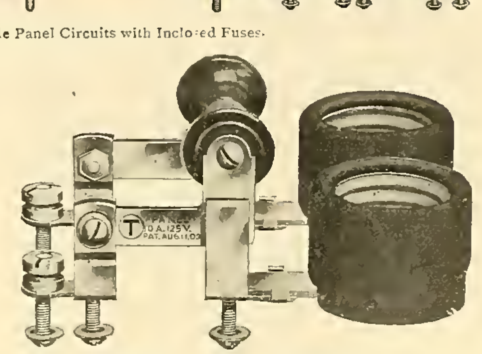
Double Panel Circuits with Inclosed Fuses.



Double-pole Panel Switch with N. E. C. Inclosed Fuses.



Lug.



Double-pole Panel Switch for Plug Fuses.

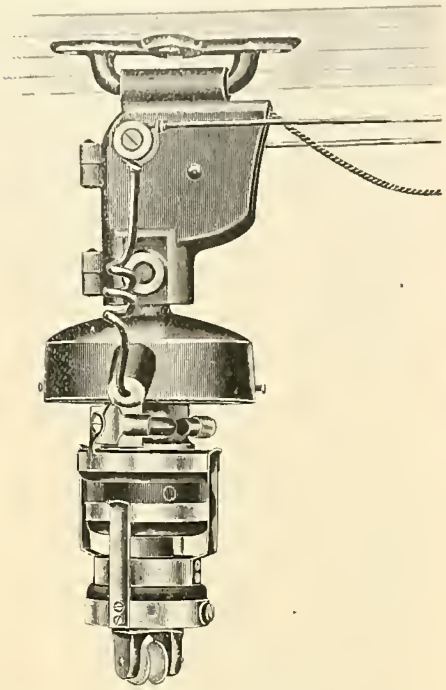
A NEW LINE OF PANEL CIRCUITS AND SWITCH PARTS.

who wish to purchase their slate or marble separately and arrange the circuits as they desire. Since these fittings are obtainable, one does not have to depend on the factory when an additional circuit or some slight change is needed. The freight rates are much lower on slate than on completed panels, so it may be expected that the saving in transportation charges will be influential in increasing the demand for these panel parts. The provisions for fusing are constructed for both National Electric Code and plug fuses. In addition to any particular complete panel set, bus bars and lugs can be furnished, so that complete unmounted panels can be obtained.

The illustrations on this page show several of the combinations which are listed by the manufacturers. An inspection of these cuts will suggest many convenient uses to which this elastic form of panel construction easily lends itself.

Improved Mayo Automatic Arc Lamp Hanger.

The usefulness of an arc lamp hanger that avoids unsightly hanging and loose wires or the necessity

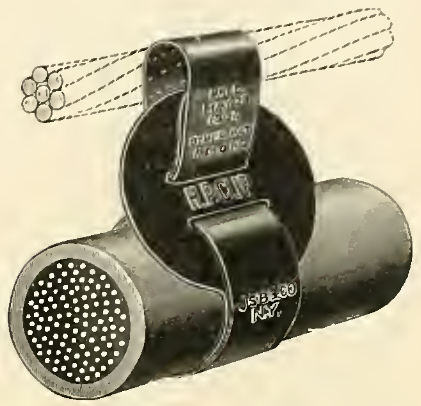


IMPROVED MAYO ARC LAMP HANGER.

of a ladder to reach the lamp for trimming, is self-evident, and the general installation of a device of this kind which will operate positively will be hailed with delight by lamp-trimmers. The improved Mayo automatic hanger, manufactured by the National Sewing Machine Company at Belvidere, Ill., adds as well an ingenious device by which the weight of the lamp is carried by the hanger, and the raising and lowering operations are accomplished by a single pull of the rope. As shown in the accompanying illustration, there is no strain on the rope when the lamp is in place. When lowered the lamp is cut out of circuit so that there is assured perfect protection from live wires during trimming. The contact is made by clips bearing against two rings in the hanger so that a good contact and proper poling of the carbons are secured in whatever position the lamp is pulled into the hanger. The hanger is weatherproof and the insulation is of micanite. There is a carbon pointed switch, and the contacts at the rings are kept clean by the friction of the springs. The hanger measures about six by eight inches and its parts are interchangeable. The manufacturer believes that where this hanger is used, one man can do the work of three.

Rustless Cable Hanger.

The H P rustless cable hanger, for suspending telephone and telegraph cables from messenger wires, is manufactured by James S. Barron & Co., 200-206 West Broadway, New York. It is made of one piece of sheet zinc so that no electrolytic action can take place between separate parts. As the hanger completely encircles the messenger suspension, it cannot jump off. The cable is gripped



RUSTLESS CABLE HANGER.

tightly, preventing slipping. As shown in the illustration, the hanger consists of a zinc strap ending in a circular clip which is slotted.

In installing, after running the cable over temporary supports, as hooks or cable blocks, the hangers are applied from a car drawn along the messenger. The circular end of the hanger is held against the cable and the free end wound around and passed through the lower slot, then around again and through the upper slot, over the suspension wire, and finally the end hooked into the upper slot, with the result shown in the illustration.

A Severe Earth Current.

W. J. Camp, electrical engineer of the Canadian Pacific Railway Telegraphs, reports that recently earth currents were so severe in Canada that all duplexes had to be disconnected at Fort William, Ont., and even then were unable to work the lines single. At times the currents were so large as to set fire to the switchboard, and there was considerable difficulty in controlling the fire, which had broken into small flame.

Notes on Transformer Testing.[1]

By H. W. Tobey.

Generally speaking, it may be said that transformer tests are required for the purpose of determining the chief characteristics of the finished apparatus, thus enabling it to be compared with the original calculations and designs and with the guarantee. They may be classified as follows: Conversion; polarity; resistance; copper loss; core loss and exciting current; regulation; high potential;[2] high voltage;[2] temperature rise.

Conversion.—The most satisfactory method of test is without doubt one employing a standard multiratio transformer and a single voltmeter, provided

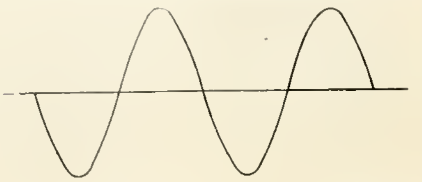


FIG. 1. INFLUENCE OF WAVE FORM UPON CORE-LOSS AND EXCITING CURRENT.

the potential of the source of current supply does not fluctuate. Then, by applying a suitable common voltage to the high-tension side of the transformer under test and the standard the two low-tension voltages may readily be compared and the true ratio obtained.

Where the supply is at all unsteady or where the ratio of the standard varies considerably from that of the transformer under test, the two-voltmeter method is preferable. Accurate results may then be obtained by taking two sets of simultaneous readings, between which the instruments are interchanged to eliminate any dissimilarity between them.

The opposition method is also sometimes used to good advantage. With this, however, care should be used to see that the low-tension voltage of the standard and of the transformer under test are exactly in phase.

As an additional precaution single-phase transformers which are required to operate in parallel on single-phase circuits or delta on three-phase circuits, also delta-connected phases in three-phase transformers should be connected, as they are eventually intended to operate, and a test made for circulating current.

Polarity.—The relative position of primary and secondary leads is ordinarily determined either by direct comparison with a standard transformer or by applying direct current to the high-tension winding, noting the position of positive and negative connections by means of a direct-current voltmeter, then shifting the voltmeter leads to the low-tension winding and noting the voltmeter deflection upon breaking the direct-current circuit. When testing large numbers of small transformers having approximately the same voltage and ratio, the first method is quicker and more satisfactory. For power transformers having as a rule widely differing voltage the second method is usually preferable.

Resistance and Copper Loss.—In the measurement of resistance for the determination of copper loss and total resistance drop the fall of potential method

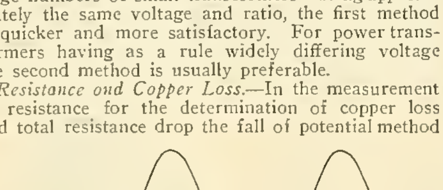


FIG. 2. INFLUENCE OF WAVE FORM UPON CORE-LOSS AND EXCITING CURRENT.

gives in general the most satisfactory results of any of the standard methods. The instruments required are less delicate than the galvanometer used in bridge measurements, may be readily calibrated, and will give accurate results over a wide range.

When measuring resistances of small transformer windings the instruments come to rest very quickly and little time is required for taking the readings. With large transformers, however, unless special precautions are taken, this is seldom true; for even with the terminals of the opposite winding short-circuited on themselves, some seconds, or even several minutes, often elapse before the instruments settle, so to speak, to a final value, and until this settling has stopped, readings will not indicate the true resistance.

Fortunately this condition of affairs may be overcome by forcing through the winding under test a direct current of 10 or 12 times that finally required for the measurement, and after a moment or two dropping it to normal before taking the reading. (Of course during the passage of this increased current the voltmeter should be disconnected and the ammeter short-circuiting switch closed.)

Core Loss and Exciting Current.—The influence of wave form upon core loss and exciting current has already been carefully investigated, and the importance of using a sine-wave source of current supply is well known. It is doubtful, though, if all fully realize how far from a sine wave the electromotive force of some generators really is under actual conditions of test; that is, when supplying core loss to transformers. This may occur, even though the wave form of the generator is entirely satisfactory under normal conditions, from the fact that the wave becomes badly distorted at low power factors which occur when transformers, particularly those designed for low frequencies, are operated on open circuit. The extent to which this distortion may reach and its effect on core loss and exciting current are clearly indicated in the accompanying curves and data which follow:

The curve, Fig. 1, was taken on one of the generators in question while on open circuit. The curve, Fig. 2, was taken on the same machine while furnishing core loss and exciting current to a transformer. It will be noted that both approximate very closely a sine wave. The oscillograph curve shown in Fig. 3 was taken while a generator having a very peaked wave was exciting the same transformer at the same voltage. The resulting core-loss and exciting-current measurements are given as follows:

First case: Sine wave, core loss 1,177 watts, current 33.5 amperes.

Second case: Peaked wave, core loss 924 watts, current 15.4 amperes.

By comparing these sets of readings it will be seen that in changing the source of supply from one, giving very nearly a sine electromotive force

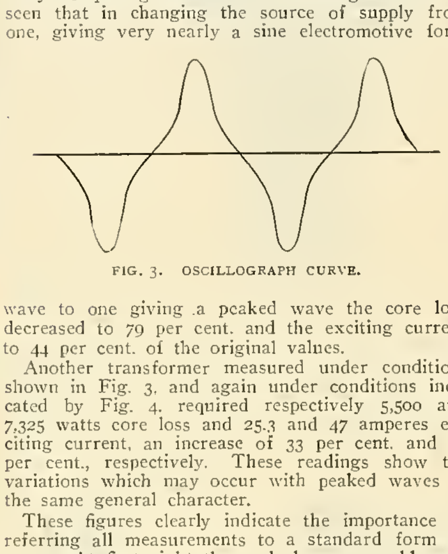


FIG. 3. OSCILLOGRAPH CURVE.

wave to one giving a peaked wave the core loss decreased to 79 per cent. and the exciting current to 44 per cent. of the original values.

Another transformer measured under conditions shown in Fig. 3, and again under conditions indicated by Fig. 4, required respectively 5,500 and 7,325 watts core loss and 25.3 and 47 amperes exciting current, an increase of 33 per cent. and 87 per cent., respectively. These readings show the variations which may occur with peaked waves of the same general character.

These figures clearly indicate the importance of referring all measurements to a standard form of wave. At first sight the peaked wave would seem to have some advantages over the sine wave, owing to the lower core loss and exciting current values which result. After all sides of the question are considered, however, including among other things the effect of wave-shape on insulation strains, etc., a sine-wave electromotive force is undoubtedly the best. And what is equally important, the generator from which the supply is obtained should not only maintain the standard form on open circuit and on non-inductive loads, but also on low power-factor inductive loads, i. e., under the conditions of test.

In the measurement of core loss on three-phase transformers the windings across which the readings are taken should be Y-connected and the opposite windings left open in case they are intended for delta connection. Otherwise the circulating current due to unequal distribution of flux in the core and to the short-circuiting of the odd harmonics will show up as an increase in core loss, thus giving incorrect results. In case the transformer windings on one side are delta connected and for any reason cannot be changed it is preferable to connect both sides in delta before taking the core-loss measurement. The resulting circulating current will then occur in two windings instead of one, and being proportionately less will produce smaller disturbing losses in the copper than if but one winding alone is delta connected.

Regulation.—In general it is now customary to determine the regulation of a transformer by one of the several methods which require impedance measurements with one of the windings short-circuited on itself, this having entirely superseded the old way of measuring the voltage with transformer free and loaded.

Here, too, it is important to employ a generator which will give a sine wave at low power-factor loads, for while it is true that the wave shape does not affect the measurements so seriously as those mentioned under the preceding heading, nevertheless the variation is fairly well marked.

High-potential Test.—If the testing transformer has extremely close inherent regulation, and the charging current under conditions of test is but a small proportion of its normal current capacity it is reasonably safe to rely upon the low-tension voltmeter reading, and to consider that this times the ratio of conversion is an approximate indication of the high-tension voltage. If these conditions do

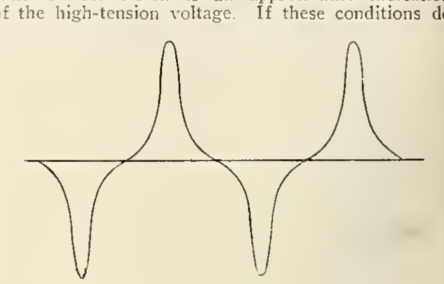


FIG. 4. VARIATION OCCURRING WITH PEAKED WAVE OF THE SAME GENERAL CHARACTER.

not exist the spark-gap method must be relied upon. It should be used, however, with great care.

As the conditions under which the testing outfit operate are changed entirely by the introduction of the transformer under test, it is obviously not right to measure the high-tension voltage by spark-gap before this transformer is connected. On the other hand, if the transformer is connected in, together with the properly adjusted spark-gap, and the voltage is raised until the latter arcs over, high-frequency oscillations almost invariably occur and result in a rise in voltage. The final value of this voltage may be considerably higher than that required, resulting possibly in an uncalled-for breakdown of insulation.

Such a disturbance may be overcome in one of two ways, both of which have been tried with satisfactory results. The first consists of inserting in series with the gap a high resistance,[3] the presence of which prevents the occurrence of a high-frequency disturbance when the spark-gap breaks down. The only precaution necessary in the use of this auxiliary resistance is the calibration of the spark-gap with the resistance in series, as its presence will in general increase the effective value of the gap. In other words, the distance between needle points, as given in the standard Institute table, may need to be decreased by from five to 10 per cent. to obtain correct results.

The other method referred to above consists in making all connections for the high-potential test and placing the spark-gap across the circuit, the gap previously having been set, however, for a

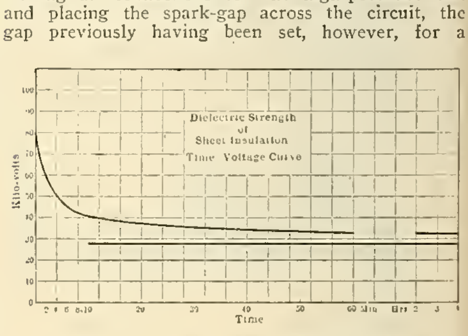


FIG. 5. RELATION BETWEEN TIME AND VOLTAGE.

somewhat lower voltage than that required, two-thirds for example. The voltage is then increased and the low-tension voltmeter reading is noted at the moment the spark-gap breaks. The gap is now disconnected and the electromotive force again raised until the voltmeter reading, in the case cited, is 50 per cent. greater than before. The desired potential is thus obtained with fair accuracy without any disturbance in the circuit.

The importance of using a sine-wave generator for supplying current to the testing transformer is hardly to be questioned. Otherwise it will be extremely difficult to obtain the desired testing strain.

As to varying the voltage of the high-potential transformer, several methods are possible, including the use of a variable resistance, a variable reactance, or changing the excitation of the generator field. The first, except perhaps in the case of low-voltage tests on small apparatus, should not be resorted to, as it has a very disturbing effect on the wave form. The second gives more satisfactory results in this respect and serves very well when the required range is not too great.

A discussion of this branch of the subject would hardly be complete without some reference to the

1 Abstract of a paper presented at the convention of the American Institute of Electrical Engineers, Niagara Falls, N. Y., June 28, 1907. The author is a member of the engineering department of the Stanley-G. I. Company.

2 Both of these are essentially insulation tests. The terms "high potential" and "high voltage" are used arbitrarily to distinguish between a test applied between primary and secondary windings and iron and one applied across terminals of the same winding. The first tests the strength of the insulating barriers and canvas while the second tests the insulation between turns and between layers.

3 For potentials ranging from 100,000 to 200,000 volts, a resistance consisting of a dozen U-shaped glass tubes one-half inch inside diameter and two feet in length will be found satisfactory. These should be mounted in a suitable rack, filled with water and connected in series.

effect which the time of application of the high potential has on the resisting strength of insulation. In other words, if an insulating material will safely withstand 50,000 volts for one minute, what potential will it withstand if the test is continued for five minutes, and what will it resist indefinitely?

This relation between time and voltage is fairly well represented by the curve shown in Fig. 5. This was obtained from a series of tests on sheet insulation, potential from a 60-cycle sine-wave generator being applied to two brass discs arranged on opposite sides of the test piece.

It will be noted that for periods of one minute the sample safely withstood a pressure of 65,000 volts. For five-minute tests it was necessary to lower the pressure to about 70 per cent. of this value, or 46,000 volts; while in order to resist the test indefinitely the applied voltage had again to be lowered to 27,500, or about 40 per cent. of its original value.

These figures can hardly be taken as general, for they change considerably with different kinds of insulation and the resulting curves assume widely varying forms. In most cases the reduction in strength as the length of the test increases is much

FIG. 5. RELATION BETWEEN TIME AND VOLTAGE.

less than indicated above, so that in comparing the instantaneous test and continuous test, for example, the reduction is nearer 50 per cent. or 60 per cent. instead of 70 per cent. as in the sample noted. These figures serve to emphasize, nevertheless, the undesirability of long-continued strains and tend to confirm the advisability of retaining the present one-minute standard.

High-voltage Tests.—The test which determines the strength of insulation between turns, between layers and between leads is equally as important as the "high-potential" test just referred to. If the transformer windings withstand double voltage, or, in the case of lightning transformers, triple voltage, their internal condition is reasonably well assured.

In applying this test it is usually advisable, and in most cases necessary, to use a frequency considerably higher than that for which the transformer was designed; otherwise the exciting current will become so excessive as to make it difficult or even impossible to obtain the desired increase in voltage. In general, satisfactory results are obtained by employing a frequency as much above that for which the apparatus is designed as the test voltage is above normal terminal voltage. With a 60-cycle transformer under consideration, for example, 120-cycle current gives good results for double-voltage tests, while 180 cycles is usually satisfactory for triple voltage. A 180 to 200-cycle generator answers very well therefore in the majority of instances.

Temperature Tests.—Except, perhaps, in the case of special tests on small transformers, or where a single transformer is to be tested, the differential method of applying load for the temperature test or heat run is the most satisfactory and probably the one most universally used. This insures very nearly the conditions of actual operation, enables the work to be carried on with a minimum waste of power and requires a comparatively small amount of auxiliary apparatus. The total losses occurring are in general somewhat in excess of those which would take place if the transformer were normally excited and loaded on a dead resistance, or if it were operating under actual conditions of service, therefore the results are always on the safe side.

The resistance readings taken at intervals during the run for the purpose of temperature determinations should obviously be made with the shortest possible delay in view of the necessary removal of load at such times. It is here therefore that the precaution mentioned under the subject of "Resistance and Copper Loss" is most useful. By observing this and by employing a suitable arrangement of double-throw switches to which the measuring instruments and source of direct-current supply may be permanently connected the time required to take a resistance reading is reduced to a minimum.

General.—The order in which tests should be made depends more or less upon local conditions, so that no fixed rule can be given, nor, in fact, is one necessary. The general order in which the tests have here been described is perhaps as good as any. The question of instruments with which to carry on the various tests has not been touched upon, for this forms a complete subject in itself.

Assistant Examiner for Patent Office.

The United States Civil Service Commission announces an examination on October 16-17, 1907, at a number of cities to secure eligibles from which to fill vacancies as they may occur in the position of assistant examiner in the Patent Office at an entrance salary of $1,200 per annum.

As the number of eligibles for this position has always been insufficient to meet the needs of the service, qualified persons are urged to enter this examination. For several years past practically all who have passed the examination for this position have been offered appointment.

The examination will consist of the following subjects: Physics, embracing the requirements of a general college course, chemistry, inorganic and organic, quantitative and qualitative analysis; mathematics up to differential calculus, the general field of mechanics, mechanic arts, industrial arts and processes, and applied chemistry; mechanical drawings and French or German. Applicants should at once apply either to the United States Civil Service Commission, Washington, D. C., or to the secretary of the board of examiners at any of the usual cities for application form 1312.

Commutating-pole Direct-current Railway Motors.[1]

By E. H. Anderson.

In order to appreciate the development and reasons for the existence of a commutating pole railway motor, it is well to discuss in some degree some other developments. In the beginning, railway-motor designers had many difficulties to contend with. The question of gearing was possibly foremost, whether it should be single or double reduction, or possibly gearless. All these were tried with more or less success. Possibly insulation is next in order, various methods having been tried. The conductors have been covered with a variety of materials, but double or triple cotton-covered insulation has practically become standard. The present method of lubricating the bearings with oil has resulted from a process of elimination, many forms of grease-cups, oil-cups, wicks, etc., having been tried; in fact, the preferred lubrication at one time was grease.

During this period of development the armature was changed from a smooth to a slotted core, and much thought was given to the size of commutator, number of segments, turns per coil, etc., in the effort to produce successful operation of the commutator. Some means had thus to be adopted for radically improving commutation, and the following deals more particularly with this subject:

Armature Forces.—The armature in its simplest

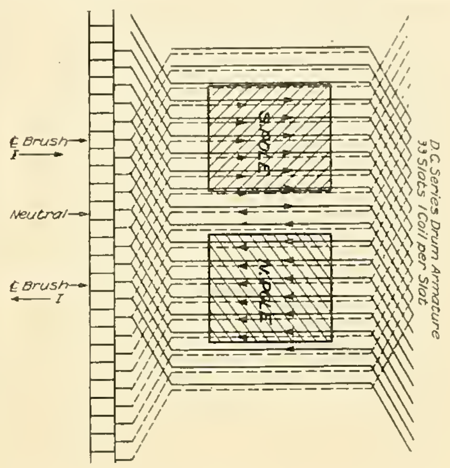


FIG. 1.

conception is a drum, divided into four sections for four poles; under a north pole is a broad distributed sheet of current running parallel to the shaft; under a south pole is also a broad distributed sheet of current, but in reverse direction. Fig. 1 is a diagrammatic representation of a direct-current series drum armature having 33 slots with one coil per slot.

This distributed armature current produces a magnetizing force which changes the distribution of the main flux in the pole faces, as shown in Fig. 2. It will be seen that in the center of the pole there is no distributing effect, but in the center between poles there is the maximum magnetizing effect from the armature. This is where the conductors are commutated by the brush and the direction of the current reversed in passing from the zone of one pole to the zone of the next.

The magnetizing effect of the armature, being a maximum midway between poles, produces a flux through the air space to the frame. The conductors in motion cut this flux, producing a voltage in the coil to be commutated.

The combined result of armature and field-magnetizing effect is to cause a flux to leak from the pole tip over into the armature just where the conductors are being commutated.

The two leakage fluxes are alike and add to produce voltage in the coil which is being commutated. Thus there is a potential between commutator bars, and when these are short-circuited by the brush, a local current is caused to flow in the coil under commutation. This local current adds to the line current already there. Any conductor carrying current has lines of force interlinked about itself, caused by the current in the conductor. The conductors, imbedded in and surrounded on three sides by iron, have a good opportunity of surrounding themselves with a lot of leakage flux. The interlinkage of leakage flux is similar to the inertia in mechanics.

The combined current (line and local) has still greater interlinkage of leakage lines and becomes more difficult to reverse. The reversing has been done heretofore by the increasing resistance of contact between the brush and the commutator bar as the latter is passing out under the brush, the rate of change of current ever increasing. This causes the reactance or kicking voltage to become higher and higher. As the bar leaves the brush the change in current in the coil becomes so rapid that an appreciable voltage is induced and arcs through the air from the bar to the brush, or vice

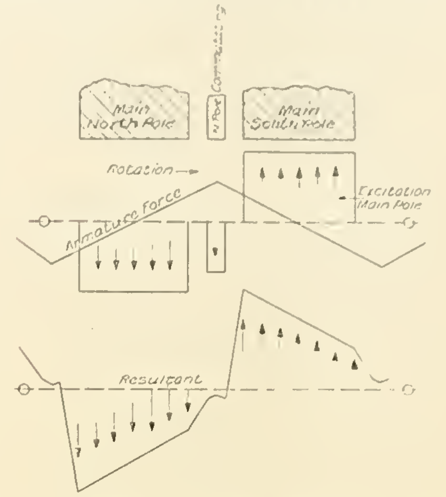


FIG. 2. ARMATURE FORCES.

versa, thus producing what is commonly known as sparking.

The object is, then, to remove the sparking by counteracting one, or all, of its causes. Should we place midway between the main poles another coil, having the same magnetizing power as the armature, but so connected as to magnetize in the reverse direction to the armature there would be nothing to cause a leakage flux from the armature to the frame. Then again, should we further excite this coil so as to overcome and balance the combined effect of armature and field forces, commonly known as distortion and leakage of the main flux from the pole tip, we would annul this troublesome cause of sparking. After the above two effects are taken care of, there remains a force necessary to produce a potential sufficient to reverse the current in the armature coil.

In order to produce this potential there must be such a density of flux as will generate this required voltage by the conductors cutting same in revolving. The width of such magnetic density should be sufficient to embrace the conductors commutated by the brush when running in either direction or rotation.

The commutating voltage produced by the flux of the commutating pole is the accelerating force required to change the direction of current in the armature coils one by one as they come under the brush. It must be sufficient to accomplish this in the time that the coil, being connected to two

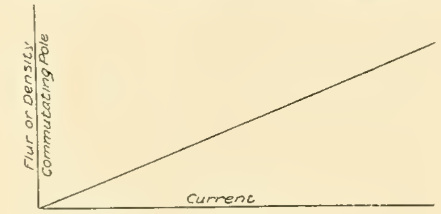


FIG. 3. RELATION BETWEEN COMMUTING-POLE DENSITY AND CURRENT.

adjacent commutator bars, is under the brush. When the commutator bar leaves the brush, the current is already reversed, flowing in proper direction, and is of the proper amount, so there is no tendency to spark. Commutation may then be said to be perfect.

The next question is: Can the action be automatic for varying current as well as speed? The commutating pole may be excited by the main current of the motor, being connected permanently in series with the armature. The commutating-pole flux will then vary almost directly as the current, which is the desired result. When the current is half, the commutating-pole flux is half, and the commutating voltage corresponding thereto. Thus the action is entirely automatic for variation in current or speed, or both.

Fig. 3 shows that the relation between commutating-pole density and current should be a straight line, rising and falling directly with the current.

It is well understood that an absolutely straight line between current and density cannot be obtained when a more or less saturated iron circuit carries the flux, but it can be approached suffi-

1. Abstract of a paper presented at the convention of the American Institute of Electrical Engineers, Niagara Falls, N. Y., June 27, 1907. The author is a designing engineer with the General Electric Company.

ciently close for all practical purposes by careful design and experience in these matters. In a series motor the density of the whole iron circuit increases as the load comes on, and there is an increased stability in commutation which serves to offset, partly, if not entirely, the lack of commutating-pole density on high load. The combined effect is to produce perfect commutation at all loads.

Since the commutation is automatically taken care of for variations in speed and current, it is possible to change the voltage impressed on the motor through quite a range without sparking. This is thoroughly borne out by motors of 50 to 250 horsepower recently constructed in this country.

The only limitations in raising the voltage are:

1. Armature speed and strength of binding wire.
2. Volts between bars.
3. Insulation.

This brings us naturally to the question: What effect will this commutating pole have on designs for voltages higher than are now general for railway service?

Railway-motor commutators, before being connected to the armature winding, are tested from bar to bar with 400 to 500 volts, alternating current, which means a maximum of 40 per cent. more, so that actual jumping of current from bar to bar on a clean commutator would not occur at less than 500 volts per segment. An ordinary commutator of 111 segments and four poles would, under these conditions, be good for 13,000 volts between brushes. The actual jumping of current across side micas of a clean commutator is not the limiting condition.

Our limiting condition is the voltage per bar which will maintain an arc already established. The allowable voltage per segment is largely dependent upon the condition of the commutator. The condition of commutator depends upon the deteriorating tendencies, such as sparking and other causes, like poor carbon brushes, hard side micas, etc.

If the sparking be eliminated, the etching of the commutator bars is largely reduced. The carbon brushes are required to carry only the line current, instead of the line and a large amount of local current; therefore the brushes are not disintegrated so rapidly. The carbon brush has less mica to wear off, because the bars are not burned away. The result is that the carbon brushes work better, and the commutator stays in a very much better condition. The conclusion from the above is that much higher average volts per segment may be used with commutating-pole motors than with motors not having commutating poles.

The usual non-commutating-pole railway motor, 40 to 50 horsepower, has a commutator about 9.5 inches in diameter, with 111 to 125 segments. The average potential between segments is approximately 18 volts. Large motors, operating on 650 volts normal, have 155 to 165 segments, and the average potential between segments is approximately 17 volts. If the average volts between segments on commutating-pole motors be assumed as 24, and the number of commutator bars per inch of circumference as 5, we have the following possible voltages on various sizes of motors and commutator diameters:

Horsepower	Diameter of Commutator.	Maximum Volts Motor.
40	9	850
75	11	1,040
100	13	1,230
150	14.5	1,370
200	16	1,510
250	18	1,700

The above may be said to apply only as far as tendencies are concerned. Not all these various voltages would be practical. It would be better, for various reasons, to adopt 1,200 volts as the higher standard.

The propositions requiring higher potentials than 600 volts, are usually 30 to 50-ton cars with speeds of 40 to 60 miles per hour. These call for a motor of 75 horsepower or larger, so the sizes naturally fall where 1,200 volts can be made with reasonable cost.

The commutating-pole motor, on 600 volts, makes possible commutation and general operation in service many times better than that of the non-commutating-pole motor. On 1,200 volts the commutation is decidedly better than with a non-commutating-pole-type motor on 600 volts.

The 1,200-volt motor requires proportionally more insulation than the present 600-volt motor. This extra insulation requires more diameter and more external dimension.

Theoretical Possibilities of Voltage.—We have the possibility of 1,200 volts per motor, the motor having four poles. Should the motor be bipolar and the speeds high enough to make the design possible we may have 2,500 volts per motor. Then again, if there should be two windings on one core, a commutator on each, and these windings connected in series, we have the possibility of a 5,000-volt motor. Then again, should we have a double-track railway and the rail neutral we might have 10,000 volt direct current between the two trolley wires.

It will be appreciated that more voltage means more insulation, more space and more cost. It will also be seen that the control, car lighting and operation of auxiliary apparatus require special consideration.

Service Capacity.—The non-commutating pole motor has inherently a higher iron density, which serves as a compensating feature, improving commutation. The commutator pole compensates for armature reaction and takes care of troubles due to lack of compensating features; a lower iron density may therefore be utilized and lower iron losses obtained.

The absence of sparking makes the commutating losses very much less. The rating on the hourly basis may not be much greater than with the non-commutating pole motor. On account of core loss and commutator loss being considerably less, and these prominent features in heating, the commutating-pole motor has naturally a higher continuous rating; it is not only capable of taking large fluctuations of voltage and current, but will have a greater all-day service capacity. This latter feature becomes more pronounced as the distance between stops is greater.

There are several ways of making use of higher direct-current potentials. The most prominent of these are the following:

1. (a) City service, 600-volt trolley.
   Maximum speed 25 to 30 miles per hour.
   Stops and schedules incident to city service.
   (b) Interurban service, 1,200-volt trolley.
   Maximum speed 50 to 60 miles per hour.
   Few stops and high schedules.

The motors would be wound and insulated for 1,200 volts.

Two motors would be connected in multiple, and the two groups of a four-motor equipment handled in series and in parallel.

2. (a) City service, 600-volt trolley.
   Maximum speed 25 to 30 miles per hour.
   Stops and schedules incident to city service.
   (b) Suburban service, 600-volt trolley.
   Maximum speed 30 to 60 miles per hour.
   Stops and schedules incident to suburban business.
   (c) Interurban service, 1,200-volt trolley.
   Maximum speed 50 to 60 miles per hour.
   Few stops and high-schedule speed.

The motors would be wound for 600 volts with a relatively low armature speed and insulated for 1,200 volts.

On a 600-volt trolley two motors are connected in multiple, and the two groups handled in series and parallel.

On a 1,200-volt trolley, two motors are connected in series, and the two groups of four-motor equipment handled in series and parallel.

The armature speed and commutating features should be so designed that if one wheel slips and one motor has 1,200 volts or so across its terminal, its armature speed will be reasonable and the commutation good.

Interurban cars with four axles and four motors usually accelerate at 1 to 1.5 miles per hour per second: this requires about 100 to 150 pounds per ton, which is 5 to 7.5 per cent. coefficient of traction. These are low coefficient values for interurban roads and are seldom met with; however, should slipping occur the motor design should be such that no damage to equipment will result. In the city the dirty street may give a low condition of traction, but under these conditions the motors may be used in multiple or operated as any four-motor equipment is now handled.

Advantages of Commutating-pole Railway Motors as Compared with Non-commutating Pole Type.

1. Sparkless commutation even on heavy overloads.
2. Flashing at commutator largely reduced and probably eliminated.
3. Less wear on commutator.
4. Cleaner and safer motor because of reduced carbon and copper dust from brushes and commutator.
5. Marked reduction in heating of commutator.
6. Great current density in brushes.
7. Increased life of brushes.
8. Increased efficiency and free running capacity because of lower core and commutator losses.
9. Possibility of successfully using higher voltages.
10. Greater facility in design of large motors, especially as regards commutation.
11. Possibility of increasing service capacity of motors by blowing.

Wireless Service Aids Central American Fruit Plantations

The United Fruit Company, which operates fruit steamers from its plantations in Central America and the West Indies to United States ports, having its corporation headquarters in Boston, has received a license from the United States War Department to establish a wireless telegraph station at Point San Antonio on the extreme westerly end of Cuba. The company has about 100 vessels in its service and the perishable nature of its cargoes makes communication with the company officials exceedingly desirable while at sea. The company has wireless stations already along the Gulf of Mexico and Caribbean Sea. A relay was desired at the Cuban point named.

Indiana Telephone Items.

The Home Telephone Company of Goshen has just contracted for $35,000 worth of improvements, including a new switchboard. A few other contracts are yet to be awarded.

A question of who shall pay the cost where it becomes necessary to remove wires in order to permit the moving of a house across the street or public highway has been raised in Indiana. The usual custom where it is desired to move a building through the path of telephone wires, is for the mover to pay the expense and for the telephone company to move its wires and poles. Where the mover is not financially responsible, it is customary to estimate the expense of changing the wires and require the mover to pay it in advance, or give the company an indemnifying bond covering any expense or loss which the company may suffer. House movers are objecting to this custom, and the matter is likely to be settled by the courts.

The executive committee of the Indiana Independent Telephone Association has arranged for the beginning of district meetings during the month of September. The question of the association's attitude toward the consolidation of the Independent and the Bell exchanges in certain localities, having been settled at the last annual meeting of the association, the questions to be discussed and considered during the coming district meetings will be that of economical operating, construction and maintenance of telephone plants.

The Central Union and American Telephone and Telegraph companies operating in this state have sent out notices that the discounts that have been allowed large customers of the toll lines will be discontinued, on account of the large increase in the cost of labor, materials and other expenses.

The Madison Telephone Company of Madison is erecting a new building and is preparing to install a new system complete. It has decided to discontinue a sub-licensee contract with the Bell company and to return the transmitters and receivers. It is in the market for a complete Independent outfit of its own. S.

New England Telephone News

The American Telephone and Telegraph Company has decided to change the monthly statement of output which has been a feature of its publicity department for about 25 years, and present hereafter a summary that will show the amount of gain each month in the number of stations.

Arlington, Mass., has opened a new and up-to-date telephone exchange. The office is in a fireproof brick structure erected by the New England Telephone and Telegraph Company in a central location in the town and is equipped to operate 1,500 telephones.

There exists for Boston and vicinity an organization called the Suburban Telephone Reform Association. Through its secretary, Stoughton Bell, the association has requested the State Highway Commission, which exercises supervision over the telephone business in the state in certain particulars that have been defined by the statutes, to consider five specified matters looking to a more satisfactory service. The methods of the association are likely to secure important concessions, because it is prepared to prove its case whenever it submits its desires to a competent tribunal. B.

Telephone News from the Northwest.

The Great Western Telephone Company seeks a franchise at Pierre, S. D., for a competing exchange. The Dakota Central Telephone Company is already in the field.

The Central Telephone Company of Carlos, Minn., has been incorporated with $25,000 capital stock.

The Independent Telephone Company has been incorporated at Lexington, Neb., with a capitalization of $12,500. C. F. Wiggins is interested.

The University Place (Neb.) Telephone Company has let the contract to the Lincoln Telephone Company for the construction of a $25,000 plant. Work will be started at once.

An underground telephone system is being installed at Pomeroy, Iowa. R.

GENERAL TELEPHONE NEWS.

The Rocky Mountain Bell Telephone Company has gone into court to restrain a number of labor organizations and individuals of Livingston, Mont., from conducting a boycott or in any manner interfering with its business. The entire system has been placed on the "unfair" list.

The San Francisco Home Telephone Company is making rapid headway in the laying of its underground conduits throughout the down-town business district. Two exchanges will be erected at present and plans have been prepared for five exchanges to cover the entire city. A cable will be laid across the bay to Oakland, and it is proposed to establish several stations for the receipt and sending of interurban telephone messages before the central offices in San Francisco are ready for operation.

CORRESPONDENCE.

Continental Europe.

Paris, August 13. The French government decided some time ago to assume control of all the radio-telegraphic operations which are to take place in this country in the future, and will henceforth allow no such stations to be erected by private companies. This is in line with the policy which has been adopted as regards the telephone and telegraph service, which are under the control of the state. Although this may somewhat hinder the development of radio-telegraphy in France, it is considered essential in time of war that all such operations should be in the hands of the state. A more recent decree, which appeared not long since, relates to the character of the stations which are to be erected on the coast or inland. Such posts are divided into four classes: First, coast stations or posts located in the interior of the country for the commercial service; second, coast stations specially used for the navy department; third, special military posts for the land army; fourth, lighthouses which are equipped with the apparatus. These systems in general are to be controlled by the departments of war, navy and public works. That the government expects to take up the question of radio-telegraphic stations on a somewhat larger scale than at present is seen by the fact that a special commission has been appointed to act with the public works department in order to examine the question and find the best technical conditions for operating the stations and also to take measures for making a series of experiments.

An international exposition of considerable importance will be held at Brussels in 1910 under the patronage of King Leopold and it is to rank among the great expositions of recent years.

Among the new hydro-electric plants which it is proposed to erect in Spain may be mentioned a large plant in the province of Seville. The plant will be about 75 miles distant from Seville and is to be located on the Carchado River, which will give a considerable amount of power. In the station will be erected a number of turbine-alternator groups of 1,500 horsepower each. These machines are of the three-phase type and operate at 5,000 volts. A bank of transformers will provide a voltage of 50,000 volts for the power line.

The Royal Academy of Sciences of Turin has lately published the conditions of the prize which Senator Vallauri founded in his recent legacy. Five thousand six hundred dollars is to be awarded to the Italian or foreign scientist who publishes the most important and best-known work in the domain of physical science within the period lying between June 1, 1907, and December 31, 1910. Manuscript works will not be considered in the present case.

According to recent figures it appears that the copper mines of Japan are now yielding an output of 40,000 tons annually. This places them in line with the mines of the United States, Mexico and Spain. It is to be noticed that Japan will be a competitor in the foreign market, seeing that it is able to undersell the other countries. This is brought out by the following case which I may cite as an example: In the Hamburg market American copper was quoted at 2,820 francs per ton not long since, while Japanese copper delivered at the spot was quoted at 2,700 francs. A. DE C.

Great Britain.

London, August 17.—The annual return relating to the working of the Pacific cable is again a somewhat sorry affair, there being a deficit of nearly $270,000. This amount will have to be provided on certain arranged proportions by what are called the contributing governments, viz., Great Britain, Canada, Australia and New Zealand. The biggest share falls to Australia; Canada and Great Britain pay equal proportions and New Zealand makes the smallest contribution. Minus interest and sinking fund charges there was a credit balance of $120,000. The revenue showed a fairly substantial increase, but it was due to an abnormal cause in the main, viz., the breakdown for several months of the eastern extension, Australasia and China Telegraph Company's cable between Australia and New Zealand for nearly two months. The total traffic receipts amounted to $582,500, representing 96,783 messages, totaling 1,126,940 words.

A company has been formed called the Calcium Carbide Factories, Ltd., for the purpose of building a factory in Yorkshire on the site of the power station of the Yorkshire Electric Power Company, with which it will work in conjunction. The idea is that the new works will take power from the electric company between a minimum and maximum of 250 horsepower and 2,500 horsepower, respectively, and so help to maintain a steady output from the power house. In other words, the generating station will be at liberty to supply just as much energy within these limits as the other demands will permit, a valuable position for any power station.

The Swansea municipal telephone service has been handed over to the National Telephone Company and the sole survivors of the municipal telephone idea are Hull and Portsmouth. In this connection may be mentioned the decision of the National Telephone Company in concert with the postmaster general to abolish the unlimited service rate in the provinces and to establish universally the message rate system. Up and down the country great opposition has been offered to this by chambers of commerce and big merchants on the ground and it is not disputed that their telephone charges for the same number of calls that they now make on the average per annum will be just about doubled. Instead of an unlimited service for $85 per annum the charge is to be $25, for which a subscriber is entitled to 500 calls. For the next 1,000 calls the charge will be four cents per call; above 1,000 calls the charge will be three cents, then two cents. At a certain point to prevent overloading of the subscriber's line and presumably to induce him to have another instrument the charge is again four cents per call. A few simple calculations will show that an average large business house will very soon reach a number of calls which will increase the annual bill to considerably beyond $85 (the present unlimited service rate); hence this inevitable outburst, which is natural. Of course the main object of the change is to encourage and develop the small user, who, although a very large potential source of profit on any telephone undertaking, has hitherto been sadly neglected in Great Britain.

A Franco-British exhibition is to be held in London from May till October next year. I notice that the Institution of Electrical Engineers is giving its support to the engineering section. There is also a tacit understanding that a representative electrical exhibition will be held in Manchester in the autumn of next year, and if this is so it rather has the appearance that the two exhibitions will be incompatible with one another. Once it is definitely decided to hold the Manchester exhibition it may be taken for granted that there will not be a great response to the invitation of the Institution of Electrical Engineers to exhibit at the Franco-British.

Railway fares in London and tramway and omnibus fares in and out of London continue to call for much attention. Just recently many half-yearly meetings have been held at which the subject has been the one topic upon which the shareholders have been addressed. I have already mentioned the fact that a sort of standing committee has been formed of the various transport authorities in London, and there are strong hopes that some sensible arrangement will be come to to prevent the present absurd cutting of fares. So far as the railways are concerned, electrical working has proved little, if any, cheaper than steam working, and yet the fares have had to be reduced by a very large percentage. The common view now taken by railway, tramway and omnibus managers is that the public should be imbued with the spirit that quicker and more comfortable traveling must be paid more for—not less—presumably on the maxim that time is money. One real grievance stands out, however. The companies have had it put upon them by Parliament to run workmen's trains at certain fares. These fares, which are unremunerative, cannot be altered. Consequently the whole brunt of the increase will fall upon those who have the good or bad fortune to travel at other hours than those prescribed by the cheap trains acts.

The accounts of the Glasgow municipal electricity undertaking are always interesting and those just issued for the year ended May 31, 1907, are no less so than usual. The total capital expenditure upon the undertaking (which, by the way, is quite distinct from the tramway undertaking) now stands at $8,300,000. There are 15,500 consumers connected and they took 24,677,993 units, an increase of about 24 per cent. over the figure for the previous year. The motors connected number 3,302, the output being 11,954 horsepower. Nearly 10,000,000 units were sold for power purposes. After providing for interest, sinking fund and depreciation there is a balance of $15,000, and this sum has been added to the reserve fund. The gross revenue amounted to $1,225,000, an increase of $150,000. G.

New England.

Boston, August 24.—Stone & Webster, railway engineers, builders and owners of many important street traction properties over the country, have purchased a building at 147 Milk Street, this city, and will have the entire structure refitted for their own occupancy.

The telegraphers' strike has not seriously incommoded the business interests of Boston, for quite a number of operators kept at work here, and the Western Union and Postal companies have both claimed to be handling messages easily.

Moody Boynton, inventor of what he terms the bicycle railway system, has been trying to finance his project for a road from Brookton to Boston since his charter was reissued, and requires, it is said, $2,000,000 for the purpose.

The Yetman Typewriter Transmitter Company, it is announced, has purchased an idle factory in North Adams, this state, and will occupy it shortly, giving employment to 200 hands.

The Massachusetts Railroad Commission has received a petition asking for approval of the construction of a new electric railway from Marlboro, Mass., to connect for Boston via Waltham, and run through Weston, Wayland, Sudbury and Maynard. Atherton W. Rogers heads the directors of the new company. B.

New York.

New York City, August 24.—W. J. K. Kenny, a receiver for the New York Electrical Workers Union, has presented a report on the condition of affairs and declares that "thousands of dollars have been taken by certain officers and members of the union in disregard of the laws of the state." No system whatever was employed, it is said, in keeping up the books of the union or in the establishment of a duplicate set. The treasurer has disappeared and so have the books, so it is a pretty difficult matter to close up the union. A meeting of the union is to be called for the second Wednesday in September for the election of a new set of directors and other officers.

The new high-pressure salt-water fire service which is being installed in the city to prevent the great waste of water from the commercial mains and which will be maintained at a pressure of approximately 250 pounds is now nearing completion, and already bids have been received for furnishing the requisite power to the stations in Manhattan as well as in Brooklyn. It has been decided to give the contract to the Edison companies, the New York Edison Company in Manhattan and the Edison Electric Illuminating Company in Brooklyn, they being the only companies which have the proper facilities for supplying the power. The illuminating company bid $3,850 per month and 1½ cents per kilowatt-hour for electricity. After the failure of the municipal plant which lighted the Williamsburgh Bridge and which lighting has been turned over to the New York Edison, the city has been more reticent as to the matter of municipal operation.

The Public Service Commission in the Second district announced today that it had denied the application of the Newburg Light, Heat and Power Company for leave to increase its capital stock from $500,000 to $750,000.

Preparatory to taking up the question of railroad car service and demurrage charges the Public Service Commission in the Second district is requiring all steam and street railroads in its district to furnish to the commission information of its schedules, rates, rules and regulations, distribution of rolling stock, amount of freight handled and the number and quality of its equipment, so that a study may be made and if possible a remedy found for the delay in handling coal and other commodities and tending to greatly assist in improving the general service.

An order has been adopted by the Public Service Commission and is to be served on all electric-lighting companies which are within its territory. The order requires the companies to furnish copies of all documents relative to incorporation, legislative grants, consolidation or merger agreements, franchise rights, mortgages, leases, deeds, contracts, etc., and to furnish a detailed description and location of all property owned, together with a map showing all pipes, conduits and other structures maintained in the streets. E. H. S.

Indiana.

Indianapolis, August 24.—General Manager Harry Dickey of the Winona Interurban Company announces that a temporary power plant will be installed at Akron, so that cars can be run from Peru to Fulton County in a short time. The work of distributing ties on this line is progressing rapidly. At one point the company is up against an expensive proposition in the nature of a sink-hole which gave no indication of trouble until recently, when it swallowed a $2,500 concrete bridge. There is no way to rescue the old arch, and a new one will have to be built.

The first car was run over the St. Joe Valley Railroad into Angolia on the 21st inst. The car came into the Wayne Street crossing, where it was met by President Bucklen, Mayor Carver and a large crowd of waiting people.

Perry A. Randall, president of the Fort Wayne and South Bend Traction Company, has arranged with the American Trust Company of Chicago, as trustee, to finance his enterprise.

The City Council of Richmond has given the McGowan syndicate two weeks in which to accept a franchise providing for transfers between interurban and local cars, or cease using the streets for operating through interurban cars. In defense of this action the companies have joined in a petition to the Wayne County Circuit Court for an injunction against the council's enforcement of the ordinance. The companies are preparing to establish freight stations on the east and the west sides of the city, and propose to transfer freight by drays in case the courts decide that they have no right to operate freight cars upon the streets of Richmond.

The inspectors sent out under authority of the Indiana Railway Commission to inspect railroad tracks, devices, crossings, bridges, stations, equipments, etc., of both steam and traction lines, are making lengthy reports to the commission, advising a large number of changes and improvements in order to make travel more safe and also lessen the hazard of railroad employes. The commission immediately sends notices that the improvements recommended by the commission must be made at once.

The Central Station Engineering Company of Frankfort has incorporated with a capital of $25,000. It proposes to do a general construction business, making a specialty of constructing and equipping central-station plants with water, heat, light, power, etc.

The $200,000 plant of the Indiana Creosoting Company in Bloomington has been put in operation. Twenty-five thousand cross-ties, and many telegraph, telephone, trolley poles and bridge timbers are now on hand to be treated. The company has a complete electric-car system covering its 10 acres of ground, to carry its timbers into and out of the plant. The plant is the third of the kind to be established in this state, the others being at Evansville and Shirley.

The Moore Fare Register Company of Indianapolis, recently incorporated, will establish and equip a plant for the manufacture of fare registers and other supplies for interurban and street railroads. The directors are C. L. Davis, Albert Deprez and Enos Porter. S. S.

Ohio.

Toledo, August 24.—Announcement is made that hereafter all purchasing for the Lake Shore Electric Railway Company will be done in the office of the general manager at Norwalk, Ohio, instead of at Cleveland as heretofore. All purchases are to be made over the signature of F. J. Stout.

The People's Telephone Company at Wharton, Ohio have adopted a plan of giving daily weather reports to their farm patrons. At 10:30 each morning a weather report ring is given and the report read from the central office.

About $25,000 worth of electrical work was recently awarded to the Erner & Hopkins Company of Columbus by the Hocking Valley Railroad at Logan. M. A. Pixley will be in charge. The work will not be commenced for some time, as the various buildings are not yet complete.

After a long and vigorous fight between those in favor of a second telephone system for Napoleon and Henry County and those desiring only the Home telephone, the Home telephone people won out before the council, which refused to grant a franchise to another telephone company. The Home company has agreed to take over the old mutual lines at a reasonable figure.

A new interurban electric line is being planned to extend between Norwalk and Sandusky, Ohio. The venture is being projected by Sherman Culp, vice-president of the Sandusky, Norwalk and Mansfield Railway Company, with a party of eastern capitalists.

To avoid all misunderstandings as to responsibility the Lake Shore Electric Railway Company is installing the Egry dispatching machine in all offices and in the booths where orders are received by conductors. The dispatcher gives the order by telephone, the conductor writes it down, turns the crank and has a copy for himself, one for the motorman and one left in the machine for permanent record.

A 16-mile addition to the Sandusky, Fremont and Southern Electric will be built from Fremont to Tiffin, Ohio. The estimated cost of construction is $25,000 per mile.

A large car barn and repair shop will be erected at Dayton, Ohio, by the People's Railway Company on a new site just purchased. The present car barns will be tore down and a power house erected on the ground.

The Valley Transit and Power Company was recently incorporated at Columbus, Ohio, with a capital stock of $100,000, for the stated purpose of building a line from Canton to Columbus. It has been intimated that the real purpose is to close the gap between New Philadelphia and Coshocton, giving direct electric service between Cleveland and the capital city. H. L. S.

Illinois.

Peoria, August 24.—The City Council has ordered the Western Union Telegraph Company to put all its wires underground for a mile and a half on Washington Street as well as the wires to the Weather Bureau, a distance of more than two miles.

General Manager Fischer of the Illinois Traction Company, who was a visitor to the city this week, said that as soon as the schedule could be arranged limited trains would be put on between here and Bloomington.

The Nernst Lamp Company has established a branch office here. A store has been secured on Main Street and fitted up to show the various types of lamps sold by the company. Mr. Soldinger who is in charge, is pleased with the outlook.

The Peoria Railway Terminal is still buying land to use for switching facilities, having recorded a tract of 18 acres at South Bartonville this week. Work on the yards is progressing nicely and the steel is expected to arrive this week.

According to the last report of the Illinois Traction Company the outstanding bond issue of the system was $13,817,500 for the completed lines and $6,213,000 for the roads under construction. The amounts for the completed lines all bear interest at 5 per cent. except the Danville property, the Danville and Champaign Railway and the Jacksonville Railway Company, which bear 6 per cent. interest. The report also gives in detail the amount of bonds outstanding on each piece of property owned by the system.

The Peoria, Streator and Ottawa Railway Company, which proposed to build a road between those cities, has certified an assignment of all its rights and franchises to the Chicago, Peoria and Ottawa Railway Company.

The Danville Car Company has certified to the secretary of state of an increase of capital from $250,000 to $750,000.

The Illinois Traction Company is now running a sleeper out of Springfield to St. Louis every night at 12:30. The car formerly ran through from Decatur, but the business failed to justify its continuation, so the passengers desiring to take the sleeper must now board it at Springfield.

Authority for the construction of electric block signals between Murrayville and Roodhouse has been granted and work will be commenced at once.

A professional nurse living in Chicago has sued the Peoria Railway Company for $5,000 damages for alleged injuries. She was a passenger on the cars from a park up the river when the car stopped to uncouple a trailer. At this the end of the car on which she was standing, released from the weight of the trailer, suddenly shot into the air and she "soared like a bird" into the air, alighting with great force and violence upon the ground. V. N.

Pacific Slope.

San Francisco, August 21.—There are many reports to the effect that the street-car strike is to be settled speedily, and that an agreement with the leaders of the Carmens' Union to call off the strike has been decided upon by President Patrick Calhoun of the United Railroads, on a basis of $3 per day of nine hours. The service is still being improved and a number of additional cars have been placed in operation.

It is announced that the San Francisco Gas and Electric Company has closed a contract with the Union Oil Company to deliver 2,500,000 barrels of fuel oil a year at $1 per barrel on the wharf in San Francisco, to be used for firing the boilers at the lighting company's electric generating stations. The oil will be taken from wells in Southern California.

The Presidio and Ferries Railroad Company has modified its plans with a view to dispensing with the use of a cable, which it was supposed would be required to transport loaded cars over the Union Street Hill, since it has been found, by actual demonstration, that with motors, it is possible to surmount grades of 14 per cent. with little difficulty. At the only place where the grade exceeds this figure and amounts to 18¾ per cent., it is proposed to install a combination cable and clutch to draw the cars up the incline. This method can be employed, it is said, without materially delaying the movement of traffic. The tracks of the road are now completed for 32 blocks from Polk Street to the Presidio and Harbor View, and from Montgomery to East Street on Jackson Street. Twenty-four blocks remain to be laid.

The San Francisco Board of Supervisors has denied the United Railroads an overhead-trolley permit, and has taken the first step looking to the abolition, 18 months hence, of all overhead electric wires in the district eastward from Devisadero Street.

Vallejo and Northern Railroad officials have denied the report that the company has sold out to the Northern Electric Company. Franchises applied for by both roads are pending before the city trustees of Sacramento, Cal. The Vallejo and Northern, which has projected an electric road 105 miles long connecting Vallejo and Sacramento, has acquired rights-of-way, and it is said that actual construction will soon be commenced. A line of fast steamers is to be established to connect Vallejo with San Francisco.

The Sonoma and Lake County Railroad Company is about to build an electric line from Lakeport to Cloverdale, which will pass through Adams Springs, Highland Springs, Saratoga and Bartlett. The company will commence the construction of the line as soon as arrangements are completed for a connection with San Francisco.

President H. P. O'Reilly, local manager of the American Telegraphone Company, announces that a factory will be established in Seattle, Wash., to manufacture instruments for the Pacific coast supply.

More than $100,000 has been subscribed by the citizens of Valdez at a mass meeting for organizing the Alaska Home Railway Company to build an electric road from Valdez to the interior of Alaska. Construction has been commenced on wharves and terminals in the heart of the town. H. D. Reynolds, owner of the Alaska Coast Company, headed the project.

A. E. Dickinson, J. E. Fulton, vice-president and general manager, and Engineer D. F. McIntyre, who recently visited San Francisco, are seeking to establish communication through the California and Northwestern Railroad or one of the other lines tapping their territory. The total outlay is estimated at $750,000, and the line will cover a distance of 27 miles, the highest point traversed being the 1,800-foot altitude between Highland Springs and Pieta Creek, about 11 miles from Lakeport. The line will handle passenger and freight traffic and will cater to tourist business.

Preparations for the commencement of work on the Los Angeles Pacific Railway Company's subway have been begun. The tunnel strikes out in a diagonal direction from the south side of Temple and Hill streets in Los Angeles, going northwest toward Hollywood.

J. C. Stevens, president of the Willamette Valley Company, and Howard Butcher, director, both of Philadelphia, have been in Portland, Ore., holding a conference with A. Welch, vice-president and general manager, to outline plans for the development of the various projects being carried out by the company, which owns a large number of gas and electric plants throughout the Pacific Northwest, and plans building some electric lines. The latest project is an interurban road between Portland and Salem, with a branch running to Eugene.

The Northwest Electric Company will in a short time begin the erection of a large plant for the manufacture of all kinds of electrical appliances, somewhere in the south end of the city of Seattle, Wash. The new company will absorb the Seattle Electric Heating and Manufacturing Company. A. E. Ransom will have general supervision of the plant. A.

PERSONAL.

James W. Moore, a prominent man of Richmond, Ind., and secretary of the Richmond Home Telephone Company, died at his home in Richmond during last week.

President Coffin of the General Electric Company has gone abroad for an automobile trip through France and England, to be absent until the middle of October.

Walter A. Murphy, superintendent of the Carbaras-Boone Traction Company, Boone, Iowa, is dead as the result of an electric shock obtained while handling a car controller.

George Dyer, superintendent of the Sandusky division of the Lake Erie and Western Railroad, with headquarters in Lima, Ohio, has resigned his position to become general manager of the South Bend and Indiana Interurban Railway system, commonly known as the Murdock lines.

Edward W. Barrows, secretary-treasurer of the American Engineering Company of Indianapolis, has returned from Texas, where in the interests of his company he closed a contract to build and equip an electric traction line from Fort Worth, Tex., to Mineral Wells, a distance of 60 miles.

John S. Speer, general manager of the Speer Carbon Company, St. Marys, Pa., passed through Chicago last week en route to St. Marys. Mr. Speer has been enjoying a well-earned vacation and spent the last five weeks on a tour of the Western States, accompanied by Mrs. Speer and a party of friends.

Mr. Avery P. Eckert will become general sales manager of the Duplex Metals Company, with his new headquarters at 208 Fifth Avenue, New York. Mr. Eckert's long and well-known electrical career began with the New York Telephone Company. Following three years with the Kerite Company, for 14 years he has been associated with the Safety Insulated Wire and Cable Company. For some time he was secretary of the Electrical Trades Society of New York. His company is engaged in introducing Monnot wire, which consists of an iron strand clad with copper, so that tensile strength, elasticity and durability of both metals are combined. The company controls patents for welding metals and the Westinghouse company will use material thus treated for making steam-turbine blades.

F. B. Maltby, who has been connected with the Panama Canal work as principal assistant engineer to J. F. Stevens, has resigned to go with Dodge & Day, engineers and constructors, of Philadelphia, in the capacity of chief engineer. Mr. Maltby is a graduate of the University of Illinois, receiving an honorary degree from the same institution. He has had a long experience in railroad construction work, municipal engineering and irrigation work, and has had charge, for the United States government, of all the dredging operations in the lower Mississippi River, and designed and built the lock and movable dam on the Osage River in Missouri for the government. Mr. Maltby has been connected with the Panama Canal for the last 2½ years, having had charge of the construction of railroads, docks and wharves, shops and dredging. He constructed a cold-storage plant, laundry and bakery in Panama. He has designed over $1,250,000 worth of dredging plant for the canal work, and the preliminary plans and construction work for the Great Gatun lock and dam were done under his direction.

ELECTRIC LIGHTING.

The Prentice (Wis.) Light, Water and Power Company has been incorporated with a capital stock of $3,000.

The Lawton (Okla.) Lighting Company has been incorporated with a capital of $100,000 by C. S. Stephenson and others.

George I. Watters of Victor, Mont., proposes to develop waterpower and establish an electric-light plant in Stevensville, Mont.

The Waurika (Okla.) Public Service Corporation has been incorporated with a capital of $200,000 and will furnish electric light and gas.

A. B. Hulit has applied for a franchise for an electric-light plant to compete with the present plant at Oklahoma City, Okla.

ELECTRIC RAILWAYS.

The Arkansas Valley Traction Company has been incorporated by H. W. Potter, J. E. Gauger and Eugene S. Alnutt with a capital of $150,000.

The Russellville and Ozark Mountain Traction, Light and Power Company has been chartered with a capital stock of $200,000. The incorporators are prominent business men of Pine Bluff, Atkins, Ozark and Russellville, whose object is to build interurban lines between Russellville and neighboring towns. Adam J. Robins is president.

It is expected that an electric line will be built from Clarkston through Lewiston, Idaho, and across the Clearwater into the bench land district, where eventually a connection will be made with the Spokane and Inland Empire, which is building into Moscow. Another part of the great scheme is to use power developed at Grande Ronde to lift the water from the river and distribute it over the bench land for irrigation purposes.

RADIO-TELEGRAPHY.

M. A. Vivien, chief engineer of the Marconi wireless system, arrived on the liner La Touraine, from Havre, last week. He said the French line was to be equipped with powerful wireless apparatus that would keep the big ships of the fleet constantly in touch with either the American or European coasts.

The Dutch Indian government has granted to a syndicate a concession for establishing a radio-telegraph system between Java, Celebes, Borneo and the neighboring islands. The company, with a capital of 2,650,000 florins (florin equals 40.2 cents American) is now in the course of flotation, but there will be no public issue.

PUBLICATIONS.

Thomson polyphase induction wattmeters measure the energy in any two-phase, three-phase or monocyclic circuit, and consist of two single-phase motor elements, each acting upon its own disk with both disks mounted upon a single shaft actuating the regiser. The meters may be applied to a circuit carrying a mixed load of lamps, motors or other devices and record accurately, irrespective of load conditions. Bulletin No. 4527, issued by the General Electric Company, Schenectady, N. Y., describes the latest form of these meters which are made in three types; one for house service with metal cover and two for switchboard use, one having a metal cover and the other a glass cover. The bulletin gives catalogue numbers and capacities, etc., of the various sizes and a large number of connection diagrams showing the method of installation on different classes of circuits.

Helios flaming-arc lamps are described in a handsome and interesting bulletin, No. 40, issued by the manufacturers in Philadelphia. The properties and illumination data of flaming arc lamps are fully explained and illustrated by curves and diagrams. Most of the pages are taken up with the description and operation of the Helios lamps, and a comparison table for incandescent, enclosed arc and the Helios lights gives the cost for 600 hours of burning as $356, $265 and $78, respectively.

The Cutler-Hammer Manufacturing Company of Milwaukee, maker of electric controlling devices, has just issued a booklet—pigeonhole size—descriptive of its line of electric crane controllers. In addition to full descriptions and illustrations of five types of crane and hoist controllers, the booklet contains connection and dimension diagrams, repair part charts, prices, net weight and shipping weight of apparatus, etc. An improved form of contactor for handling heavy currents is also described.

The Excello Arc Lamp Company, 24-26 East Twenty-third Street, New York, has issued a list of the principal spare parts for Excello flaming arc lamps. A complete "exploded" view of replacement parts has each detail numbered so that by reference to an accompanying list the prices may be learned. Recent improvements in the construction of the lamps are noted in order to enable customers to order differing parts intelligibly. The publication is to be looked upon as another proof of the manufacturers' desire to give the users of their lamps every satisfaction.

SOCIETIES AND SCHOOLS.

The Navy Department will soon erect at the Mare Island Navy Yard at Vallejo, Cal., a building costing $25,000 for use as an electrical school for the enlisted men of the navy. A small school is now maintained where wireless telegraphy is taught and where all of the electrical apparatus for the various wireless stations established on the coast is tested. All but one of the operators in charge of the Pacific coast stations are graduates of the Mare Island school.

The American Street and Interurban Railway Engineering Association has sent to the general managers and engineers of member companies the list of questions which will constitute the question box to be presented at the Engineering Association convention held at Atlantic City during October. Each recipient is asked to make a point of answering at least five questions. The question box is to be placed in printed pamphlet form, together with the replies received from the various companies and will be distributed in advance of the convention.

The American Street and Interurban Railway Association has asked for another report from its committee on municipal ownership, to be presented at the convention to be held in October next. In order that the report should cover all progress made either for or against the movement as well as some statement in regard to general conditions here and abroad a sheet has been enclosed with a letter to the general manager of street and interurban properties in America covering a few questions designed to ascertain the condition of affairs with respect to municipal ownership in the immediate vicinity of the addressee.

MISCELLANEOUS.

The short ends of old carbons may be cemented together to form rods which burn quite well and are no more brittle than ordinary carbons. The cement required is of potassium silicate and carbon dust. The rods have their ends faced off square and, after application of the adhesive which as used is of a pasty consistency, are pressed together by hand.

The United States Civil Service Commission announces an examination on September 11-12, 1907, to be held at various cities throughout the country, to secure eligibles for three vacancies in the position of miscellaneous computer at the Naval Observatory, Washington, D. C., and similar vacancies as they may occur in that observatory. The department states that miscellaneous computers are paid by the hour and earn from $800 to $1,000 per annum. Promotions are made from this grade without further examination to the grade of computer, at $1,200 per annum, as vacancies occur. As an insufficient number of eligibles to meet the needs of the service were secured from previous examinations held for this position, qualified persons are urged to enter this examination.

TRADE NEWS.

Mr. Colby has succeeded to the electrical supply business of Colby & Vredenburg of Trinidad, Colo.

In Little Rock, Ark., the Electric Construction Company has been incorporated with a capital of $25,000 and proposes to sell electrical supplies and apparatus.

The last semi-annual report of the Chicago Pneumatic Tool Company shows the profits for the half year ended June 30th to have been $507,528.12. Deducting amounts set aside for depreciation and repair of plant, development of new tools, interest, sinking fund and dividends a balance of $190,818.88 has been added to the previous surplus, making $1,069,228.32 surplus to be carried forward.

An American consular officer in South America has sent the names of prospective purchasers of electric engines to the United States Bureau of Manufactures. He also writes of the proposed electrification of a street-car line, the installation of an electric-lighting plant and the proposed improvement of the electric-lighting plant now in operation. Particulars may be learned by addressing the bureau at Washington and referring to the file number, 1346.

BUSINESS.

Mr. William W. Merrill has resigned as president of the Appleton Electric Company of Chicago and disposed of his entire stock holdings to Mr. Albert I. Appleton and Mr. John V. Painter. Mr. Appleton assumes the presidency of the company, of which he is also treasurer, and Mr. Painter becomes secretary.

The new firm of George H. Erich & Co., dealers in electrical supplies, has taken over all the business interests formerly conducted by George H. Erich at 358 Dearborn Street. The new concern will retain the same offices, and Mr. Erich hopes to continue to receive the favors of his friends under his new business arrangement.

ILLUSTRATED ELECTRICAL PATENT RECORD.

Issued (United States Patent Office) August 20, 1907.

863,609. Electrically Signaling from Moving Trains. Alva D. Jones, Louisville, Ky., assignor of parts to T. Harris, W. O. Bradley, J. Gayle, F. A. Fuller, E. D. Martin, A. G. Martin and J. C. Strother. Application filed December 3, 1906.

A vertically swinging arm is provided to be raised and lowered from the locomotive cab and ends in a supplemental bifurcated extensible arm, each fork of which carries a metallic brush to make contact with the line conductor.

863,613. Means for Operating the Controlling Switches of Electric Vehicles. Louis Krieger, Paris, France. Application filed January 10, 1906.

The switch control is arranged inside of the tubular steering pillar.

863,617. Combined Telephone Receiver and Transmitter. Rodney F. Ludlow, Philadelphia, Pa. Application filed April 6, 1904.

One diaphragm serves for both functions, being located in the field of the receiver magnets and also having connection through levers with a transmitter capsule.

863,643. Grinding Machine. George P. Ransom, Oshkosh, Wis. Application filed May 29, 1907.

In order to maintain a constant surface speed of the grindstone, a gauge fitted against its periphery is mechanically connected to the motor controller so that as the stone's diameter decreases from use, the motor speed is correspondingly increased.

863,656. Safety Fuse. Joseph Sachs and Frank D. Reynolds, Hartford, Conn., assignors to the Sachs Company, Hartford, Conn. Application filed March 22, 1906.

The fuse comprises a tube with end caps and the fuse strip electrically connected between them. An indicator wire inside the tube is visible through a flap in the casing.

863,667. Relay. Jacob B. Struble, Wilkinsburg, Pa., assignor to the Union Switch and Signal Company, Swissvale, Pa. Application filed February 18, 1907.

The relay consists of a core affording two magnetic paths with a winding for each. By increasing the reluctance of one magnetic path over the other, a pivoted armature will be moved in response to the strongest magnetic circuit.

863,674. Joint for Carbon Electrodes. Frank J. Tone, Niagara Falls, N. Y. Application filed September 25, 1906.

One carbon has a tapered threaded end and the other a tapered threaded socket.

863,683. Brush Holder for Electric Motors or the Like. Thomas S. Watson, Milwaukee, Wis. Application filed September 1, 1906.

The brush-holder comprises jaws having oppositely disposed parallel ways that are tapered in cross-section to form guides.

863,690. Trolley Device. Samuel E. Belcher, Los Angeles, Cal. Application filed January 10, 1906.

The trolley pole is controlled by a compressed-air cylinder.

863,692. System of Electrical Distribution. William L. Bliss, New York, N. Y. Application filed July 20, 1904.

This distribution system for governing the supply of a storage battery into the generator circuit has a regulator with two windings, one of which is connected in the supply circuit and the other in the translating circuit. The regulator is rendered inoperative whenever the generator and battery combine to furnish current to the translating devices.

863,705. Telephone Signal System. Howard M. Eldred, Milwaukee, Wis. Application filed March 19, 1906.

For a magneto-signaling telephone system, the drop is connected to one side of line through a cut-off contact in the jack. The other terminal of the winding is led to a grounded generator. The subscriber signals the operator by simply pressing a button which establishes a ground at his station. (See cut.)

863,720. Telephone Call-bell or Ringer. William Kaisling, Chicago, Ill., assignor to Milo G. Kellogg, Chicago, Ill. Application filed March 2, 1906.

Details of construction of a ringer are given.

863,755. Controlling Apparatus for Railroad Signaling. Petrus J. Portman, Amsterdam, Netherlands. Application filed June 8, 1906.

A dial has a number of long and short contact strips to which the circuit is closed by contacts carried by the pointer.

863,773. Lightning Arrester. Ernst J. Berg, Schenectady, N. Y., assignor to the General Electric Company, Schenectady, N. Y. Application filed January 8, 1907.

The circuit shown has a translating device electrically connected with the line through a reactance, condensers connected in series across the reactance and forming a discharge path for high frequency oscillations, and a discharge path including a spark-gap connected to the line.

863,774. Parallel Connected Generators. Ernst J. Berg, Schenectady, N. Y., assignor to the General Electric Company, Schenectady, N. Y. Application filed January 17, 1907.

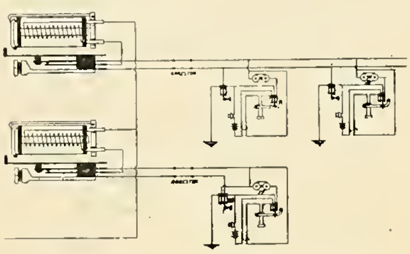
When several generators are connected in parallel and driven by prime movers having different speed-regulation characteristics, the plan is to produce automatically a relative decrease in the field-strength of the generator having the best speed regulation upon a sudden increase of load on the generators.

863,791. Protective Device. Loren Emery, Schenectady, N. Y., assignor to the General Electric Company, Schenectady, N. Y. Application filed January 10, 1907.

The device is operative to open the circuit upon an overload and upon a reversal of energy.

863,793. Forming Filaments Out of Viscose or Similar Viscous Material. Charles A. Ernst, Lansdowne, Pa., assignor to Silas W. Pettit, Philadelphia, Pa. Application filed April 27, 1907.

To form viscose for producing cellulose filaments, soda-cellulose is treated with carbon bi-sulphide to form cellulose xanthate and the xanthate is then dissolved in an alkaline solution containing sodium sulphite to prevent the further action of the carbon bisulphide on the cellulose.



NO. 863,705.—TELEPHONE SIGNAL SYSTEM.

863,799. Electric Meter. Charles E. Holmes, Lynn, Mass., assignor to the General Electric Company, Schenectady, N. Y. Application filed November 23, 1904.

The feature of the meter casing is a spring which when depressed permits of removing the entire operating mechanism.

863,807. Snap Switch. Frank W. Sanford, Schenectady, N. Y., assignor to the General Electric Company, Schenectady, N. Y. Application filed February 1, 1905.

Details of construction of a snap switch having "off" and "on" buttons, are given.

863,808. Dial Plate for Switches. Howard R. Sargent, Schenectady, N. Y., assignor to the General Electric Company, Schenectady, N. Y. Application filed August 24, 1905.

The dial plate is carried by the rotatable switch contacts.

863,810. Telegraph Key. Henry Smith, Raleigh, N. C. Application filed July 17, 1906.

This key is one of a kind designed to relieve the operator of making dots which are in this instrument formed by contacts, made by a vibrating reed. One key is used to send dashes and a second key transmits dots as long as it is depressed.

863,814. Dynamo-electric Machine. Louis E. Underwood, Lynn, Mass., assignor to the General Electric Company, Schenectady, N. Y. Application filed April 9, 1904.

The machine is fitted with the usual polar projections from the frame, and has a piping system through which a cooling fluid may flow, detachably secured in the spaces between the windings. (See cut.)

863,818. Rail-bond. Ben Willard, New Orleans, La., assignor to the General Electric Company, Schenectady, N. Y. Application filed March 31, 1899.

The terminals of the flexible conducting cable make contact with a number of rail connections which are serially connected by flexible conductors.

863,847. Electrical Socket Seal. Llewellyn T. Hatfield, Sacramento, Cal. Application filed August 3, 1906.

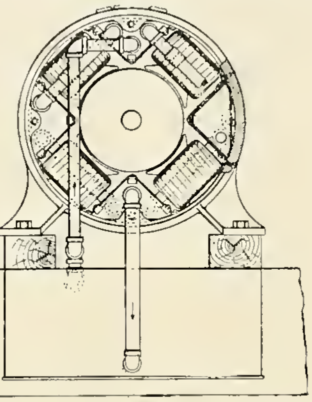
A non-conducting plug is arranged to be fitted in the socket and sealed.

863,852. Transmission of Intelligence by Electric Means. Isidor Kitsee, Philadelphia, Pa. Application filed February 5, 1904.

[illegible] telephonic communication between two distant [illegible] over a single line without earth connection, artificial local circuits at each station are provided, each of local circuits having a value at least equal to the value of the line-proper.

863,853. Telegraphy. Isador Kitsee, Philadelphia, Pa. Application filed April 24, 1907.

In a system of duplex telegraphy in which two sources of current are connected in opposition, there are means for making the home instrument immune to the home transmission.



NO. 865,814.—COOLING SYSTEM FOR DYNAMO-ELECTRIC MACHINES.

863,875. System of Selective Electric Signaling. Sylvanus A. Reed, New York, N. Y. Application filed August 4, 1906.

In a circuit having condensers, oppositely biased ringers with a predetermined tension in their biasing springs, a low and a high resistance, there are also means for operating the ringers adapted for alternately charging and discharging the condensers respectively through the low and high resistance or vice versa, the high resistance being sufficient so to reduce the current that it will be insufficient to overcome the tension of the biasing spring.

863,913. Block-signaling Apparatus. Walter E. Foster, Chicago, Ill., assignor to the Union Switch and Signal Company, Swissvale, Pa. Application filed April 25, 1907.

By an arrangement of electromagnets and polarized relays the lock of a controller at one station may be released from the next station or may be controlled by a passing train which reverses the line polarity.

863,924. Selective Signaling System. William W. Kidney, Buffalo, N. Y., assignor to the Century Telephone Construction Company, Buffalo, N. Y. Application filed May 28, 1907.

Current of requisite polarity is applied to a line on which a number of sub-stations are connected, each equipped with polarized signaling apparatus, a condenser and a contact on the ringer armature for opening and closing the circuit to the condenser.

863,955. Interrupter Apparatus. Reinhold H. Wappler, New York, N. Y. Application filed October 30, 1906.

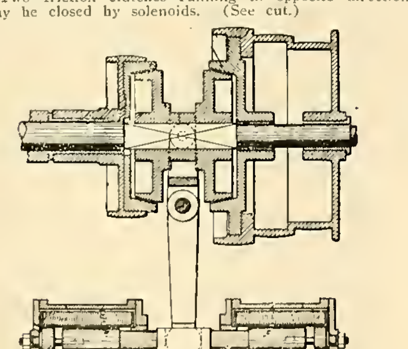
An auxiliary interrupter-electromagnet attracts the pole of an armature mounted on an axle, which carries a cam opening the circuit in this position. The now deenergized magnet allows the armature to move past, permitting the closure of the circuit, so that the operation is continuous.

863,956. Electric Cloth-cutting Machine. Edward M. Waring, New York, N. Y. Application filed July 11, 1906. Renewed July 26, 1907.

An electric motor in the body of the machine drives the cutting knife.

863,966. Electromagnetically Operated Mechanism for Reversing the Motion of Machine Tools. Julius Billeter, Aschersleben, Germany. Application filed October 25, 1906.

Two friction clutches running in opposite directions may be closed by solenoids. (See cut.)



NO 863,966.—ELECTROMAGNETICALLY OPERATED REVERSE.

863,969. Telegraph and Telephone Cable Core. William Dieselhorst, Old Charlton, and Arthur W. Martin, London, England. Application filed March 29, 1904.

A method of making cable cores, consists in twisting together pairs of individual conductors with a constant length of lay from end to end of each twisted pair, and again twisting the twin conductors in pairs but with a different length of lay.

863,984. Trolley. Nelson J. Greenison, New York, N. Y. Application filed January 28, 1907.

The trolley harp extends vertically from an extension to the trolley pole.

864,027. Automatic Circuit Closer. Henry A. Pearson and Harry Adams, U. S. Navy. Application filed October 22, 1906.

When the circuit is opened by a circuit-breaking device the movement of the controller shaft automatically restores the connection as the controller is moved to its "off" position.

864,048. Electric Time Switch. Bernhard Tropp, New York, N. Y., assignor of one-half to William Henry Laird, New York, N. Y. Application filed February 1, 1906.

Power to operate the switch is supplied through a spring by an electric motor which is automatically started and stopped after a predetermined period.

864,102. Luminometer. John T. Marshall, Metuchen, N. J., assignor to the General Electric Company, Schenectady, N. Y. Application filed July 26, 1906.

On the base of the photometer an electric lamp is mounted and covered by an opaque box in one of whose faces is a photometer screen. The lamp, with resistances in the box, forms the arms of a Wheatstone bridge, whose balance is secured by an adjustable resistance and galvanometer.

864,129. Controlling Mechanism for Electric Signaling Systems. Willard H. Gilman, Medford, Mass., assignor to the International Telemeter Company. Application filed October 31, 1906.

In brief this may be explained to be a controlling apparatus comprising an electromagnet and its armature, a contact device made and broken by successive reverse movements of the armature, a second contact device made and broken upon each movement of the armature, and locking means for preventing the operation of one of the contact devices.

864,135. Spark Plug. Charles A. Mezger, New York, N. Y. Application filed December 26, 1906.

NO. 864,135—SPARK PLUG.

A non-rotative annulus of relatively soft metal surrounds the insulation member at an enlarged portion and is engaged and partly inclosed by the bushing. (See cut.)

REISSUE.

12,681. Floor Surfacer, Cleaner and Polisher. Aaron T. Spence, Alameda, and Samuel B. Zimmer and John H. Prugh, Oakland, Cal., assignors to the American Floor Surfacing Machine Company. Application filed April 8, 1905. Original No. 728,423 dated May 19, 1903.

An electrically driven floor surfacer has the details of its construction described.

PATENTS THAT HAVE EXPIRED.

Following is a list of electrical patents (issued by the United States Patent Office) that expired August 26, 1907:

434,943. Electric Connector. E. L. Orcutt, Somerville, Mass.
434,949. Gearing for Electrically Propelled Vehicles. N. B. Possons, Cleveland, Ohio.
434,961. Section Insulator for Overhead Electric Conductors. E. Thomson, Lynn, Mass.
435,015. Dynamo-electric Machine. W. F. Collins, New York, N. Y.
435,084. Electric-lighting System. A. H. Bauer, Chicago, Ill.
435,093. Electric Switch. C. H. Herrick, Winchester, Mass.
435,097. Electric Signal for Cable Railways. S. J. Jacobs, New York, N. Y.
435,105. System for Electric Circuits. F. Stitzel, Louisville, Ky.
435,110. Electric Forging Machine. G. D. Burton, Boston, Mass.
435,111. Electric Car Heating and Feeding Apparatus for Forging Machines. G. D. Burton, Boston, Mass.
435,114. Means for Distributing Electric Energy. S. De Ferranti, London, England.
435,116. Guard for Electric-light Globes. R. M. Gardiner, Hamilton, Canada.
435,185. Electrical Watchman's Clock. H. S. Park, Chicago, Ill.
435,213. Electric Alarm for Clocks. W. H. Deane, Brooklyn, N. Y.
435,223. Electric Cut Out. C. Heisler, St. Louis, Mo.
435,259. Electric Device for Preventing Accidents on Railways. G. Thew, Peru, N. Y.
435,261. Generator for Electric Engine Circuits. C. J. Van Depoele, Lynn, Mass.
435,262. Structure for Supporting and Insulating Suspended Bare Conductors. C. J. Van Depoele, Lynn, Mass.
435,263. Electric Railway Conduit with Tubular Conductors. C. J. Van Depoele, Lynn, Mass.
435,264. Reciprocating Electric Hammer. C. J. Van Depoele, Lynn, Mass.
435,283. Method of and Apparatus for Welding by Electricity. C. L. Coffin, Detroit, Mich.
435,284. Process of Heating Metals by Electricity. C. L. Coffin, Detroit, Mich.
435,292. Autographic Telegraph. H. Etheridge, Pittsburg, Pa.
435,295. Automatic Telephone Connector. W. H. Ford, St. Louis, Mo.
435,340. Automatic Electric Train Signal and Controlling Device. W. H. Wilson, New York, N. Y.
435,343. Articulate Electromagnet. F. H. Brown, Chicago, Ill.

WESTERN ELECTRICIAN

EVERY SATURDAY

Vol. XLI. CHICAGO, SEPTEMBER 7, 1907 No. 10

The Lockport-Chicago (Drainage Canal) High-tension Transmission Line.

A high-tension transmission pole-line whose construction has been the subject of considerable interest among electrical engineers and others is nearing completion along the banks of the Chicago Drainage Canal between Lockport and Chicago. Near Lockport, as readers of the Western Electrician know, the water of the Chicago Sanitary District's drainage canal, fed by the reversed Chicago River from Lake Michigan, has a considerable drop to the Desplaines River, from which it finds its way to the Gulf. By the extension of the canal two miles beyond Lockport between great concrete retaining walls, which rise above the level of the surrounding country as the land slopes away, a power-house site has been obtained which insures a 40-foot fall for the ultimate flow of 600,000 cubic feet of lake water.

The 32,000-kilowatt generating station at the site thus secured is now near completion and the primary installation of 20,000 horsepower will soon be available for use. A complete and illustrated description of this station appeared in the Western Electrician of April 20th. A considerable portion of the electric power from this plant will be transmitted to Chicago over one of the most substantial pole lines ever constructed.

The present article will be directed to a description of the unusually interesting construction of the pole line which follows the canal into Chicago and which includes some features that make it one of the most unique as to size and modern in design in the world. The difficulties in erecting the massive steel poles were heightened by the changing characteristics of the country along the 40 miles of the transmission line, which runs on the bank of the canal between the water and the spoil pile. The channel has been cut through solid rock from Willow Springs, Ill., to the Lockport power house, a distance of about 16½ miles. This rock has been piled along the shore in great mounds, and at one place the derrick wagon had to be placed on a mound of rock 12 feet high to set a pole in a hole which had been blasted in the solid rock below. Aside from this there were several difficult railroad crossings to be made.

As will be gained from inspection of the accompanying illustrations, the poles are intended to accommodate two three-phase transmission circuits and a ground wire carried on the peaks of the poles which will extend the whole length of the line. The transmission voltage will be 44,000.

The erecting of the poles is shown in Figs. 1, 2 and 3. Some idea of their great size will be obtained from a glance at Fig. 4, where the height of the pole, almost 60 feet, may be compared with the man at the base.

The poles are of steel, square in plan section, of bridge construction, and weigh complete 4,000 pounds. On a side they measure 42 inches at the base and 20 inches at the top. The cross-arms are similarly of bridge construction, the lower arm being 18 feet long and weighing 600 pounds, while the top arm is 12 feet long and weighs 300 pounds. The material used in the diagonal braces is 2 by 2 by 3-16 inch angle. The size of the material in the corner posts varies from 3½ by 3½ by ¼ inch at the base to 3 by 3 by 3-16 inch at the top of the pole. The rivets in the body of the pole are all three-quarters inch and in the cross-arms five-eighths inch.

Fig. 6 is a detail drawing of the pole construction, giving dimensions.

The Aermotor Company of Chicago, manufacturer of windmill machinery and towers, made the lowest bid for the construction of the poles and received $130 apiece for the 500 furnished.

The poles are placed 350 feet apart. They are set into the ground 5½ feet and the hole filled in with concrete which is brought up six inches above the surrounding earth and rounded off at the edges so that no water will lodge about the base. Fig. 5 shows a straight stretch of the line just out of Chicago and illustrates the accurate alignment which has been maintained in the setting. The view is typical of the upper end of the drainage canal and shows the water course itself and the high spoil banks flanking it on either side. The other poles shown in the picture are 40-foot telephone poles, which are, it may be seen, effectually dwarfed by the large steel structures.

Setting of the poles was undertaken by the Brennan Electric Construction Company of Chicago, which company also contracted for the wiring of the power house and the stringing of the high-tension wires. The bid made by this concern was much lower than others submitted, which is accounted for by the fact that the company had devised and figured on an economical method of construction which, while considered unique, has proved itself perfectly successful and equal to the various difficulties encountered.

The holes are dug perfectly square, are accurately lined, and are four feet on a side. This leaves three inches outside the pole on the four sides for the concrete into which the poles are set.

The derrick wagon seen in Fig. 2 was especially designed by the constructing company. It consists of a stone wagon with the platform extending one foot behind the rear axle; on this is set a 40-foot gin pole, to the top of which are attached guy lines which hold it in a perpendicular position. While setting a pole these lines are fastened to stakes driven in the clay or to bars inserted in the crevices in the rock. Moving from pole to pole the gin pole is kept in an upright position by the men who walk alongside and hold on to the guy lines.

In raising the steel poles (see Fig. 1) a three-quarter-inch wire cable is used, which is threaded through two 14-inch iron double-sheave blocks, then through the top of the pole over a sheave wheel, and finally down to the base of the gin pole on the derrick wagon, where it is attached to a crab hoist. Four men can raise the pole with this hoist. After the pole is set, lined and graded, it is securely guyed, and the derrick wagon proceeds to the next.

Concrete is placed in the following manner: A canal boat (shown in Fig. 3) loaded with stone and cement is towed up from the quarry and landed at the first pole to be concreted. On this boat is placed a Smith concrete mixer of one-half-yard capacity. The concrete is mixed on the boat and wheeled out and dumped around the pole. When the proper quantity has been placed about the pole the gangplanks are pulled aboard, the line untied and the boat floats down to the next pole.

By this method one gang has set as many as

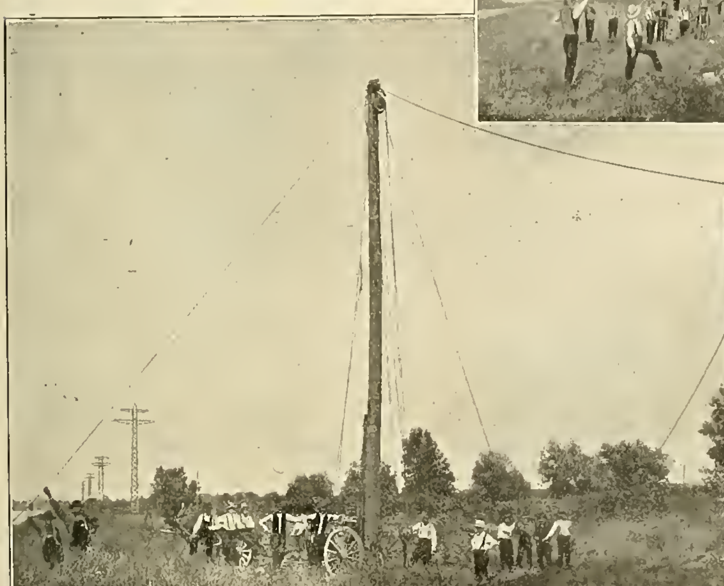


Fig. 1. Raising One of the 60-foot, 4,000-pound Steel Poles into Position.
Fig. 2. Derrick Wagon with its 40-foot Gin Pole for raising the Steel Poles. Fig. 3. Concrete Mixer on Boat which Floats down the Canal from Pole to Pole.
THE LOCKPORT-CHICAGO (DRAINAGE CANAL) HIGH-TENSION TRANSMISSION LINE.

12 poles in a day, though difficulties are sometimes encountered which do not allow such progress. Three hundred and seventy-five of the poles are now set, beginning at the Chicago end, and the work of placing the balance and stringing the wires it is expected will be completed by October 15th.

The poles were designed to carry the transmission wires on the lower arms 47 feet above the ground. The insulators of each three-phase circuit will be arranged at the apexes of an equilateral triangle six feet on a side, so that distance will be maintained between wires. The wires are carried 16 inches above the metal arms. The insulators, furnished by the Locke Insulator Manufacturing Company, are of the type shown in Fig. 7. They have a diameter of 14 inches and are 12 inches high, and were tested assembled ready for use at 120,000 volts. Each of the four shells tested at 60,000 volts before assembly. This insulater, mounted on a suitable metal pin, is guaranteed for a maximum horizontal strain of 4,000 to 5,000 pounds and is ordinarily rated for 60,000 volts.

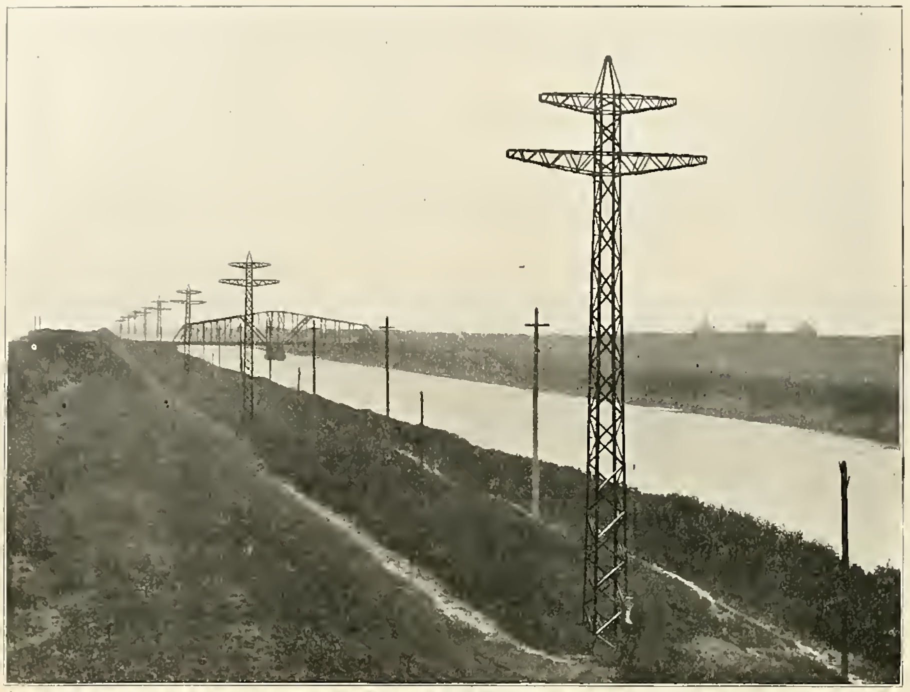


FIG. 4. VIEW ON CHICAGO DRAINAGE CANAL, SHOWING LOCKPORT-CHICAGO TRANSMISSION LINE.

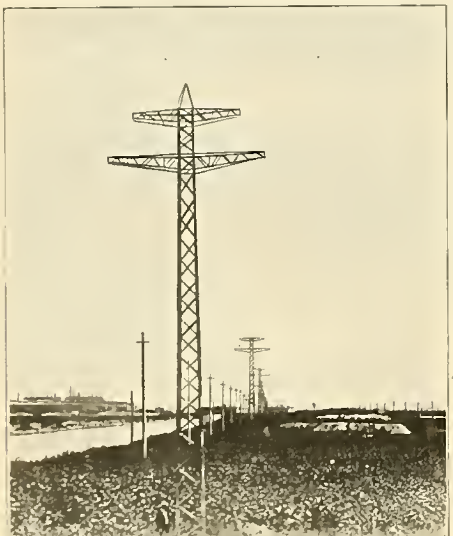


FIG. 5. VIEW OF LOCKPORT-CHICAGO TRANSMISSION LINE, WITH SUB-STATION IN THE DISTANCE.

At the top of the pole the four corner posts end in a cap which is fitted with a socketed clamp to be tightened down on the one-half-inch iron ground wire which will be carried the whole length of the line. This cable will connect all the poles electrically and on account of its position above the transmission wires is expected to receive any lightning which may strike the line and carry it off to the excellent grounds afforded by the concrete-[illegible] poles.

Electric Illumination of Niagara Falls.

Various schemes have been proposed to illuminate Niagara Falls. The latest proposition for illuminating the great waterfalls is quite in keeping with their natural grandeur and beauty and illustrates one of the most interesting developments in illuminating engineering.

The city of Niagara Falls has contracted with the General Electric Company of Schenectady, N. Y., for the necessary apparatus to illuminate the cataract, and the work of installation is expected to be completed early this month, when the falls will be artificially lighted for the first time. Two batteries of searchlights of the naval type will be used. One battery of not less than five 60-inch projectors will be mounted on the highest available point on the Canadian side and so placed as to catch the crest of the falls and plunge the light into the broken water as it rushes down between the bridge and the brink on the American side. The color attachments will be used so as to tinge the water various shades of carmine, crimson, orange, yellow, green, violet and purple. These various colors will be combined in different ways so as to introduce innumerable pleasing tints and shades in various combinations.

The second battery will consist of not less than 25 36-inch projectors mounted in the form of a crescent at the base of the gorge on the Canadian side. These will also be provided with color attachments and the projectors will be so placed that they can be concentrated on either the American or Canadian falls, or subdivided so as to cover the Canadian or American falls as well as the "Bridal Veil" falls. Along the edge of the water opposite the battery the scintillator head, which discharges clouds of steam to augment the mists in producing cloud effects, will also be placed.

The two batteries of searchlights are powerful enough to bathe the falling water in a flood of dazzling light, and with the color scintillators the effect will be beautiful indeed. All the projectors will be controlled from a single vantage point by one operator manipulating a keyboard. In this way it will be possible to obtain a thoroughly artistic interpretation of the color scheme.

The scintillating apparatus consists of three parts, namely, the scintillator-head, the color disks and the boiler. The scintillator head consists of the steam pipes, nozzles and valves by which the various cloud effects are produced. The color disks are carried in a frame in front of the projectors. The construction of these color screens is such that sheets of various colored gelatine can be attached therein. Upon revolving these screens colors can be brought in front of the arc with the result that a beautiful color is imparted to the beam.

The scintillator-head will be located close to the water and at intervals masses of steam will be emitted from the nozzles. Upon this bank of rising steam the searchlights will play their colored beams, producing a sunset effect of startling beauty. Steam will be supplied from a concealed boiler. Other novelties will be bombs filled with black powder which will be thrown above the falls to burst with heavy clouds of smoke or a shower of confetti.

The apparatus with which the falls will be

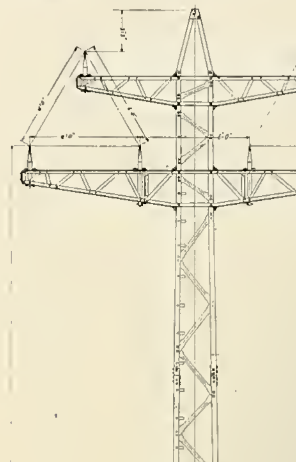


FIG. 6. DETAIL DRAWING OF THE LOCKPORT-CHICAGO TRANSMISSION POLE.

lighted was thoroughly tested at Nahant, Mass., last fall. Several of the searchlights to be used will be the largest and most powerful types made, and with the two batteries it will be possible to produce an artificial aurora-borealis in the heavens which, under proper atmospheric conditions, will be visible at Rochester or Toronto.

The illumination of the mighty torrent by night will be an added attraction to the sightseeing tourists who annually visit Niagara. The apparatus permits of so much originality that the programme will be changed every night, and in the

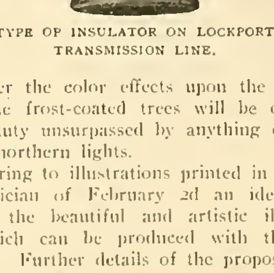


FIG. 7. TYPE OF INSULATOR ON LOCKPORT-CHICAGO TRANSMISSION LINE.

early winter the color effects upon the snow, the ice and the frost-coated trees will be of a spectacular beauty unsurpassed by anything other than the great northern lights.

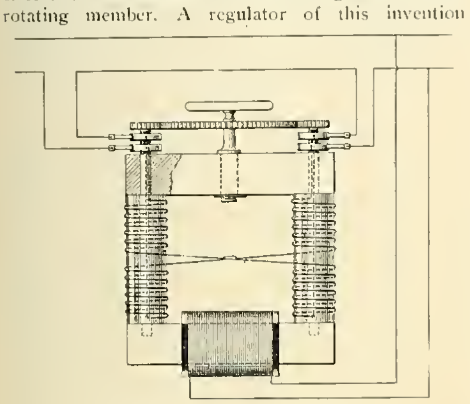
By referring to illustrations printed in the Western Electrician of February 2d an idea may be gained of the beautiful and artistic illuminating effects which can be produced with the electric scintillator. Further details of the proposed illumination of the falls were given in the issue of June 22d.

An Ingenious Voltage Regulator.

This invention, which secures a transformer that may be made to furnish a variable potential at the secondary terminals, will certainly strike the practical electrician or the laboratory worker as being ingenious in principle. As such, the idea is applicable to many allied purposes, and various transformers, regulators and auto-transformers might be made on this principle.

One of the forms which will serve to illustrate the scheme involved is shown in the accompanying drawing. Broadly, the device consists of a magnetic circuit formed by rotatable iron spools yoked by iron keepers. On one of the latter what may be considered the primary winding is placed. The secondary winding is of a flexible conductor, which is carried by the spools, and so arranged that on turning the spools, which are controlled from one hand-wheel, it will unwind from one spool onto the other, resulting in subtractive or cumulative inductive relations. The ends of the secondary windings are led out through slip-rings and brushes. The variation is gradual and without interruption of the circuit.

With the generic idea in mind, many useful applications will at once suggest themselves. Potential regulators, as generally constructed, consist either of transformers having spaced leads to which one side of a circuit is successively connected to vary the voltage, or depend for operation upon the position of a winding on a rotatable core with respect to a stationary winding. The first requires circuit interruption, while the latter involves a considerable air-gap in the magnetic circuit and necessitates a careful alignment of the rotating member. A regulator of this invention



THOMPSON'S VOLTAGE REGULATOR.

may be constructed with an inexpensive core and may effect a wide regulation without circuit interruptions. In case the flexible winding is in two portions, they may be wound upon parallel spools or bobbins, as illustrated.

Another scheme the inventor suggests is the provision of a non-magnetic auxiliary spool to reel up the conductor unwound from the spool included in the core. The principal advantage in providing two flexible portions, the turns of which may be interchanged in position, lies in the fact that the available space on the core is completely occupied at all times.

As then arranged the turns of both portions of the flexible winding are in such relation that the electromotive forces induced in all the turns of both portions may be added together and act in one direction, or by simultaneously rotating the core spools, the turns of one portion of the flexible winding may partially or wholly neutralize the turns of the other portion, or the electromotive forces generated may be added together in the opposite direction. Thus, the voltage delivered from the line may be varied from a maximum obtained when all the turns are acting in the same direction, corresponding to that of the line voltage, to a minimum value obtained when all the turns act in opposition to the line voltage.

When collector rings are mounted in such a position that the magnetic flux in the core passes through them, it is advisable to provide an opening in the ring in which insulation may be inserted to prevent the induction of a short-circuited current in the ring, and, in regulation, where such short-circuited currents would be excessive, a pair of narrow brushes, which are connected by an inductive resistance, may be advantageously employed to engage the ring at different points, the circuit connection being made to the middle point of the interposed resistance instead of to a single brush, which would in some instances short-circuit the ring or break the circuit.

The invention has been patented by William D. Thompson and is assigned to the Westinghouse Electric and Manufacturing Company.

Underground Work at Peoria.

The Peoria Gas and Electric Company of Peoria, Ill., is putting its wires underground in the down town district within the fire limits. The accom

UNDERGROUND WORK IN LIBERTY STREET, PEORIA.

panying illustrations show the work in progress, the pictures being taken in Liberty Street, at the foot of which the company's plant is located. There are 54 ducts running up Liberty Street, arranged six wide and nine high. The top layer of ducts will be used for the distribution, and at various points service boxes will be built and the services to the buildings taken direct to the basements, the intention being to make one service box take care of three customers. When a tap is made for a service and there is no other customer ready for service who can be taken care of from the same box, the taps will be made and the stub ends sealed up so that in future when the service is desired the main cable will not have to be opened.

In the picture looking down Liberty Street the stacks of the company's plant are shown at the right, also the pole line and wires which are to be removed. At the bottom of the trench is first laid a concrete foundation varying in thickness according to the number of ducts, usually four inches. On this is laid the ducts, all well placed in cement. Owing to the sandy nature of the soil, the trenches require sheeting in most places to prevent the slipping of the pavement. Nearly all of the downtown district has a brick pavement, laid on a concrete foundation, with a

UNDERGROUND WORK IN PEORIA —ARRANGEMENT OF DUCTS.

sand cushion of two inches between the bricks and the concrete. One picture shows the ducts in place and the arrangement of them.

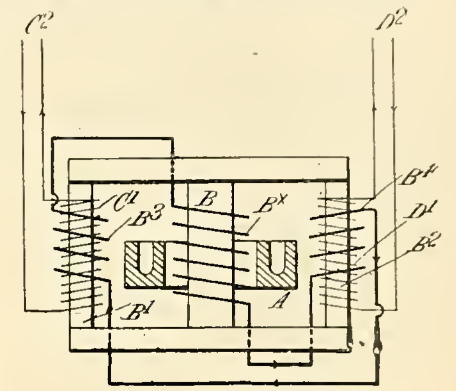
The contract for the entire installation of the work was let to G. M. Gest of New York. The work is under the direct charge of H. J. Hawkshaw as superintendent for Mr. Gest.

Through electric trains between Evanston and Milwaukee will be in operation by the middle of October, according to Mr. A. C. Frost, president of the Chicago and Milwaukee Electric Railroad Company. Buffet dining cars will be attached to all through trains, but the report that sleeping cars would also be run is denied by Mr. Frost, as he expects to make a schedule time of 2½ hours.

Polyphase Induction Furnace.

There is a class of induction furnaces, known as the Kjellin type, which are constructed upon the principle of a transformer, and in which the charge to be melted forms the secondary. These furnaces have been operated successfully with single-phase alternating current, but various attempts have been made to utilize polyphase currents, such as two or three phase currents, providing one annular bath or fusion chamber for each phase, either separate or in conjunction. But the losses caused by heat radiation were found very high, in fact, about nine kilowatts per square foot of the bath surface, and where only the polyphase current was available it was found necessary to convert it into single-phase by motor generators, thus greatly increasing the original cost of the installation. Moreover, as the fusion chambers or secondaries have to be placed at a considerable distance from the primary coil, an arrangement of two or three fusion chambers will greatly increase the magnetic leakage in the transformer, causing a low power factor and inefficient operation of the generating plant.

According to an invention designed to overcome these difficulties, and upon which J. Harden of London, England, has secured a United States patent, polyphase alternating currents are employed in the working of induction furnaces by combining transformers to convert the polyphase currents of the supply mains into single-phase currents in the induction furnace. For this purpose the primary windings of the induction furnace are connected to the secondaries of transformers whose primaries are connected to the different phase windings of a polyphase system, so that the currents induced in the secondaries are all in the same direction,



A POLYPHASE INDUCTION FURNACE.

but possess phase differences corresponding to the phases of the polyphase system.

Herewith is given a diagram showing the transformers for a two-phase system, combined with the induction furnace itself. (A) is the annular fusion chamber surrounding the middle member (B) of the furnace, the side members of which are indicated by the letters (B^1) (B^2).

The primary windings (C^1) (D^1) and also the secondary windings (B^3) (B^4) are wound upon the outer members (B^1) (B^2) of the induction furnace. In this case, the windings (B^3) (B^4), which are secondary windings with respect to the windings (C^1) (D^1), are the primary windings with respect to the charge contained in the annular chamber or bath (A).

The advantage of this construction is the economy of material occasioned by employing the furnace core (B) as the middle member of the transformer, while as well serving as means for positioning the magnetic flux.

Tantalum Stronger Than Steel.

The following physical properties of the metal tantalum are of interest, since the recent extensive application of tantalum high-efficiency lamps: The melting point of tantalum is said to be between 2,250 and 2,300° C. Its resistance increases with rise of temperature, just as in the case of osmium or other metals. At ordinary temperatures the resistance of a wire one meter long and one square millimeter in section is 0.165 ohm. At the temperature of the incandescent lamp this figure becomes 0.85 ohm. The breaking strength of tantalum, when cold, is very great, being 93 kilos per square millimeter, as compared with from 70 to 80 kilos, for good steel. When heated, however, it becomes soft like osmium, and a filament, after burning for some time, is easily broken. The material is for incandescent filaments, the diameter being from 0.035 to 0.05 millimeter.

Some Hydraulic Features of Kern River Plant No. 1.

Several references have already been made in the Western Electrician to the recently completed Kern River Station No. 1 of the Edison Electric Company of Los Angeles. But a number of accounts will hardly exhaust the interesting features of this unusual installation. This plant, from which is developed enough power to double the capacity of all the Edison Company's other plants combined, is located far up in the lower Sierras of California, almost at the headwaters of the Kern River, whence through a wonderful channel, comprising 20 tunnels in all, water is led down 12 miles from the mountains for a fall of nearly a thousand feet and hurled against the four great Allis-Chalmers impulse wheels, aggregating over 40,000 horsepower and direct-connected to General Electric generators.

DISCHARGE WATER FROM FIRST WHEEL AT KERN RIVER PLANT NO. 1.

The engineering problems involved in building tunnels, flumes, penstocks and power houses to endure the heavy strains put upon them, were no more difficult to solve than the transmission of the electrical output from the new station under a pressure of 75,000 volts over a distance of 117 miles to Los Angeles. The route of transmission lies through the canyon in a direct line, thence over the hills, plains and divide, to follow the course of the Piru River and its tributaries. Large galvanized-iron towers carry the heavy wire cables of the transmission line.

In many respects the Kern River development is unique. It is said to be the largest hydraulic electric plant west of Niagara. The transmission line is one of the longest in the world. The pressure of 75,000 volts over such a length of cable is the highest ever attempted. The conduit which leads to the pressure main is the longest underground tunnel system in use for this purpose. The concrete-encased penstock, tapering so as to accelerate the force of the water at the power house, is said to be the first of its kind ever placed in service.

The four big wheels which convert hydraulic to mechanical energy have each a capacity of 10,750 horsepower at full gate and a speed of 250 revolutions per minute, when operating under a net effective head of 865 feet. In addition to the main turbines, there are two exciter turbines, also of Allis-Chalmers design, each with a capacity of 450 horsepower, and a speed of 430 revolutions per minute.

The large waterwheel units are of the impulse type, with hand-adjustable needles and governor-operated deflecting nozzles. Each unit has two runners, one on either end of the generator shaft. The interchangeable buckets are made of non-corrosive phosphor bronze of special mixture for the high head and are attached to the cast-steel disks bolted to the flnaged ends of the generator shaft. These disks of cast steel furnish sufficient flywheel effect to supplement the amount contained in the generator, in order to meet the guarantee of speed regulation. (For sudden changes of load amounting to 25 per cent., 50 per cent. and 100 per cent. it is guaranteed that the speed variations will not exceed 1.7 per cent., 3.5 per cent. and 7.8 per cent., respectively.)

The nozzles are provided with hand-adjustable needle and arranged to be deflected by the governor automatically, or by the latter's hand-regulating device. By deflecting the jet instead of regulating its discharge by adjusting the needle with the governor it is possible to secure a constant velocity of water in the pipe line as well as a constant discharge of water into the tail race, even when the plant is operating with heavy fluctuations of the commercial load.

The nozzles are of the best quality of cast steel. Special attention may be called to the design which has a number of new features. The nozzles consist of two "Y" pipes, flanged together in such a way that the whole nozzle has a diamond shape. The upstream end of the nozzles forms the movable part of the knuckle joint and the downstream end carries the nozzle tip. It is declared that by making the nozzles diamond-shape these advantages are obtained:

1. The center of the jet corresponds to the center of inlet pipe; therefore any reaction from the jet upon the needle and nozzle is not eccentric. This is of importance with deflecting nozzles, where any variable reaction upon the governor should be avoided.

2. As the two branches of the "Y" join at ample distance from nozzle tip the water has time to gather concentrically around the needle under an absolutely uniform pressure. The result is that the jet leaves the nozzle tip at a high velocity and without disturbance.

3. Due to the fact that the jet leaves the nozzle tip uniformly, the needle is axially balanced and not subject to any vibration.

4. The needle stem not being subject to any bending, it need not be made slender and flexible, but is made very substantial. The end of the stem projecting through the front "Y" pipe is of smaller diameter than the stem. The differential room thus formed can be put under adjustable water pressure. This pressure tends to close the needle and puts all pins and links of the connection in a position for hand adjustment under slight pressure in the closing direction. By this any rattling of the needle is prevented.

The upstream end of the nozzle forming the movable part of the knuckle joint is hooked into the stationary part or swivel-head. The swivel-head is heavily bolted to the foundation, as it has to take up the full pressure of 375,000 pounds, tending to pull the nozzle away downstream. This pressure is taken up by two steel pins carefully fitted into their bearings and provided with suitable lubrication.

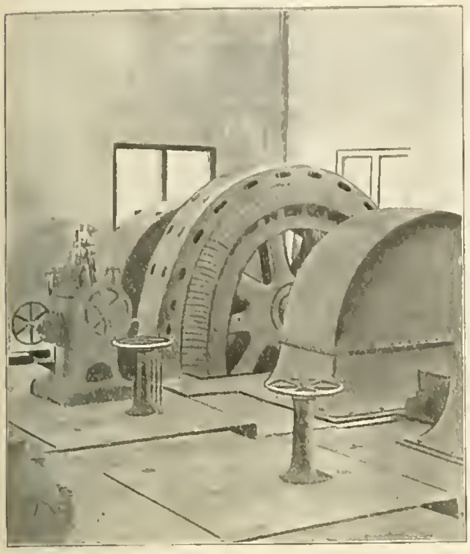
A 28-inch gate valve is connected to the swivel-head and controlled either by hand or electrically by a motor operated from the switchboard. All parts of this gate subject to the operating pressure are made of the best quality of cast steel. The gate is single-seated and bronze-lined.

The needle consists of a hollow stem of cast steel, into which is screwed and secured the steel needle tip. A heavy cast-iron base plate grouted and rigidly bolted to each side of the generator base frame forms the solid foundation for the cast-iron wheel housing. These housings are made very substantial in order to avoid resounding. They are divided horizontally along the center line of shaft, thus allowing easy removal for inspection or for replacing of the buckets. The sides of the housing have extensions of removable steel plates which protect the concrete against the impact of the discharging water. The pits in which the deflecting nozzles are located are of sufficient width to allow passage on either side. They are covered with substantial cast-iron floor plates made in sections of such size as to permit of easy removal.

Another feature of these impulse wheels deserves comment on account of its novelty. As already mentioned, the regulation of the wheels is effected by a governor which deflects the jets of the two nozzles. The needles are adjusted by hand and are usually set to that maximum size of jet which will be sufficient to develop the maximum peak load expected for that period of setting of the needles. In other words, there is always a maximum amount of water leaving the nozzles. The governor adjusts the deflecting nozzle in such a way that only as much water is directed upon the buckets as is needed for the load for the time being. The balance discharges below the buckets into the tail race. It is evident that at times when all load is thrown off the wheels the governor will deflect the jets entirely. Each jet has a maximum diameter of 7⅜ inches and leaves the nozzle tip at a velocity exceeding 225 feet per second. It was, therefore, necessary to provide means of receiving this tremendous power and deflect the jet into the tail race in such a way that its impact would not be detrimental to the parts against which it is directed.

DISCHARGE OPENINGS AT KERN RIVER PLANT NO. 1, SHOWING DEFLECTORS IN PLACE.

This has been successfully accomplished by the present arrangement of deflectors. It consists of an upper channel heavily ribbed and bolted to the concrete foundation and of a lower bottom plate. The channel at its upper end is slightly more inclined than the deflected jet. Thus the jet will strike the bottom of the channel under a small angle and therefore tend to spread and fill the section of the channel. The channel gradually widens and consequently the jet is offered a larger resistance area. The lower part of the channel is curved and at its end the jet discharges almost perpendicularly. The bottom plate is "S" shaped, its upper



ONE OF THE GENERATING UNITS IN KERN RIVER PLANT NO. 1.

end being flush with the bottom of the wheel pit, the lower end being practically level. The jet strikes the bottom plate almost in the turn of the "S" and under a small angle. Thus the jet is again forced to spread and follow the base of the bottom plate. In due consideration of the unavoidable wear and tear of these deflectors, they are lined with removable steel plates wherever the surfaces are exposed to the flow of the deflected jet.

The exciter units are also of the impulse type, with hand-adjustable needles and governor-operated deflecting hoods. Each unit has one runner overhung on one end of the exciter shaft, the other end carrying a flywheel. The interchangeable buckets are bolted to a cast-steel disk which is keyed upon the exciter shaft. This disk and the flywheel furnish sufficient flywheel effect for the speed regulation guaranteed. The nozzle is stationary and "S" shaped in the horizontal plan and carries the stand and handwheel for hand operation of the needle. The needle has a removable tip. A hand-operated gate valve is connected to the upstream flange of the nozzle. The base of the wheel housing is cast in one piece with the exciter base frame. The cast-iron wheel housing is split horizontally along center line of the shaft. The sides of the base have extensions of removable steel plates which protect the concrete against the impact of the discharging water. The pits of the nozzles are covered with removable cast-iron floor plates.

The automatic regulation is effected by a governor which deflects the jet from the buckets, this, however, not being accomplished by deflecting the whole nozzle but simply by inserting a hood, which cuts into the jet from underneath and directs this part of it directly into the tail race. That part of the hood which deflects the jet is made of steel and is removable. Care is taken in designing this arrangement so that the knife edge of the hood does not disturb the working portion of the jet.

When the governor arrangement was designed the leading idea was to have each turbine with its respective governor form an independent unit. Although the available operating water pressure of 370 pounds from the force main is ample to operate governors, it was preferred to substitute oil pressure. It was also preferable not to feed the governors with oil pressure from a control system, but to make each governor absolutely self-contained.

Special attention was paid to the safe operation of the units, avoiding from the beginning any runaway. For this purpose the arrangement of the generator as well as the exciter governor was made in such a manner that the jets will be automatically deflected from the buckets should the oil pressure in the governor fail.

The weight of each generator deflecting nozzle is partly carried by an hydraulic balancing piston, which receives water pressure directly from the force main. As soon as the oil pressure in the governor fails the nozzle will lower on account of the unbalanced weight, and thus deflect the jet from the buckets. The same result is accomplished with the deflecting hood of the exciter wheels, which is connected to a hydraulic water piston, tending always to insert the hood and thus deflect the jet.

The governors are driven by a silent chain from their respective wheel shafts. The connections between the operating pistons and the deflecting nozzles or hoods consist of levers, pins, links and shafts, and the use of gears or racks has been avoided, thereby preventing the jars that result in lost motion and wear and tear.

The oil pump is attached to the casing and immersed in the oil reservoir. It is of the rotary type, having no valves, which are often the cause of failure of oil pressure. The main pump shaft also carries the bevel gear which drives the flyballs operating the pilot valve over the regulating lever. The pilot valve is self-contained between opposing pressures and any reaction upon the flyballs is eliminated. It is evident that this is a condition of prime importance for exact regulation. The pilot valve distributes the oil pressure in the regulating cylinder. The motion of the regulating piston is reversedly transmitted to the regulating valve by means of a combined compensation. The leverage of this compensation is adjustable, so that the governor may be set to any change of speed between no load and full load, from 16 per cent. to absolutely constant speed.

The governors are equipped with four regulating devices which can be used at any time, viz.:

1. Mechanical hand regulation (without oil pressure).

2. Automatic regulation with flyballs.

3. Hand regulation with oil pressure (flyballs disconnected by a clutch coupling inserted between pump shaft and flyball shaft).

4. Hand regulation with oil pressure and electric motor operated from the switchboard. (Synchronizing attachment.)

The exciter governors are of similar design, except that they are not provided for electric hand regulation.

The Kern River installation of the Edison Company is but one of three waterpower developments owned by this company in addition to six or seven steam plants located within a radius of 200 miles, all of which will operate in synchronism. A portion of the output of this plant will be disposed of along the line to Los Angeles. A very considerable amount of power will be utilized in the city of Santa Barbara. The demand for power in Los Angeles, Santa Barbara and San Luis Obispo counties far exceeds the supply, and the output from this station will help to satisfy the general requirements rather than be devoted to any specific purpose. The Edison Company contemplates the building of plants Nos. 2, 3 and 4 on the Kern River, which will aggregate over 100,000 horsepower in addition to the output of the present station.

Milling Head Used as Ice Cutter for Third Rail.

Sleet and ice are sources of great annoyance to third-rail systems of railways for the reason that the coating on the third rail which they form acts practically as an insulator to prevent the current from reaching the shoe or contact device on the

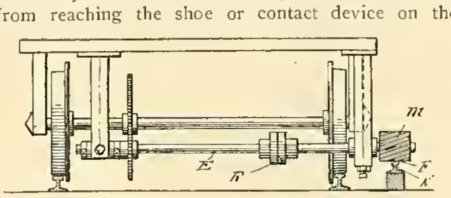


FIG. 1. MILLING-HEAD ICE CUTTER FOR THIRD RAIL.

car. Various methods have been proposed to cope with the difficulty, including the use of chemical solutions or mechanical rail cleaners, and several are in use. An interesting example of the mechanical type is that recently invented by George A. Spice of Chicago and covered by a United States patent. Here a milling-head or cutter is used as shown at (F) in Fig. 1 of the accompanying drawings, which shows the manner of attachment to the car truck, the third rail being at (N). Fig. 2 is a vertical section of the cutter employed, and Fig.

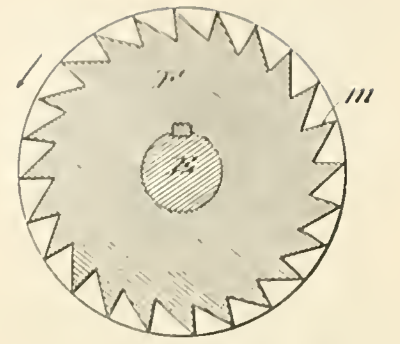


FIG. 2. VERTICAL SECTION OF THIRD-RAIL ROTARY ICE CUTTER.

3 is a partial, horizontally developed bottom plan view of the same cutter.

The drawings show the general arrangement of Mr. Spice's invention with sufficient clearness. The cutter-head is practically cylindrical and provided peripherally with teeth (m) disposed spirally and parallel with each other. It is so disposed relatively to the car wheels as to normally ride upon the third-rail of the system, being normally maintained under pressure in contact with the upper surface of the third rail by means of springs, the latter serving also to cushion vertical movements imparted to the cutter-head by inequalities in the height of the third rail at various points along the route.

Gearing is provided so that a higher surface speed is imparted to the cutter than the surface speed of the car wheels. The cutter revolves in the same direction as the wheels.

The teeth of the cutter (F) are disposed so that one face is practically radial, and this face is presented in the direction of motion of the cutter, so that the sharp cutting edges will during the revolution of the cutter-head act in practically the same way as the cutter-head of a planer to cut away any coating of ice or sleet on the rail. The angle of disposition of the teeth is also such relatively to the direction of motion as to throw the ice and

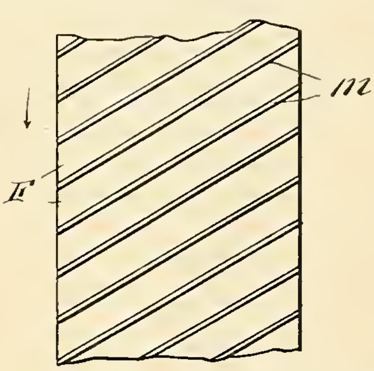


FIG. 3. PLAN VIEW OF THIRD-RAIL ROTARY ICE CUTTER.

sleet removed away from the car instead of toward it.

An insulating coupling (R) is provided on the shaft (E) of the milling-head cutter. The device is simple, and during warm weather it may be readily removed from the truck.

Hydro-electric Power for the Alamo Mining District.

A hydro-electric development attended by extraordinary conditions as to character of country and difficulty of construction is being completed on Congo Creek, 20 miles west of Sumpter, Ore., by the Fremont Power Company, of which Mr. John Thomsen is manager. The company has expended about $500,000 thus far and proposes to furnish power for operating the quartz mills in the Sumpter district, driving the machinery of the Sumpter smelter, and furnishing light for the city of Sumpter. The plant is installed, the transmission line is nearly completed to Bourne, and current is about to be turned on to that point. Bourne is a mining town, five miles from Sumpter, and is the center of the Alamo mining district, including the Alamo, Quebec, Strasburg, Belcher, I. X. L., Hicks, Phœnix, Psyche, Snow Creek and other quartz mines where stamp mills are being erected. The line will be extended south to the Quartzburg district, where are the Standard, Copperopolis, Present Need and Gem mines.

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CORRESPONDENCE relating to electricity or any of its practical applications is cordially invited, and the co-operation of all electrical thinkers and workers earnestly desired. Clear, concise, well written articles are especially welcome; and communications, views, news items, local newspaper clippings, or any information likely to interest electricians, will be thankfully received and cheerfully acknowledged.

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CONTENTS OF THIS NUMBER.

DEPARTMENTS.

DATES AHEAD.

Canadian Electrical Show, Power Building, Montreal, September 2d to 14th.

Colorado Light, Power and Railway Association (annual meeting), Savoy Hotel, Denver, Colo., September 18th, 19th and 20th.

Central Electric Railway Association (regular meeting), Columbus, Ohio, September 26th.

New York Electrical Show, Madison Square Garden, September 30th to October 9th.

American Street and Interurban Railway Association and affiliated societies (annual convention), Atlantic City, N. J., October 14th to 18th.

TYPOGRAPHICAL ERRORS are seemingly destined to cause annoyance, profanity or hilarity, as it may be, so long as the art of printing continues to exist. A curious example of these thorns in the flesh occurred recently in an esteemed English electrical journal. Speaking of the recent American specifications for street lighting, this journal remarked that "the committee consisted of Messrs. Dudley Tarrand, A. E. Kenelly, C. P. Steinmentz, L. A. Furguson and P. Spencer." In this list every surname is misspelled except the last.

TO ENCOURAGE the wiring of old buildings the monthly-payment plan is adopted by central-station companies with gratifying results. Mr. F. H. Golding of Dayton recommended this plan "where conditions seem to warrant" in his paper, "How to Get the Old Buildings Wired," read on June 7th last at the Washington convention of the National Electric Light Association, and the subject also attracted much attention at the recent Ohio convention. The Chicago Edison Company has now adopted the plan and extended it to make the cost of the wiring of the old building payable in 24 monthly installments. This makes the cost of even quite a considerable job of wiring scarcely felt, and the plan is proving remarkably successful. Many customers are by this means secured who would not otherwise feel able to meet the installation expense.

THE DISCHARGE of electricity at high potentials through gases has been the subject of some attractive laboratory experiments in the production of artificial fogs on the small scale of a bell-jar, whose results have led to beautiful and accurate determinations of the absolute size and number of the molecules of the gas. Reversing the process there has been proposed the artificial dispersion of fogs by similar apparatus working on a larger scale. The proposed station will require a large induction coil or transformer capable of giving a spark about 40 inches. Its primary will be energized by a source of direct current, the circuit being rapidly broken by a rotating interrupter. A condenser may be bridged across the interrupter to absorb the heavy arc which would follow the breaking of the large current required to operate the coil. The current from the secondary windings is led through mercury-vapor rectifiers which change it from alternating into a pulsating unidirectional flow. Large Leyden jars are connected in the circuit to secure the proper capacity. The positive wire is carried to the top of an aerial mast, where it ends in a crown of points. It is said that with such apparatus clear spaces 300 to 400 feet across have been found in very thick fogs. While clear regions even of this size would be very useful in harbors or on railways, it is to be remembered that such a space extending at least for a quarter of a mile in every direction from a vessel at sea would be necessary for safety if bare steerage headway were to be maintained. But the proposition is an attractive one and seems endowed with potentialities, when developed on a still larger scale, of avoiding collisions with other vessels, derelicts and icebergs which are the dread of mariners.

PRESENT PROSPECTS are that the time is near at hand when Chicago will be connected with Detroit, Indianapolis and St. Louis by diverging lines of electric railway on the east, southeast and southwest as it already is with Milwaukee on the north. The line to Kankakee, 54 miles south, will be in operation in a few months, no doubt, while the nearby cities of Elgin, Aurora and Joliet have been linked to Chicago by electric bonds for several years. The constant extension of the interurban electric railway and its ever-increasing popularity constitute one of the most significant economic tendencies of the present day. The electric lines link town and town and city more closely together. People like to ride on them, particularly in summer; they afford frequent trains and convenient stopping places. They are home-like and neighborly, while the comparatively infrequent steam trains are more alien and strange. At first the retail merchants in villages and small cities feared that the interurbans would tempt the country people to go to the larger cities to do their shopping to a greater extent than before; but it is found that the country merchant can also take advantage of the interurban to secure quick shipments, to keep himself as well as his stock up-to-date by frequent visits to the city. The electric railway is popular with all classes, with the women and children as well as with the men, and it needs only a trip into the country in almost any direction to see how rapidly it is being extended.

This popularity is not likely to be endangered unless a false economy in men or material results in a disproportionate number of accidents. Some accidents seem to be bound to happen in railroading—to be beyond human foresight—but many that do occur could be prevented; and the responsible managers of the electric railways, profiting by the painful record of the steam railroads in this country, will do well to make safety of travel an aim of such great importance as not even to be eclipsed by the very natural and laudable desire to return large dividends. Let the electric railway be synonymous with the most careful regard for human life, and let the electric-railway accidents that have already happened—would that there were less of them!—serve as warnings or severe lessons which may make like disasters less frequent in the future.

MAYOR BUSSE is to be thanked and congratulated for his first message to the Chicago City Council, in which he advocates the "electrification" of the steam railroads within the city. This reform is needed and inevitable, and the Western Electrician has pleaded for it for several years. The mayor's action was indorsed by the Council, and accordingly the local transportation committee of that body, with expert assistance, will "make such investigations and prepare such reports as may be necessary, to advise this Council fully as to the possibility of installing the necessary electrical equipment for use on the railway terminals of Chicago to do away with the steam engines and eliminate the smoke nuisance from that source." The mayor's message is a temperate document, and indeed it is to be expected that anyone who has given careful attention to the subject will appreciate the magnitude of the problem and the expense and effort which it will impose upon the railroad companies. Nevertheless, the improvement is bound to come, and the mayor's action will doubtless prove to be the entering wedge which will result, in a few years, in the electrical operation of the railroad terminals in Chicago.

In his message the mayor calls attention to the example of New York city in electrifying railroad terminals, and he remarks that if similar action be taken in Chicago the smoke nuisance would be thereby greatly abated. The mayor investigated the situation in New York, and in his report continues:

"Our observations, while satisfying us as to the advisability of substituting electrical motive power for steam power on railroad terminals in the city, have no definite bearing, of course, upon the difficulties to be surmounted and the practical details involved in the working out of such a change. As Chicago is the greatest railroad center in the world, this problem of doing away with the common type of soft-coal-burning steam engines inside the city is, of course, a tremendous one, but it is a problem which I think the railroads realize must be faced some time in the near future, and it is one which the city must help to solve, to the end that the smoke nuisance may be eliminated."

The mayor advocates the change on the single ground of abating the smoke nuisance, but there are also other advantages, as the marked decrease in the noise of train operation—and the noises of city life constitute a serious detriment to health and comfort—and the greater ease of riding for the many thousands who use the trains daily, to say nothing of the enhancement of property values in neighborhoods adjacent to the railroad lines. Chicago will be greatly benefited by the change, and although the undertaking is a large one, it should be entered upon with a confident and resolute spirit.

Insurance Report on Motor and Generator Accidents in England.

The British Engine, Boiler and General Insurance Company issues annually an instructive report upon the electrical and other machinery which is confided to its care. The following results of the inspections in connection with breakdowns and other accidents are furnished by the London correspondent of the Western Electrician, who says:

It is satisfactory to note that whereas a considerable increase took place in the number of dynamos and motors insured, the breakdowns increased in a lower ratio. Dynamos failed in the proportion of one in 16 of those insured, and motors, one in 8.2. Direct-current machines failed twice as often as alternating-current machines, but the cost of repair per breakdown for direct-current machines was only about one-half that of alternating-current machines. The company has also now a large number of starting resistances insured, but the breakdowns of these have increased far more rapidly than in the case of dynamos and motors.

A warning is uttered against the use of foreign-made commutators, which invariably seem to have the insulating washers of "made-up" mica of poor quality material, instead of the soft, green mica, for small motors, as frequently recommended.

The following figures show the percentage proportion of the various parts of machines which have failed: 50 per cent. of armatures and rotors in dynamos and 44 per cent. in the case of motors; 11 per cent. of magnet coils and starters in dynamos and 14 per cent. in motors; 20 per cent. of commutators and brush gear in dynamos and 28 per cent. in motors. The remaining 19 per cent. and 14 per cent., respectively, are attributed to miscellaneous.

In connection with starting switches and controllers, it is stated that 48 per cent. of the resistance coils have failed; 10 per cent. of contacts and switch arms, and 17 per cent. of the automatic apparatus. In attributing the breakdowns to various causes, it appears that the largest percentage in the case of dynamos is due to bad workmanship and design, while in connection with motors and starters age and deterioration are responsible for the greater proportion of mishaps.

This report is quite an unofficial one, issued by the insurance company in the interests of its clients, and is quite distinct from the Home Office electrical inspector's report. Nevertheless, although the present document is not of such a far-reaching character in importance, it contains information, gained from actual experience, of value to all manufacturers of electrical and other plants.

Canadian Electrical Convention.

Plans for the seventeenth annual convention of the Canadian Electrical Association have progressed most satisfactorily with the result that a programme of unusual interest has been prepared. The convention will be in Montreal on September 11th, 12th and 13th and the meetings will be held in the assembly hall of the Canadian Society of Civil Engineers. Exhibits will be in the government drill hall on Craig Street. The local committee has prepared an excellent programme of entertainment features.

The usual arrangements have been made with the Eastern Canadian Passenger Association, including points in the United States in its territory, for reduced fares on the certificate plan for both rail and water. Persons should purchase a first-class full fare one-way ticket to Montreal and obtain from the ticket agent a standard certificate. If 50 certificates are presented the return fare will be one-third; if 300 or more certificates, free return.

After the usual opening exercises, including the president's address and committee reports, the following papers appear on the programme: "Electric Heating and Cooking Devices," by A. B. Lambe; "Trials of the Operating Man," by M. A. Sammett; "Three-wire Generators," by B. T. McCormick; "High-tension Insulators from an Engineering and Commercial Standpoint," by Clarence E. Delafield; "The Value of the Nernst Lamp to the Central Station," by A. E. Fleming; "Incandescent Lamps," by J. M. Robertson; "Frazil and Anchor Ice—the Difficulties They Cause at Hydraulic Plants—Some Remedies," by John Murphy; "The Load Factor," by R. M. Wilson; "Modern Lighting Transformers," by G. P. Cole; "The Responsibility of Electric Companies for Accidents," by George H. Montgomery.

Parts of each session will be devoted to the Question Box. Elaborate preparations have been made for entertaining the guests, including several special features for the ladies.

Mr. R. G. Black of Toronto is president of the association and Mr. T. S. Young is secretary.

Luminous Arc Lamps from the Standpoint of Central-station Operation.[1]

By Howard Grabill.

The Ashland Gas and Electric Light Company was one of the first central stations in Ohio to adopt magnetite or luminous arc lamps. This installation, made in December, 1905, consisted of 90 type 2 lamps, the rate for energy on a midnight moonlight schedule being $68 per lamp per year.

During the present summer we have been replacing this lamp with the type 3, which corrects about the only defects we have found the magnetite lamp to have. In the place of a swinging upper electrode a stationary one is substituted. The latter gives better service and is also reversible, thus practically doubling its life. A heavier and closed globe is also used instead of the former one with an open bottom, to which a rather heavy ash-pan was attached.

As T-H open arc lamps were formerly used for lighting the streets of Ashland, what we have to say is in the nature of a contrast between that lamp and the magnetite lamp. Our experience proves the latter to have many decided advantages. These points of superiority may be placed under two heads:

(1) Advantages to the public.

(2) Advantages to the central station.

The advantages to the public are (1) improved distribution of light; (2) better quality of light, and (3) fewer outages. For the central station we find the following points of superiority: (1) Economy of energy. (2) Lower cost of maintenance. (3) Ease of adjustment. (4) Ease of trimming, and (5) lower cost of repair and renewal.

The open carbon arc lamp will be remembered as having a large shadow just beneath it, a wide variation of illumination due to the wandering arc, and as giving a good light for a short distance, beyond which point the amount of light falls off abruptly. With the magnetite lamp the distribution is much more uniform. A globe with a frosted or sand-blasted bottom is used and there is almost no shadow beneath the lamp. As one walks from one toward the next, one notices that the illumination midway is much better. This is because there is more light reflected there, and also because of the absence of that sharp contrast between the amount of illumination under each open carbon lamp and that midway between them. As we made no readings with a luminometer while operating the open carbon lamp, we can make no comparison on this basis with the magnetite lamp. However, we did make some readings in a neighboring city where alternating-current enclosed series lamps are used, and find that the amount of illumination there at a distance of 165 feet is equal to that at the distance of 205 feet from a magnetite lamp.

Two things make possible the better distribution of the magnetite lamp. First, the positive electrode does not form a crater as does the positive carbon of an open arc lamp, resulting in the axis of maximum distribution being at an angle of about 45 degrees. Second, since the arc in the magnetite or luminous arc lamp always has the same relative position, it is possible to use a reflector. This reflector is placed in a horizontal position just above the arc, but being enameled iron it is unaffected by the heat and so is not a part that would need to be renewed during the life of the lamp. The result is that the axis of maximum distribution of this lamp is at an angle of about 90 degrees, or almost horizontal.

The quality of the light is excellent, being whiter than that from alternating-current lamps and steadier than from open carbon lamps. Another advantage which this lamp has is that of fewer outages. When a lamp is found not to be burning it can usually be started by jerking the rope by which it is raised and lowered. It is caused by a small particle of the burnt electrodes getting between them and acting as an insulator. We have found it necessary to replace broken globes at once, as this lamp will not burn unprotected from the air. This is no serious defect, as the long-burning feature of the lamp makes frequent trimming or handling unnecessary; hence the chances for broken globes are reduced. In our experience the ratio of outages as compared with the carbon lamp is one to three in favor of the magnetite lamp.

The low wattage of the magnetite lamp is one of its most distinguishing characteristics. It is designed to operate on direct-current series circuits with 70 to 85 volts at the lamp terminals or by mercury arc rectifiers connected to alternating-current circuits. We are using the direct-current system, energy being furnished by a Brush arc machine. To replace a 480-watt lamp with one consuming 320 watts we have found to be a great benefit to our company.

Because of the long-burning feature of this lamp the maintenance cost, as compared with open carbon lamps, is very low. The upper or positive electrode, a heavy piece of copper, is reversible and has a life of about 4,000 hours. The lower electrode, an iron tube five-eighths inch in diameter and eight inches long, and filled with black magnetite oxide of iron, has a life of 175 hours. It is thus necessary for us to trim our lamps only nine times a year. The cost of maintaining these electrodes on a schedule such as ours is about 60 cents per lamp per year.

The two adjustments—the length of the arc and the feed contact magnet—are easily made. The length of the arc is controlled by an adjustable stop which is fastened by a set screw to the left-hand guide rod. To increase the arc voltage, raise this stop; to decrease the voltage, lower it. After an adjustment has been made the lower electrode rod should be tripped and then pushed up as in trimming. The feed contact magnet is adjusted by lowering or raising the armature disc and checknut placed just below it. If the lamp feeds too often the disk should be turned to the left. If not often enough it should be turned to the right. This magnet is in shunt with the arc and should close the contacts, causing the lamp to feed, when the arc voltage rises to about 110 volts. As we have said, these two adjustments are easily made.

In trimming the lamp the first thing to do after the globe has been unlatched and swung over to the side is to clean the center tube. It serves as a chimney through which the fumes of the arc pass out of the lamp, and unless kept clean there is danger of these reddish-brown fumes accumulating in it, clogging it up and then settling on the inside of the globe, shutting off the light. A small brush run through this tube a few times readily cleans it. Next the globe should be cleaned. The accumulation of this reddish-brown dust on the globes from one trimming to the next, while slight, is sufficient to cut off considerable light. It is, however, easily removed with a cloth dampened with coal oil. To replace the burned-out electrode the tripping rod should be pushed up until the clutch in the lamp is disengaged. The lower electrode holder will then drop into a position where the change is quickly made. To those who have had the experience of trimming of the open carbon lamps, the ease with which the magnetite lamp is trimmed is at once apparent.

Repairs and renewals cost us last year 54 cents per lamp. With the type 3 lamp we do not think this item will be as large, since it has a heavier globe and does away with a large copper ash-pan, and these were the only two parts it was necessary for us to replace during the year. For the present year, however, this item will be larger on account of our changing to the new type lamp.

As a whole, the system comes fully up to our expectations and we regard it as the best in operation at the present day. In fact the magnetite lamp, with its improved distribution of light, economy of energy and low cost of maintenance, represents a distinct advance in the art of illumination and cannot but appeal to any central station contemplating a change.

1. A paper read at the Toledo convention of the Ohio Electric Light Association, August 20. Mr. Grabill is connected with the Ashland (Ohio) Gas and Electric Company.

The Easy-payment Plan of Wiring.

The Chicago Edison Company and the Commonwealth Electric Company have recently adopted a new plan for the wiring of residences and high-class apartments that has yielded excellent results. The scheme, in a nutshell, is to extend payment for this class of work into 24 equal monthly installments. By this policy a great deal of new business is being secured that otherwise could not be obtained, for the installation and wiring charges are spread out so that the consumer scarcely notices them.

A large part of the public has been eager for the use of electric light, especially since the recent further reduction of rates, but has hesitated on account of the cost of wiring. This problem has now been solved by the installment plan. The plan is confined to completed buildings and does not apply to new structures. The wiring of old buildings has been much more difficult to secure than that of new ones. Mr. Cregier of the contract department has charge of this line of work and reports that he can scarcely get men enough to handle it. This latest plan is but another move of the company in its campaign to make the use of electricity practically universal in Chicago and vicinity. The plan is also being tried in other cities.

Conventions at the Madison Square Electrical Show.

During the electrical show to be held at Madison Square Garden, New York city, September 30th to October 9th, two important conventions will be held in the concert hall at the garden. At recent meeting of officers of the Street Railway Association of the State of New York and of the state Gas and Electric Association it was decided to hold the annual gathering at Madison Square Garden during the show.

ELEMENTS OF ELECTRICAL ENGINEERING.

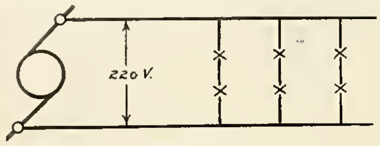
By Geo. R. Metcalfe.

XXXII.—Electric Lighting.

Balancing in Three-Wire Systems.

In order that the three-wire system of distribution described in the previous chapter shall operate satisfactorily, a careful study of the load should be made with a view to having it divided at all times as evenly as possible between the two sides of the system. The difference in the load between the two sides of the system is known as the unbalanced load, and it is important to keep the unbalanced load as small as possible, as any large amount of unbalancing seriously affects the regulation of the whole system.

If a much larger number of lamps are connected to one side than there are connected to the other side, the voltage of the light-load side will be too high, while that of the heavily loaded side will drop. For example, on a three-wire lighting

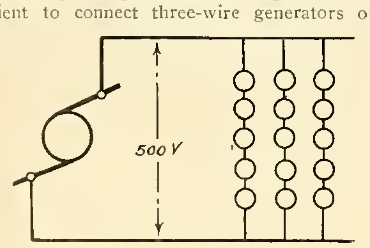


CONNECTIONS OF SERIES-MULTIPLE ARC LAMPS.

circuit with a normal voltage of 220 volts between the outside wires and 110 volts on either side, the unbalanced load may be sufficient to cause one side to drop to 108 volts, and the voltage on the opposite side will be 112 volts. If this condition exists in a central-station distribution, all the customers' lamps connected on the low-voltage side will burn below their normal candlepower and have a dim appearance, while those lamps on the high-voltage side will burn too brightly, which will considerably shorten their lives. In connecting the lamps on a three-wire system, therefore, great care must be taken so to arrange them that the load on both sides will be very nearly even.

In connecting up a small number of lamps, such as would be used ordinarily in a small private house, a two-wire service is usually supplied, which is connected on either side of the system, which will tend to produce the best balance. In larger installations a three-wire service is generally carried into the building, and the entire wiring of the building is on the three-wire system. Where any device is used which requires a large amount of current, such as a very high candlepower lamp or a large motor, it should be connected across the outside wires, where it cannot affect the balance of the system when thrown in or out.

From what has been said, it is evident that if the system were perfectly balanced there would be no necessity for carrying the middle or neutral wire back to the generators, as the neutral wire only carries the unbalanced load. In large stations, therefore, operating a number of generators, it is sufficient to connect three-wire generators of the



SERIES-MULTIPLE DISTRIBUTION —FIVE 110-VOLT LAMPS IN SERIES ON 550-VOLT CIRCUIT.

proper voltage to the outside lines only, and to install only a sufficient number of three-wire generators to carry the difference between the loads on the two sides of the system.

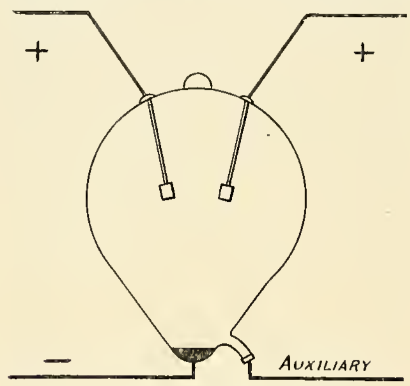
Series Parallel Distribution.

This system of distribution is used only to a limited extent for both arc and incandescent lighting. It consists of connecting groups of lamps in series and arranging several such groups in parallel. This connection is explained in the accompanying diagrams, and is principally used for operating two arc lamps in series on 220-volt distributing systems, or for operating series of five incandescent lamps from 550-volt railway circuits. The incandescent lamps used on electric-railway cars are generally connected in this manner, as are also many arc lamps which are used upon 220-volt constant-potential distributing systems.

Mercury Rectifiers.

Within the last three years mercury rectifiers have been used to some extent for the operation of arc lights. By means of the mercury rectifier direct-current arc lamps may be operated from alternating-current circuits without the intervention of moving machinery. Previous to this the only way to obtain direct current from an alternating-current supply was by the use of a rotary-converter or a motor-generator set, either of which consume considerable power and are impracticable for use where only small amounts of current are required, on account of their size and the expense of installation and attendance. The mercury rectifier changes an alternating current into a pulsating direct current without the use of any moving machinery, and is well adapted for the conversion of small amounts of current, as it occupies but little space and when once started operates continuously without further attention.

A diagram of the mercury rectifier is shown herewith. The rectifier consists of a glass bulb somewhat similar in outline to the ordinary pear-shaped incandescent lamp, and is about nine inches in diameter by one foot high. It contains four electrodes, the upper two of which are of graphite and the lower two of mercury. Each of these electrodes is provided with leads and terminals and the bulb is thoroughly exhausted of air. The two upper electrodes are called positive electrodes, and



OUTLINE DIAGRAM OF MERCURY RECTIFIER.

the large lower electrode in the center of the bulb is called the negative electrode. The small auxiliary lower electrode is used only for the purpose of starting the rectifier into operation.

The operation of the rectifier is based on the rather peculiar conditions which exist in relation to the conductivity of mercury vapor. When mercury vapor is in contact with solid metallic electrodes, current will flow very readily from the solid electrode to the mercury vapor, but if the current is flowing in the opposite direction, that is, from the mercury vapor to the solid electrode, the resistance is so high that it practically prevents all flow of current. In other words, the current flows readily from the solid to the vapor, and does not flow at all from the vapor to the solid. When alternating current, therefore, is supplied to the two positive electrodes of the rectifier, these electrodes pass the current in one direction only, and oppose all current flowing in the opposite direction, so that the pulsations of alternating current flow alternately between the positive electrodes through the mercury vapor to the negative electrode, which, therefore, gives off a direct or unidirectional current which is pulsating in character.

There is but little resistance to the flow of current between the mercury vapor and the mercury after the rectifier has started into operation, but there is a high resistance at the negative electrode which must be overcome before it is possible to start the rectifier into operation. The accompanying diagram of current waves will serve to explain the operation of the rectifier more clearly. Curves (A) and (B) show the current waves in the two positive electrodes, and the resultant curve (C) shows the rectified current which passes out from the negative electrode. The lower curve (D) shows the alternating-current electromotive force supplied to the rectifier, and it is apparent that if the part of the wave below the zero line were reversed there would result a direct current of very large pulsations which would vary from zero to the maximum value. While this would be a true unidirectional current, such a current could not be produced by the rectifier, for the reason that as soon as the value of the electromotive force reached zero the resistance of the negative electrode would be established, which would break the circuit.

It therefore becomes necessary to provide some means for bridging over this zero point of the electromotive force, and this is done by inserting a reactance in the circuit which changes the wave form of the current to the shapes shown in curves

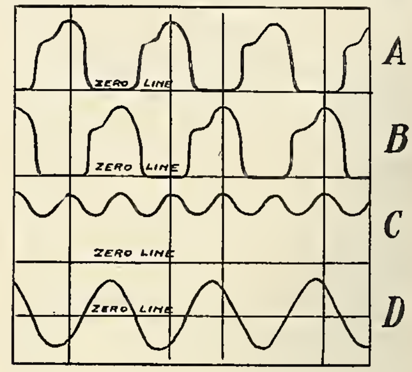


DIAGRAM OF CURRENT WAVES AND ELECTROMOTIVE FORCE.

(A) and (B). The reactance absorbs some of the energy from the peak of the wave and gives out this energy again at the lower part of the wave, so that the curve does not reach the zero point, and the two waves overlap, the resultant curve being shown at (C) in the diagram. It will be seen, therefore, that the whole of the alternating-current wave, both above and below the zero line, is utilized by the rectifier.

In order to start the rectifier into operation, the bulb is mounted so that it can be tilted, permitting the mercury to flow between the auxiliary and the negative electrode. The short space between the two electrodes is thus bridged by a little stream of mercury which becomes vaporized as soon as the current passes, after which the bulb is set vertical, and the positive electrodes come into operation. A resistance is inserted in series with the auxiliary electrode, through which the current is started. After the negative resistance is broken down and the positive electrodes become active, this starting resistance is automatically cut out.

The accompanying diagram shows one of the methods of connecting the rectifier to an alternating-current source of supply. In this method of connection the alternating-current circuit is con-

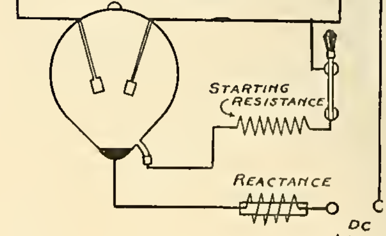


DIAGRAM OF CONNECTIONS FOR MERCURY-RECTIFIER CIRCUIT.

nected to two taps on an auto-transformer, which is a transformer with only a single winding, the location of these taps being determined by the voltage of the supply circuit. The two outside ends of the auto-transformer winding are connected to the two positive electrodes of the rectifier, and from the middle point of the auto-transformer a connection is brought out which completes a circuit through the load and the reactance coil in series to the negative electrode. The starting resistance is connected between the starting electrode and one

Note.—This series of articles, intended to survey, briefly, the whole field of applied electricity for light, power and heat, was begun in the Western Electrician of February 2, 1907.

of the positive electrodes. The supply circuit may be either 110 or 220 volts alternating current, and by inserting a suitable regulating reactance in the circuit the rectified current may have a range of from 40 to 125 volts. A single rectifier bulb has a capacity of about 30 amperes, and where larger currents are required, two or more bulbs may be operated in multiple. The efficiency of the rectifier varies but little from light load to full load and is in the neighborhood of 80 per cent. for its entire range of load.

[*To be continued.*]

What Is the Best Form of Power for Stations of Five Hundred Kilowatts Capacity or Less?[1]

By Prof. F. C. Caldwell.

Ten years ago this association would hardly have considered it profitable to give much time to a discussion of this subject, but so remarkable have been the developments in central-station apparatus in the last few years that now the question is far from being an easy one to answer. Like most questions of this form, it is quite incapable of a complete and satisfactory solution within the limits of a paper of this character, and what follows can only be regarded as a framework which the members of the society may perhaps develop into a valuable structure in the course of their discussion. "Power" will be taken in the broad sense of the term, and the best form for the supply of electrical energy will be first considered.

There are now available to choose from the following types of apparatus: Direct current two-wire 220-volt and three-wire 110-volt; also alternating current, single-phase or polyphase. The choice between these will depend, first, on the character of the load to be supplied; second, upon the size of the plant, and third, upon the conditions under which it will be operated. A few years ago the two-wire 220-volt direct-current system seemed likely to take an important position for the smaller central-station supply. But two factors have recently been introduced into the problem, which are both unfavorable to its growth. The first of these is the development of metallic-filament incandescent lamps. The low resistivity of metals as compared with carbons makes the extension of these to voltages as high as 220 seem improbable, while the great saving in current, resulting from their use, must not be overlooked. The other factor is the placing on the market of successful three-wire generators at a cost not greatly in excess of the standard types. The 220-volt system has never been much used in this country outside of the smallest plants, though its simplicity and comparative economy in distribution were strong arguments in its favor. It will doubtless continue to be employed in cases where transmission for power purposes is the main business; but where lighting is an important element it is probable that it has passed its period of greatest usefulness. The problem may therefore be narrowed down to a question of three-wire direct current versus alternating current, single-phase or polyphase.

As between the direct and alternating current the question of distribution of load is the most important factor. Wherever more than one town is to be supplied from the same plant, or where the character of the farming population is such as to make the sale of power and light among them a matter of importance, the decision must be in favor of alternating current. On the other hand, where the conditions seem to set definite and comparatively narrow limits to the area which the plant will supply, the greater simplicity, higher economy in distribution and superior regulation usually obtained from direct-current plants may determine in favor of this form of supply. The amount and character of the motor load must be given careful consideration. If this is large in the immediate vicinity of the power plant, and especially if variable speed is important, the direct current will have the preference. If, on the other hand, the demand is more widely scattered, or is of such a nature that the simplicity and brushless character of the induction motor recommend themselves, the decision may be favorable to alternating current. The use of the storage battery in connection with the direct-current system gives it an advantage. In some cases, for instance, it may be possible to supply direct current for 24 hours with the use of but one 10 or 12-hour shift, at the same time obtaining the great advantages in the matter of regulation and storage against an emergency shut-down which are provided by the battery. Such a use of the battery, however, would only be possible in cases where the motor load was negligible—a condition which is in itself unfortunate. In general also the small plant is unable to supply the same quality of expert attention for the battery as is possible in a larger station, and this would often make its use questionable. In the case of quite small stations, such as are now being installed to a considerable extent in the villages of the country, the use of an alternating current system with a frequency of 25 cycles should receive careful consideration. This would often be advantageous on account of the possibility, actual or prospective, of joining up such a plant with the 25 cycle distribution system of some interurban electric railway. Ample experience has demonstrated the satisfactory operation of incandescent lamps with 25-cycle current, and in almost every case it would be more economical to purchase power from railway systems during a considerable part of the 24 hours rather than to keep the generating plant operating continuously. In many cases the whole output of the station could be most advantageously obtained in this manner. This suggests the supplying of current from one plant to a number of small towns throuhout a given district—a field which deserves more energetic cultivation than it has yet received.

The question of the use of single or polyphase alternating current is also an interesting one. Single-phase motors are obtainable in small sizes running up to about 30 horsepower, so that where the supply of power in large units is not to be anticipated, as, for instance, in the case of a strictly farming community, much is to be said in favor of the greater simplicity of the single-phase. Especially is this true in the case of the smaller plants where it is not practicable to employ a superintendent who has had much training or experience. In the case, however, of the larger plants within the range which we are considering, especially if connection with an electric-railway supply circuit is considered, the polyphase system should probably be used. With a little more care in the distribution, just as good results can be obtained as with the single-phase, and the possibility of the use of larger motors is always present.

Turning next to the question of prime movers, the following classification will be useful:

1. Waterpower.
2. Gaspower—Natural gas, producer gas.
3. Steam power—Reciprocating engines, turbines.

With regard to waterpower nothing need be said, further than to predict that before many years much more electrical energy will be developed in Ohio by waterpower than is now done. It is a very interesting problem, but of course peculiar to special localities only.

Where natural gas is available there is hardly room for any further discussion of this subject, so far is the gas engine thus operated superior to all other forms of heat engines. With a thermal efficiency approximately double that of reciprocating steam engines, with the entire absence of loss when the engine is not running and with the great rapidity with which it can be brought into operation, no form of steam engine is to be compared with it for small plants. The complication and liability to accident and shut-down which have been in the past attributed, with more or less justice, to the gas engine, have of late been rapidly losing weight by virtue of improvements in design and greater familiarity on the part of engineers. In the case of small plants for lighting and power purposes the defect of the gas engine in not having a considerable overload capacity is not so serious as in other lines, although it must be taken into account in the design of the plant.

In the absence of either water or natural gas the producer and gas-engine plant is in free competition with the various forms of steam engine, with a strong indication that the odds are coming to be more and more favorable to the former. Here success depends entirely upon the producer, which seems satisfactory in the case of the harder coals. In Ohio, however, the producer must demonstrate its ability to handle the bituminous coals of the state before it can be generally accepted as a substitute for the steam boiler. Its friends already claim the victory, and when account is taken of the relative time that has been spent in the development of the producer and the boiler, those who have been devoting themselves to the former certainly deserve congratulation. With a producer working successfully with soft coal, the steam engine will indeed have to look to its laurels, for the possibility of getting nearly twice as much energy from a ton of coal, together with the small standby losses and the quick service, give the gas engine enormous advantages, against which the somewhat lower first cost and the long-standing reputation of the steam plant cannot long prevail. Steam is, however, still with us, and doubtless will be for some time to come.

So far, the great development which the turbine has induced in the case of the larger stations has not been much felt by the smaller. Although at present turbines in a variety of smaller sizes are available, their use does not show as great an advantage over the reciprocating engine as in the large sizes. Generally speaking, also, in the case of the small station, economy of space is not so vital a matter as with the large city plant. On the other hand, the simplicity of the turbine should be a matter of even greater consequence, so that the question of relative first cost would probably be a determining factor in most cases.

Of course, wherever condensing water is available in ample quantity, anything but the very smallest plant should be operated with compound condensing machines. The availability of condensing water would also be important in determining the use of turbines.

The use of artificial means for the cooling of the condensing water, such as towers or reservoirs, is a financial one, and depends largely upon the price of coal, the cheapness of which in Ohio would seldom permit of the use of this system.

Another factor which should always receive consideration, and which may at times determine the character of the steam plant, is the sale of exhaust steam for heating purposes. The jacket-cooling water in a gas-engine plant may be similarly used.

In the case of small lighting and power plants, their combination with some other form of industrial activity should be given consideration. In many cases, a power plant may be made to pay if, during the daytime, the energy of the plant can be consumed in the operation of some productive industry. This works out especially well where the industry is of such character that a part at least of its machinery can be closed down an hour or two earlier during the winter months without seriously interfering with its success. A combined electric and pumping plant is a similar case. This is an especially desirable arrangement, if water storage is available, so that the pumps can be entirely shut down during the period of peak load. In this connection the electrically driven centrifugal pump, which has recently come before the public, ought to prove useful.

The above will serve to point out the wide range of choice with which the central-station designer of the present day is confronted, and to indicate in some measure the lines along which his decision must be made. It must never be forgotten, however, that here, as in most other engineering works, every case is a problem by itself and should be carefully studied in order to obtain the bearing of all accompanying conditions before deciding as to the best form of power.

1. Paper read before Ohio Electric Light Association at its thirteenth annual convention, held in Toledo, Ohio, August 20, 1907. The author is professor of electrical engineering in the Ohio State University.

QUESTIONS AND ANSWERS.

Resonance.

C. F. W., New York, referring to the formula for resonance, $2\pi nL - \frac{1}{2\pi nC} = 0$, states that at University College, London, some recent experiments with circuits having resistance, inductance and capacity showed $2\frac{1}{2}$ complete vibrations per second when C was 7 microfarads, L 31.5 millihenrys, and the resistance 7 ohms, and wants to know how 2.5 can be the proper value for n.

Answer.

The values given by C. F. W. do not show that $n = 2.5$ is the proper frequency for a condition of resonance; in other words, if n is 2.5, resonance could not exist. A derived formula obtained from the one above shows that $n = \frac{1}{2\pi\sqrt{LC}}$ is the critical frequency for particular values of L and C. With the values given above n must equal about $33\frac{1}{3}$ cycles per second.

Taper of Starting-box Resistances.

G. A. R., Chicago: Please give a formula for determining the resistance of the different steps of direct-current motor-starting boxes. Also kindly explain how to design solenoids for operating switches.

Answer.

The "taper" of the resistance in the different steps of a starting box depends upon the size of the motor and the purpose for which it is to be used. For small motors, the resistance steps are usually all equal. For a five-horsepower machine, under ordinary conditions, the steps might be tapered down until the last is only about half of the value of the first step; that is, resistance is cut out more rapidly during the first period of starting. For larger machines the ratio may run as high as one to six, but is so dependent on the starting behavior of the motor and many features of its design that no more definite statement can be made.

Formulas which will give data for the design of solenoids to exert a given effort will be found in practically all electrical textbooks, but the actual results depend so much on the length of the sucker armature and the air-gap around it that the best determination for the purpose will possibly be obtained from a simple experiment under the desired conditions.

Holland, Mich., is undecided whether to give a trial this winter to the Grand Rapids-Muskegon Power Company, buying current from that company instead of operating the municipal plant, and retailing it in the city.

SELLING ELECTRICITY.

Under this heading will appear, from time to time, articles, suggestions and examples which will be of assistance in the constant effort to increase the existing demand for electric current and to create new demands.

Best Ways to Meet Gas and Gasoline Competition.[1]

By F. H. Golding.

As a preliminary a list of present and prospective gas users should be obtained by a house-to-house canvass if necessary, ascertaining at the same time whether the premises are wired for electricity or not.

From the information thus obtained a working list should be prepared and the solicitor is then in a position to go after the business in a systematic and thorough manner, assisted by mailings of pertinent literature at regular intervals. In conjunction with the efforts of the solicitor and with personal mail matter, judicious and varied newspaper advertising will be found effective.

Possibly the gas or gasoline gas is proportionately a little cheaper per thousand feet than your electricity is per kilowatt, but the solicitor has a variety of arguments with which to meet this situation.

As a majority of central stations now furnish free lamp renewals and free maintenance of fuses and other slight repairs, the expense and maintenance of mantles are good talking points for the solicitor, and in many cases will make the cost of gas lighting higher than that of electric lighting. As additional arguments in favor of electricity the solicitor has cleanliness, coolness, convenience, freedom from danger of fire or asphyxiation, the elimination of redecorating at frequent intervals due to discoloration from burning gas, ability to use an electric fan, iron, sewing-machine motor or other convenient appliance when electricity is available, and many other points which suggest themselves.

The mail matter should be carefully selected with a view of aiding the solicitor in impressing the prospective customer with the general desirability of electricity, and should be so alternated with the solicitor's visits as to prevent the prospect's interest from waning in the slightest degree.

The central station should pursue a liberal policy relative to the connected load for which it will set a meter and furnish service, as frequently a very small current consumer, possibly a heating pad, fan, porch light or something practically as negligible as a revenue producer will lead to the extension of electric service over the entire premises. The electric flatiron is particularly effective in this direction, and a number of stations within the writer's observation have secured gratifying increases in their old-house business by pushing the iron where other arguments have failed.

Probably the most serious obstacle met with in gas competition is the expense of installing the electrical work, particularly in old houses, but a judicious handling of the subject on the part of the central station will overcome it. One plan which is productive of good results is the installation of a certain number of outlets at slightly above cost, furnishing everything complete and ready for use, to introduce the use of electricity on the premises. First ascertain the cost of installing the proposed number of outlets in ten or a dozen houses, selecting various types and sizes, so that an average will be a fair indication of what the average cost will be; decide on a line or set of fixtures, add the price of the fixtures to the average cost of wiring, and add 10 per cent. to the total, which will give you a flat price per house to submit to your prospects.

Another plan which is used very successfully by some of our Ohio companies is an arrangement whereby the prospective customer may pay for the work in six, 12 or 18 monthly payments, as the customer may desire.

In some cases the company contracts directly with the prospect as agent for the electrical contractor, and in others the contractor deals directly with the customer, submitting the proposition upon notification from the solicitor that the customer will entertain it, the central station guaranteeing the contractor against loss as a consideration for carrying the long-term account.

In using the partial-payment plan it may be entirely feasible to add, say, 10 per cent. for the incidental expense of carrying the account, but this will be governed by local conditions.

A room equipped with gas and electricity for purposes of comparison will greatly aid the central station in competing for store and factory lighting. In one 15 by 24 "comparison" room belonging to an Ohio company one-half the room is equipped with an open flame burner, a Welsbach burner, an inverted mantle burner and a gas arc, all so arranged that any one fixture will give its maximum light without shadows from the others. The electrical half of the room is equipped with incandescent high-efficiency and Nernst lamps so arranged that any desired combination of lights can be obtained by manipulating switches. At one end of the room indicating wattmeters and gas meters are installed, so that the comparative lighting and cost values may be readily demonstrated.

1. Abstract from suggestion offered to the Ohio Electric Light Association at the Toledo convention, August 22d. The gentlemen quoted are connected with Ohio central stations.

In competing with gasoline the added insurance hazard makes a very good argument, and a statistical compilation of fires and explosions resulting from the use of gasoline is an excellent thing for the solicitor to have with him.

By Samuel Rust.

This is a subject that every central-station man in the smaller towns and cities has to contend with and is, to my mind, a very hard one to overcome. Our business men in the smaller towns have much time to figure on expenses and count the time which they or their employes waste in cleaning and repairing gasoline or other apparatus for lighting as nothing.

A great many feel that they have that time, they are paying for it and might just as well be doing that as nothing, and the writer's experience has been when a man gets it into his head to put in a lighting outfit of this kind he will not listen to any argument you may produce. He simply compares cost of gasoline with watts consumed for a given amount of light. I have found the best thing to do is to go to your man and make a plain statement of what you know as to the cost of the installation, maintenance, depreciation and trouble. This statement may not bring results at the time, but he will remember what you have said, and if he puts in his system every time there is anything wrong it will call to his mind your talk with him. When his system begins to clog and give poor light, together with the repairing cost, constant care and expense, he will again think of your statement and wonder after all if you were not right. In the meantime you should make a special effort to be friendly and courteous to him, dropping in his place of business as often as convenient, and endeavoring to get just as near him as possible. The result will be that in time you will find that he will acknowledge his plant is not a success, and he will consent to figure with you for electric light. This is the time to get in your work, and if you have any inducements to offer, give them to him, and you will have a customer who will stay with you.

The most important and effective time to prevent this competition is before your customer gets dissatisfied. Your efforts should never cease along the lines of good service; see your customer as often as possible; study his conditions; if his place could be fitted up to get better service for less money, make suggestions to him and show him the result he might obtain.

The time has come when the central-station man must study and work for the interest of the customer as well as for that of the company, and he must use every effort to make the public feel that he is not only working for his own interest but for their interests as well.

In a small town or city cost is a big item to the business man. We have found that the installation of some high-efficiency lighting units, even though at a sacrifice to the company, will go a long way in warding off competition. A new style cluster, the addition of a reflector or the installation of an attractive lamp often is all that is needed to continue profitable business relations between the company and the customer.

In our city we are in competition with artificial gas at $1.30 per thousand and natural gas at 25 cents per thousand. The artificial gas arcs have been a very strong competitor of ours for some time, due to the gas company furnishing gas arcs free to any one that would allow them to be installed. This plan took with the people for a short time, because it appeared that they were getting something for nothing, but the reaction is coming now. It started when the customers found that their bills were not materially reduced; in fact many found that their expense for light was even higher for gas than with the electric light.

The dangerous character of gasoline and acetylene outfits is always a strong factor against their use, and the complicated nature of the apparatus and the inexperience of the users give a constant opportunity to urge the substitution of electricity. Friendly relations and frequent talks with the users finally bring results.

To recapitulate, I would suggest the best way to meet gas and gasoline competition is: Good service; prompt attention to complaints; maintain friendly relations with the non-user of your product; frequent calls and talks on his method of lighting; furnish best appliances for his use and reduce his lighting cost as much as possible consistent with good service.

By W. E. Russell.

During the 1905 convention one of the members suggested that he had been having some competition with acetylene gas plants and that he had gotten the idea to subscribe to a clipping bureau for all correct accounts of accidents therewith. The writer had occasion a short time later to forestall the first efforts of a salesman of acetylene plants by an advertisement which was run for a time in the local papers.

If the clipping bureau could furnish ammunition to fight acetylene, how much more effective it would be if one should get the clippings as to natural-gas accidents, because natural gas is in far more general use. In the fall when the long evenings had begun and people began to use the gas for heat and light the accounts of explosions and other fatalities began to flow to us through the mail with such regularity that we had enough accounts to publish a different one about every day in our local papers. The paper and date of issue which furnished the clipping were given credit in each case, and at the end was added some unsigned comment like: "Use coal for heat, electricity for light and be safe, healthy and happy." This scheme is effective, beginning regularly every fall and continuing through the winter. It is a mighty good way to combat gas, and it is not expensive. There are a number of clipping bureaus which will furnish all references to one subject for from $3 to $5 per month. Try it.

Examine your rates with a view to lowering them. Figure out cost of production first and then readjust. Go to the hotels, restaurants, drug stores, barber shops, in fact all the long-hour burners, and notify them that the gas company has now had the long-hour consumers of light long enough and that you are now making a rate that will force a swap of the short-hour burners for the long ones. In Massillon we have made a saloon, barber shop and drug-store rate of $5 per kilowatt of lamps installed as a "readiness-to-serve" charge and two cents per kilowatt for all current use. For example, a man has lamps installed that will consume 900 watts in an hour if all are burning; we make him a "readiness-to-serve" charge of $4.50 net per month and he pays two cents net per kilowatt for all current consumed, making out the bill at $5 per month for "readiness to serve" and three cents per kilowatt for all current consumed, with a discount of 10 per cent. of the "readiness to serve" and also of one cent per kilowatt for payment of the bill on or before the 10th of the month following use. We give free renewals of all clear lamps under this contract.

After more than a superficial examination through several years of competition with natural gas, the writer is forced to the conclusion that free lamp renewal giving is one of the most effectual ways to combat natural gas if combined with several others. Where the electric-light plant has no artificial light competition it may not be necessary to furnish free renewals; but with sharp gas competition there is mighty little to be said against such policy. Supply the customer with free lamps, and it not only insures you against the empty socket here and there, but it permits you to give the very best light service of which your plant is capable and at a minimum consumption of current.

Assuming that you are giving 24-hour service, go after the day user. Make a separate contract with each daylight off-your-peak user after you get him and do not try to keep rates uniform. Every different power user will present different conditions and justify rates to fit. When you make a power rate do not fail to make a minimum rate per horsepower per month.

Contract for a little space in the local paper. The electrical journals, trade publications and larger central-station monthlies will give you a lot of material from which you can crib. For a small amount you can be furnished with a monthly periodical issued in the name of your company with an ad on the back to fit local conditions. Do not say it will not pay in your town. It will. Buy a Neostyle or some other efficient duplicator of hand or typewriting and send out letter talks on what you have to sell. Do not fail in these talks to point out the defects and dangers of natural gas use. Put up an electric sign, no matter how modest its size, so that those who pass your office nights will see your good work. Impress it on your customers that you are doing all in your power to be accommodating and give a service unequaled by anybody's plant anywhere.

In order to cope with natural gas, the wiring up of new and old houses must be done at a minimum rate. The central-station man will be glad to give up the wiring business, but with natural-gas competition in smaller towns he is forced to do such work under present conditions, else he will not get all the business that he otherwise might.

If you have not waged an electric flatiron campaign your have not done your opportunities justice. Because we are, generally speaking, in the "juice" making and furnishing business, rather than apparatus vending, I believe it policy to put out irons, etc., at the lowest price possible.

By Arthur Pomeroy.

Of those who employ the gas engine for power purposes there are but few who include the full details in computing the cost of operation. The central-station representative, therefore, in endeavoring to advance the cause of the electric motor, is confronted at the outset with considerable misplaced confidence in the economy of a gas engine.

When an estimate is made on the cost of central-station purchased electric power, practically all expenses are included in the electricity cost, whereas the expense usually given for operating a gas engine includes gas alone, which, of course, is but a small portion of the total expense. To the cost of gas should be added the expense for oil, water, repairs and labor; depreciation, interest, taxes, insurance and value of space occupied.

For engines of 30 horsepower and under, running 10 hours a day, the water consumed will approximate 3,000 cubic feet per horsepower-year; lubricating oil, about 12 gallons, and this must be of a better grade, owing to the high temperature, than that used in a steam engine.

The repair bill on a gas engine is governed mainly by the design and workmanship in the engine, its age, the operator, and the character of the load on the engine. In general practice the average annual amount of repairs during the useful life of a small single-cylinder gas engine has been found to vary from eight to 15 per cent. of its first cost.

One of the most widely disputed items of expense is the salary of an operator. Almost every gas-engine salesman claims that anyone possessing a reasonable amount of mechanical intelligence is competent to operate the engine, all that is necessary being to start and stop it and keep the oil cups filled. It has, on the other hand, been demonstrated that a gas engine requires an operator of more than ordinary mechanical experience and ability to care for it, and in the long run needs more attention than a steam engine.

The stopping of a gas engine may be caused by premature ignition causing back firing; by the mechanical derangement of valves, igniters, governor mechanism, mixer, etc., due to wear and tear, poor design or cheap construction; by sudden variations in load and other causes. Likewise, the starting often causes much trouble, due to inability to secure proper mixture and ignition, and especially there may be trouble when the engine has to start under nearly full load. Accordingly, to insure good service, an experienced man in gas-engine operation should be employed, which obviously means an adequate salary.

Depreciation varies between 10 and 35 per cent. It is the consensus of opinion among users of gas engines that only in rare instances the useful life of a gas engine is as high as eight years, and many instances are known where gas engines have been scrapped at the end of three years. Twenty per cent., therefore, represents a low estimate for interest and depreciation.

Taxes and insurance should be added to the expense of gas-engine cost, and also the value of the space occupied by the engine. A motor can be hung on a wall or a ceiling, while a gas engine requires a good foundation and plenty of floor space, which latter perhaps could be used for manufacturing purposes.

It is conceded by those familiar with the relative load-carrying ability between gas engines and electric motors that the size of the engine must be nearly twice that of the motor to carry a given average load. For example, satisfactorily to take care of an average load of 10 horsepower a 20-horsepower gas engine should be installed, while a 10-horsepower motor would be sufficient. One reason for this is the natural loss in the engine itself, which includes its friction load. Another reason is that it has no overload ability. Its indicated load is its rated load.

The first investment, therefore, is greatly affected, which suggests a point too important to be overlooked—this is the earning power of invested capital. Money invested in almost any manufacturing business ought to earn at least 15 per cent., so that every $1,000 invested in motive power represents a loss of income of at least $150 a year, which amount should be charged to operating expense.

Under perfect conditions and on natural gas of 1,000 B. T. U., small gas engines consume about 15 cubic feet per indicated horsepower-hour, but under ordinary operating conditions an engine will consume about 30 cubic feet per indicated horsepower-hour. This is due to ill-fitting valves and shortage in B. T. U. of gas used and other causes. Running the engine while no machinery is actually in use rather than stop and start again increases the amount of gas for the power required. In many instances where a gas engine has been displaced by electric power it has been found that the engine has used over 50 cubic feet of gas, including gas consumed in overcoming engine friction, for each kilowatt delivered.

Fifteen cubic feet is the figure usually used in selling gas engines, but experience shows that an estimate based on 30 to 40 cubic feet is more nearly correct. When artificial gas is used the consumption will be from 20 to 28 cubic feet per indicated horsepower-hour, or from 53 to 75 cubic feet per kilowatt delivered, the variation being due to the different qualities of gas, which depends upon the method of manufacture.

In endeavoring to contract for electric power in competition with gas it is often advisable for the central-station man to confine himself at first to questions, as in this way he will be able to determine whether the prospective customer is fully acquainted with all the expenses and the accuracy of gas-engine operation. After making sure that such is the case, an excellent opportunity is afforded to bring up convincing facts that electric power supplied by the central station is ultimately the most economical and advantageous power to be obtained.

The perfect cleanliness of electric power and the small amount of attention required by electric motors recommends this power to many manufacturers. The comparatively noiseless operation of a motor adds greatly to its favor.

Electrical transmission is especially advantageous from the view of future enlargement, due to growth of business. As the business grows, motors may be added in proportion. An isolated plant has not this flexibility; its investment increases unduly with plant enlargement. This fact will appeal to a man starting a manufacturing business, for he has great faith in the future growth of his industry.

When the central-station man encounters a case where a gas engine is already installed and running smoothly he should thoroughly acquaint the owner with the advantages of electric power and see to it that he charges all the items of expense against his power cost. Then keep close watch on the performance of the engine. At the first sign of trouble be on hand with renewed activity in behalf of electricity.

By W. C. Anderson.

We believe the following to be a few of the best ways to meet natural-gas competition:

1. Make rates giving the long-hour burners prices in proportion to the cost of long-hour service.

2. Develop decorative lighting to the fullest possible extent to which this can be developed.

3. Give the customer the greatest possible amount of useful light with the smallest possible cost for current and maintenance.

4. Go after business like the sewing-machine agent goes after business. There is no reason why the electric companies should take a back seat for any one in commercial enterprise. Our profits depend greatly on the quantity sold, and we can afford to spend four times the money in getting the second $3 per capita of business than we can afford to spend in getting the first $3.

Do the street lighting. There is no reasonable excuse for a municipal street-lighting plant. Where there is a municipal street-lighting plant some one is to blame. Probably the city authorities are the principal offenders, but if they compel you to go with them one mile, go with them twain. The street-lighting contract helps to get business otherwise unobtainable. Every consumer should understand that the street-lighting contract helps the company to improve and cheapen his service and that he not only has a personal interest in this as a taxpayer but as a consumer of electricity.

By E. T. Selig.

Believing that one of the first things necessary in order to successfully meet natural-gas competition is ability to give good, reliable service, we started in at our power house, which was equipped with antiquated machinery, determined what should be done to make the operation of each department most reliable and efficient, and then made the necessary changes and additions all along the line from the fuel supply to the consumer's premises.

With service conditions satisfactory we next took up the rate question and adopted the following scale, to wit:

For the first kilowatt-hour consumed each month for each light or equivalent of maximum demand, 15 cents per kilowatt-hour.

For the second kilowatt-hour, 10 cents per kilowatt-hour.

For all over two kilowatt hours per light, six cents per kilowatt-hour.

A minimum bill equal to 15 cents for each light of maximum demand, but in no case less than $1.11 was charged.

A discount of 10 per cent. was allowed on all bills at the above rates if paid by the 10th of the month.

We established a system of free renewal of lamps growing dim or burning out in service, making a charge of 25 cents, however, for the first installation of lamps and for all renewals of broken lamps. We renew only lamps obtained from us, and in this way prevent contractors and others from furnishing a low-grade lamp.

With improved service, reasonable rates and free lamp renewals our old consumers soon lined up on our side, and through newspaper advertising, letters and personal soliciting we went after new business.

We, of course, used all the usual arguments, such as the convenience, safety and cleanliness of electric light, but perhaps the most effective of all were those regarding free renewals. We showed that, except in rare cases where a lamp might be accidentally broken, the consumer's only cost for lighting was his current bill, while in some instances the cost of gas, together with the cost of mantle and chimney renewals, amounted to more than the cost of electric light.

By using gas under our boilers we were enabled to cut our fuel cost to half that of coal, besides dispensing with the services of several firemen; therefore we rather regard natural gas as an advantage than a detriment to our electric lighting business.

Report on Electric Heating Devices.[1]

By Mathias E. Turner.

Electric Heating in Homes.

Electric heating is now bidding for favor in all departments of household heating, heating for the laundry, for the cooking, for hot water; in the sick room, and in all manner of step-saving ways about the house.

It is the custom generally for electricity-supply companies to advertise and sell these appliances, but the time should not be so far distant when electric heating devices will be so well advertised and their uses so well understood that they will be sold in large quantities, as other household utensils are sold, by department and other stores. It will, however, before that time, be necessary for the manufacturers to build a much more durable and operative economical line of goods. And your reporter has thought best to refer to those defects in detail in the apparatus with which he has had experience during the present year.

The first general criticism is that most electric heating devices are too slow in heating. What is needed is higher temperature during the first few minutes, and, if necessary to get it, more current used for a shorter space of time.

The second general criticism is that the methods used for attaching the appliances to the electric circuit must be improved. It is desirable that the attachment be a removable (both from the heating appliance and the circuit) flexible cord with a simple, durable plug, for making the connection and disconnection to the heating appliance, that does not require the burning of hands or upsetting of the vessel's contents, and that will not continually open or short-circuit.

Electricity in the Laundry.

In the laundry immersion coils are practical for boiling clothes in a clothes boiler, and are conveniently connected to a receptacle by a fixed flexible cord to the coil, and a three-heat push plug in the length of the cord. In fact, a push plug designed by one manufacturing company offers an admirable method for obtaining three heats where the appliance is not intended for use in connection with a cooking table. It is made in appropriate sizes to accommodate the small current required in a heating pad and the larger current of an immersion coil. The chief objection in the use of an immersion coil is the danger of severe shocks where the laundry floor is wet.

Laundry irons of six pounds weight and single heat are perhaps best adapted to general household use. A switch located on the iron is a simple and effective improvement over the former methods of heat regulation for ironing different materials. Favorable comment that has reached your reporter through users of electric irons is that the blunt nose and side flange found in one particular make of iron commends itself in the ease with which pleats and corners are ironed.

Electric Cooking Outfits.

Criticizing electric coooking outfits, your reporter in this report limits himself to his own experience in catering to the wants of a number of purchasers of complete cooking sets. In these cases the type of outfit advised was an oak table with a slate switchboard at the back and an oak raised shelf at the side for the oven. The table legs were equipped with well-adjusted casters. On the back of the switchboard was an asbestos-lined cabinet containing the fuses. In front three base receptacles for single-heat appliances and four three-point plug attachments were set in flush with the slate. Above these connecting points were placed three snap switches, indicating "off" and "on," and four three-heat snap switches indicating "off," "low," "medium," "high." Flexible cords 18 inches long were provided, having at the circuit-connecting end plugs for single-heat cords and three-pronged plugs with handles for three-heat cords.

This description is detail, but the practicability of electric cooking is very much detail, and it is for us who are in touch with the users of electric appliances to indicate to the manufacturers as far as we may at this time the requirements to be met in electric heating development.

Manufacturers are developing two distinct types of cooking outfits—one in which portable appliances are connected to a table similar to that described, and one in which stationary heating disks are designed much like the ordinary gas range, the difference only being that disks are used in place of flame burners. It may be that neither of these types is best. Possibly sectional shelves mounted with switches, connectors and disks, and capable of easy connection end to end or above and below each other, may offer a much more flexible method, adaptable to extension from

1. Abstract of a report made at the Toledo convention of the Ohio Electric Light Association, August 20th. Mr. Turner, the reporter, is a central-station man of Cleveland.

a very small cooking outfit, as the need for a larger outfit increases in any family.

The electric oven, with heaters top and bottom, is a superior baker, but decidedly wasteful of heat. A chef proficient in electric cooking stated that it was the best baker he had ever used. But this one piece of apparatus wastes so much heat that, because of its expensive operation, electric cooking development is somewhat retarded. The oven should be very much better heat-insulated; it should be deeper; its doors should be at the narrower end and fitted practically air tight when closed; it should be easy to clean; it should heat to a sufficiently high temperature in about 10 minutes and maintain a temperature suitable for most baking purposes for several hours, consuming not more than 250 watts per hour—which it will do if properly constructed.

In a particularly well-equipped kitchen, an electric cooking outfit replaced a gas range, excepting only a vertical gas broiler. Later a vertical electric broiler (so-called restaurant size) was tried. A voluntary testimonial, here reproduced, indicates how successfully:

"This is the first time I have found to write and tell you about the electric broiler. I have tried fish, chops and steaks, and in each experience success was the word. No smoke, no smell, no flame. I think it quite the best of all the electric utensils that I have tried for you. I intend to keep it, and would ask you to get me one extra wire broiler, as in steady cooking two are needed."

This particular type of vertical broiler is one of the best-designed cooking appliances of any kind that has come to the notice of your reporter.

Other kitchen utensils, such as fry pans, sauce pans, cereal cookers, grids, etc., compare very favorably with such appliances heated by means other than electricity. Electric waffle irons and milk warmers are unique in their comparative efficiency and convenience.

Water Heaters.

Hot water always available is requisite in all households. Until recently it has only been possible to obtain a sufficient quantity of hot water for washing purposes by means of immersion coils or similar devices which are bothersome to use, and this has made it necessary for would-be exclusive users of electricity to obtain hot water by other means. Lately there has been put on the market an instantaneous electric water heater. This device, together with all the other electrical heating appliances—more or less perfected—now makes it perfectly feasible for us to specify in the house building plans (where we are permitted by prospective customers) special heating circuits and single-pipe water systems for the exclusive use of electricity in all the duties usually performed by other illuminants and fuels, excepting winter interior heating, which we must still allow the furnace to do.

In the sick room electricity is now almost indispensable. It offers a ready means for quickly and safely boiling small quantities of liquids in portable vessels, in sterilizing articles, in vaporizing medicines under tents, as is often done for children in certain illnesses.

The heating pad has won many friends for electricity. In fact there have been several cases in which houses have been wired for electric light in order to get service to use the heating pad. Its virtues are so well known and its many applications so well advertised it scarcely needs elaboration here. In one particular make the details of construction have been admirably worked out. Its method of heat regulation and connection or disconnection to the electric circuit is convenient. It is light in weight, flexible and well adapted to many uses in the sick room and it shows good workmanship in its construction.

Now some inventive mind brings out an inexpensive device consuming little current to insert in a hot water bottle to keep the water hot.

And so we could go on, if time permitted, through many pages, describing numerous electrical devices tending to make electricity the universal light, heat and power in homes.

Before closing these general remarks on electric-heating appliances it is pertinent for your reporter to say that in so far as his experience goes it is at the present writing inadvisable for central stations to accept manufacturers' "complete cooking and heating outfits," but rather to build up their own sets, each piece being selected from the manufacturer who may be making the best article for the particular work it will be called upon to perform.

It is very necessary to the rapid development of electric cooking and heating that these pioneer electric outfits give as little trouble as possible to the users of them.

Current for Cooking in Eleven Cleveland Homes.

At the time of writing this report it was not possible to obtain from all the users of electrical cooking outfits data relative to the average number of persons in each household, etc., by reason of many families using these outfits being away from the city on a vacation. Reliable data were, however, collected from 11 homes using complete cooking outfits and are given in the following:

No	Full Months of Use.	Average No People Cooked for	Average Units Used Per Month	Average Per Month Per Person	All or Partly Electric Cooking
1...	11	7	237	*34	All.
2...	6	3	85	28	All.
3...	5	3	62	†21	All.
4...	2	7	171	24	All.
5...	1	3	34	11	Partly.
6...	2	5	47	9	Partly.
7...	2	7	68	10	Partly.
8...	2	4	40	10	Partly.
9...	4	6	34	6	Partly.
10...	5	8	360	45	Partly.
11...	1	9	71	8	Partly.
		20	555	28	All.
		42	654	16	Partly.
		62	1209	20	Total.

*Includes laundry ironing and water heating.
†Includes laundry ironing.

The above number of families using electric cooking outfits exclusively is too small to draw any definite conclusions, yet it would indicate that we might expect with the growth of this branch of the business an increased current consumption of from 100 to 200 units per residence per month.

In Cleveland a two-rate method is used for billing residences. The result is that electric heating generally receives the benefit of the secondary or lower rate. In fact, the cooking in all the 11 residences cited was done at a five-cent rate. The expense under these conditions compares favorably with artificial gas.

To illustrate how popular electrical current consuming devices are becoming in the home there was sold in Cleveland by the illuminating company during the 12 months preceding last June over 1,100 electrical heating devices. This was done through the efforts of one salesman and newspaper advertising. There are now being sold over 100 such devices a month without the aid of any direct solicitation. In addition to this, supply dealers have been selling their quota in the city.

New Developments in Arc Lamps and High-efficiency Electrodes.[1]

By George M. Little.

Arcs for lighting may be formed between electrodes of many different kinds. This paper deals with the development of the so-called magnetite electrodes and of a lamp suitable for burning them. A few points of comparison between these metallic-oxide electrodes and carbon electrodes will be considered, and some of the many interesting advantages possessed by the metallic-oxide electrodes and lamp will be touched on. Among these are the long life, high efficiency and good distribution and color of light.

The magnetite electrodes were so named because magnetite is usually one of the constituents of the negative or cathode, but it would be more satisfactory to call them metallic-oxide electrodes, as in addition to the magnetite there are always at least two other oxides present, namely, oxide of titanium and oxide of chromium.

These electrodes are made in a very different manner from the carbon electrodes. As is well known, the latter are squirted or molded from a plastic mixture and are baked, the carbon furnishing sufficient mechanical strength and electrical conductivity. A metallic-oxide electrode cannot be made this way, for it is a familiar fact that a fine powder is a poor conductor, no matter of what it

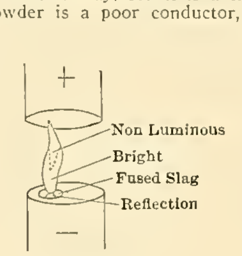


FIG. 1. METALLIC ARC WITH NEGATIVE BELOW.

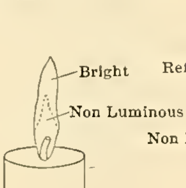


FIG. 2. CANDLE FLAME.

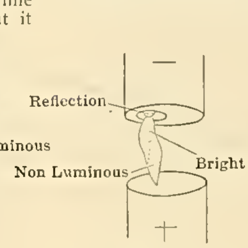


FIG. 3. METALLIC ARC WITH NEGATIVE ABOVE.

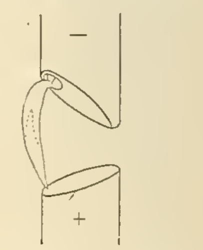


FIG. 4. SHOWING WASTING AWAY OF CARBONS TO A BEVEL BEFORE USE OF DOWN-DRAFT.

is composed, and as these electrodes are made for the most part from finely powdered oxides, it is evident that a conducting binder or a conducting case would have to be used. In practice, the mixture of oxides is tamped into a thin iron tube and the end sealed in an arc.

The oxides have distinct and separate reasons for their presence. The titanium oxide has the property of rendering the arc luminous; and it may be here noted that the metallic-oxide arc is a flame arc, the light not coming from a crater, as with carbons. The oxide of iron gives conductivity to the fused mixture when cold, the other oxides being conductors only when hot. The oxide of chromium prevents a too-rapid consumption, so that by its use an electrode may be given a very long life.

The positive, or anode, used with these metallic-oxide negatives is generally a metal and is consumed much more slowly than the negative. This is contrary to what would be expected, judging by the action of carbon electrodes.

There are a number of advantages possessed by the metallic arc over the carbon arc. In the first place, the efficiency is much better; that is, a metallic arc lamp operating on a four-ampere current, with approximately 65 to 70 volts at the arc, will give a light equal or superior to that of a 6.6-ampere, 75-volt, direct-current, enclosed-carbon arc lamp.

The distribution of light is far better. This is owing to the fact that in the enclosed-carbon arc practically all the light comes from the crater on the flat under surface of the upper electrode, most of it being thrown down and not serving to illuminate the street between lamps. The light from the carbon arc itself is weak and of a blue color. This is very pronounced at times, especially if the flat under surface of the upper electrode is somewhat inclined, thus hiding the crater. In the case of the metallic-oxide electrodes, the arc is itself the source of light, practically none coming from the crater, except by reflection. The metallic arc is much like a candle flame, having its luminous and non-luminous zones. The light is brightest near that end of the arc which is next to the negative electrode, and comes from a hollow cone-shaped mantle of volatilized oxide of titanium rendered incandescent by the heat of the arc, just as in the candle flame the light comes from a hollow cone-shaped mantle of carbon particles made white hot by the heat of the flame.

The voltage required to maintain a metallic arc is less than that of an enclosed-carbon arc. It is a familiar fact that an enclosed-carbon lamp will not burn properly with the arc voltage down to 65, while a metallic arc will burn well at less than 55. Metallic arcs are adjusted to burn at from 65 volts to 75 volts in different cases, while the carbon arcs are all set at 80. This is a very evident advantage in favor of the metallic arc, as more lamps may be put on a circuit without raising the voltage on the line.

The life of carbon electrodes, as a rule, is not over 150 hours, while the metallic-oxide electrodes can go considerably longer.

The uniform white color of the metallic arc is in marked contrast to the changeable blue and white of the enclosed-carbon arc.

As the metallic-oxide electrodes are not burned "enclosed," there is no inner globe required on the lamp.

While it looked easy to secure all of these advantages, many difficulties appeared, but they have now practically all been overcome. In the first experiments the electrodes were trimmed with the anode or positive above and the negative or metallic-oxide electrode below, just as carbon lamps are trimmed, but a number of troubles presented themselves.

First—The bright portion of the arc was near the surface of the lower electrode, which cast a large shadow.

Second—The light reflected from the brilliant surface of the fused slag on the lower electrode was thrown upward and could only be partly saved by using a reflector.

Third—An under-feed mechanism was seen to be necessary, as, contrary to the action of carbon electrodes, the negative metallic-oxide electrode is the more rapidly consumed.

Fourth—Only a comparatively short metallic-oxide electrode could be used, as a long one would necessitate the use of an unwieldy long glass globe. This would limit the life and could only be met by adopting a negative electrode of large diameter, which it is evident would be undesirable.

Fifth—A particularly undesirable feature was the gathering of a large amount of reddish soot that would collect in spongy masses around the electrodes, obscuring the light. This had to be removed by some mechanical means, such as scraping or shaking it off, and some receptacle other than the glass globe had to be provided to catch it.

Sixth—The negative or metallic electrode was seen to burn to a blunt taper point, causing the arc to be very unsteady, as it tended to leave the end and run up the side in the manner of the carbon arc when flaming.

As noted above, the bright portion of the metallic arc is located near the surface of the negative electrode, and it was seen to be very desirable to burn the electrodes with the negative above, thus getting the bright portion of the arc in such a

1. A paper read before the National Electric Light Association at Washington, D. C., June 5, 1907. The new Westinghouse metallic flame-arc lamp is described.

position that the shadow thrown down would be less, and that the light reflected from the brilliant surface of the fused pool of slag on the negative electrode would be thrown down and utilized instead of being thrown upward and wasted. The other advantages, noted above, possessed by the carbon lamp would be retained if this inverted position of the electrodes could be made practical.

The first attempt to burn the metallic-oxide electrode above and the metallic electrode below showed that there were serious obstacles to be overcome before it could become a practical method. In the first place, the electrode would not keep a square

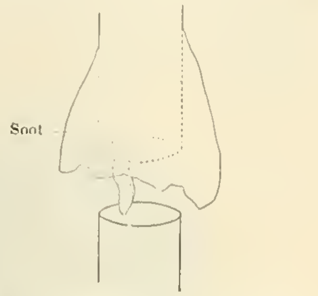


FIG. 5. SHOWING ACCUMULATION OF MASSES OF SOOT BEFORE USING THE DOWN-DRAFT

end, but would waste away on one side, and the arc would run up this bevel, or slope, giving a very unsteady light. In the second place, the volatilized oxides of iron, chromium, titanium, and so forth, would condense on the sides of the electrodes and hang down as a fringe or curtain, hiding the light.

The first means taken to overcome these troubles was the introduction of a rotating draft of air around the arc. This had the effect of forcing the arc to hold a central position, stopped the crooked burning, and steadied the light, but did not take care of the fumes. Attempts to blow the fumes away sidewise gave only partial success. Finally, a current of air was directed down around the arc, and this gave excellent results. The electrode burned perfectly square, and the clean layer of air prevented any gathering of fumes. This was a very marked advance, as this did away with any need for a mechanical scraper or shaker, the soot practically all passing out of the chimney and not requiring to be caught in any receptacle, the globe remaining clean.

When burning metallic-oxide electrodes with the metallic-oxide stick below, copper was used as an anode, with fair results. On reversing the position of the electrodes, it was found that the new conditions made it possible to improve on the action of a pure copper anode, and a number of changes were accordingly made. In the first place, if the arc plays for a time on pure copper, it will oxidize

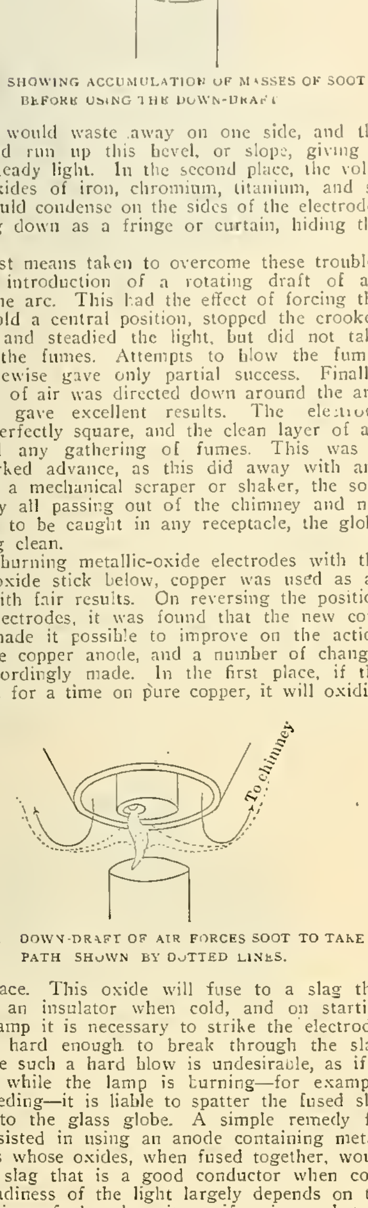


FIG. 6. DOWN-DRAFT OF AIR FORCES SOOT TO TAKE PATH SHOWN BY DOTTED LINES.

the surface. This oxide will fuse to a slag that becomes an insulator when cold, and on starting a cold lamp it is necessary to strike the electrodes together hard enough to break through the slag. To strike such a hard blow is undesirable, as if it is done while the lamp is burning—for example, when feeding—it is liable to spatter the fused slag out on to the glass globe. A simple remedy for this consisted in using an anode containing metals or alloys whose oxides, when fused together, would make a slag that is a good conductor when cold. The steadiness of the light largely depends on the composition of the slag, its uniformity and temperature. The anode surface is at all times covered with this slag, which slowly dissolves the metal and is itself slowly volatilized. If the arc plays on bare metal it consumes it rapidly, and it was found desirable to secure this slag cover from being knocked off. This was accomplished by providing a rough surface for it to cling to, and by running the entire anode tip very hot.

A characteristic property of the metallic arc has been a very noticeable dying down or dimming of the light, which would occur at irregular intervals, especially after the electrodes had burned for 20 hours or more. These dim spells would last from a few seconds to two or three minutes, when the normal brilliancy would return. This is explained as follows: In the metallic arc the brilliancy is largely due to the presence of volatilized oxide of titanium, and anything that interferes with the uniform evolution of vapors of titanium will cause the light to dim—for example, the presence of a high percentage of highly infusible oxide of chromium. This oxide of chromium is volatilized at a slower rate than the oxides of titanium and iron, and after the electrode has been burning some 20 hours the slag on the end of the cathode has become very rich in oxide of chromium, which forms a film on the surface of the fused pool of oxides. When the film is not present there is a plentiful evolution of oxides of iron and titanium, and there is a bright arc. The oxide of chromium can be seen to gather on and finally entirely cover the surface of the pool. This stops the evaporation of titanium and iron, and the light turns to a bluish color and dies down until the chromium film is burned away again. This trouble was met by modifying the mixture in such a way that the oxide of chromium could not separate from the oxides of iron and titanium, thus doing away with the film on the surface and entirely doing away with the dim spells.

In carbon lamps, there was very little done to keep the impurities volatilized from the carbons from depositing on the globe. This trouble had to be met by the carbon manufacturers, who were prodded up to produce carbons containing less than 0.2 per cent. of impurities, but this means was not to be considered in the case of the metallic-arc lamp. The metallic-arc electrodes, being chiefly composed of oxides of iron, titanium and chromium, do not burn away to an invisible gas, as does a carbon stick, but are volatilized bodily, and the vapors instantly condense, on leaving the arc, to a fluffy reddish soot that settles on everything it touches, so that a chimney is a very necessary feature in the lamp. This soot, if it comes in contact with the reflector or globe, will smudge them badly in 10 minutes. As was noted before, a current of air flowing down around the electrode served admirably to keep it clean, so it was applied to the reflector and globe, with gratifying results. A thin layer of air is introduced at the top of the reflector and forms a shield through which the soot-

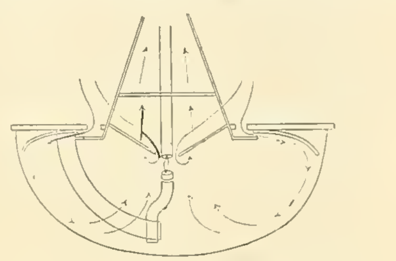


FIG. 7. PATH TAKEN BY AIR CURRENTS IN LAMP.

laden air cannot penetrate, so that the reflector and globe will keep clean for a long time.

As the air currents play such an important part in this lamp, it became necessary to do a large amount of experimental work on the design of an air intake and of a chimney top. The chimney could not be made long enough to cause a very powerful draft, as the wind was very apt to blow down it; but by persistent effort the openings have been so designed that the wind may blow from any direction (up, down or sidewise), and the only effect is to increase the natural draft in the lamp. Incidentally, the increasing of this draft actually centers the arc and holds it remarkably quiet.

It was found advisable to run the lamp at four amperes and 65 to 68 volts at the arc with a cut-out set at 85. This low cut-out was made possible by the inverted position of the electrodes and by the peculiar arrangement of the air draft, which prevented any tendency of the arc to flame or to run up the side of the electrode. Without these features, a cut-out of 100 to 110 volts would be necessary. As the power factor at which the lamps operate depends largely on the amount of variation of voltage in the arc, this 85-volt cut-out is seen to be very desirable. In actual service, the lamps,

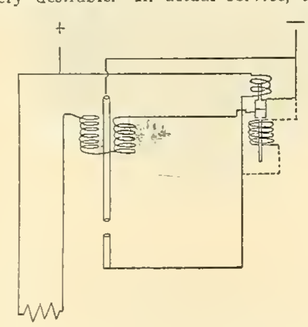


FIG. 8. DIAGRAM OF CONNECTIONS.

including a mercury arc rectifier, run very well at from 65 to 70 per cent. power factor.

In several places above we have described special conditions that must be obtained for getting the best results with these electrodes, and these conditions, of course, must be supplied by the lamp in which they are burned. An example of a lamp well adapted for this service is here shown. [It was on exhibition at the convention.] A study of its design and construction will show that it is simple and rugged, as no float feed is used, it being necessary only to strike an arc and hold the electrode in a permanent position until, due to change in voltage, the cut-out causes the restriking of the arc. The lamp consists essentially of a base and top, connected by a chimney, a set of magnets for striking the arc, a shunt cut-out for causing the lamp to feed, due to rise in voltage, and a series cut-out for disconnecting the striking magnets after the arc has been formed.

The special conditions described with regard to drafts are obtained by the down-draft tube, which directs the current of air down around the electrode, another current of air over the reflector and circling around the globe, forming a means of protection to them, and a special construction of top and case for giving proper draft conditions when under all conditions of wind.

BOOK TABLE.

Of the series of little volumes covering the general subjects of technology published by Dr. Jänecke of Hanover, Germany, brief reviews of four which relate more particularly to electrical subjects follow. The volumes are the work of reputable continental engineers, and the explanations are very clear, many phenomena being aptly illustrated by familiar analogies. While the practical instructions given in many cases apply rather to European models of machinery, the essentials of operations are given with characteristic German thoroughness. The prices of the books (in Germany) range from 34 to 67 cents.

Die Montage Elektrischer Licht und Kraftanlagen (The Arrangement of Electric-light and Power Plants). By H. Pohl. A new and revised edition. Pp. 165, with 230 illustrations and diagrams.

This is a pocket-book for engineers, electricians, installers and owners of electric plants. It is practically written and gives a review of the elementary ideas as well as more advanced excursions into special departments of electro-technology. In the latter direction the list of subjects is very complete, and the book will be found instructive to the operator as well as interesting reading for the layman.

Die Krankheiten Elektrischer Maschinen (Diseases of Electrical Machinery). By Ernst Schultz. Pp. 86, with 42 illustrations.

Carrying out the idea of the title, the book gives a list of symptoms and specific prescriptions for the treatment of generators, motors and transformers and other apparatus for direct-current and single-phase and multiphase alternating currents. Remedies for a great number of troubles, with full explanations, are given under the headings of the various faults.

Der Schalttafelwärter (The Switchboard Operator). By Emanuel Stadelmann. Pp. 160 and 106 illustrations.

After perusal of the book, the switchboard operator will surely have grasped a more accurate idea of the forces he handles and the principles of the apparatus which he uses. Following the elementary explanations, the author has taken pains to explain and illustrate by diagrams all the usual switchboard devices, measuring instruments, systems of connection and distribution, etc. The care and operation of storage batteries and lightning arresters are treated fully. The material is well ordered, and the little work will furnish good advice to those interested.

Prufung Elektrischer Maschinen und Tranformatoren (Testing of Electrical Machinery and Transformers). By Friedrich Weickert. Pp. 116 and 64 illustrations.

The little volume is quite a complete treatise on general electrical testing, but perhaps it will not be so useful to the average reader as some of the others. Measuring instruments and methods are described, with their application to the testing of direct-current machines, storage batteries, alternating-current generators, synchronous motors, polyphase motors and transformers.

Direct Current at 1,200 Volts on an Indiana Railway.

The Indianapolis and Louisville Traction Company commenced the running of cars over the 50-mile stretch between Scottsburg and Seymour, Ind., on August 25th. The feature of this new line is the use of direct current at 1,200 volts, said to be the first time direct current has been used at this high voltage in the history of electric railroading.

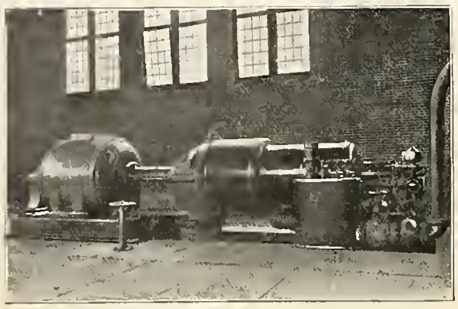
James Brown of Pittsburg, consulting engineer for the traction company, specified the 1,200-volt installation and says that he is the originator of the idea. On the trial trip Mr. Brown was enthusiastic about the new installation and is quoted as saying that the adoption of 1,200 volts direct current for trolley roads would revolutionize electric railroading, principally on account of the possibility afforded of abandoning many sub-stations.

A. A. Anderson, general manager of the Indianapolis, Columbus and Southern Traction Company, was with the party on the trial run, and it is said his company will now adopt the new system as soon as the change can be made.

Test of a 1,000-kilowatt Steam Turbine and Alternator at Kokomo, Ind.

An interesting test was recently made of the turbine-generator unit installed at Kokomo, Ind., in the power house of the Kokomo, Marion and Western Traction Company for the purpose of determining the steam consumption of the turbine when operated under normal load. Through an arrangement with the officers of the traction company, Mr. Paul Diserens of Purdue University, working in consultation with Mr. Phil H. Palmer, superintendent, represented the traction company's interests, and Mr. F. C. Purcell represented Allis-Chalmers Company. The unit tested is shown in the accompanying illustration.

The steam turbine is an Allis-Chalmers-Parsons standard horizontal turbine. The generator is a



NEW TURBO-ALTERNATOR UNIT AT KOKOMO, IND.

standard Allis-Chalmers turbo-alternator direct coupled to the steam turbine. The condensing apparatus is of the Allis-Chalmers standard turbo-jet type. The characteristics of the unit are as follows: Rated capacity, 1,000 kilowatts; speed, 1,800 revolutions per minute; frequency, 60 cycles; winding, two-phase; electromotive force, 2,300 volts; current per phase (normal), 218 amperes.

The turbine was built to operate normally with steam pressure of 140 pounds per square inch gauge pressure at turbine throttle, dry saturated, and a vacuum of 28 inches of mercury, referred to 30-inch barometer at the exhaust nozzle. The unit is calculated to carry an overload of 50 per cent. when operating under the above steam conditions and at 100 per cent. power factor.

The auxiliary machinery provided consists of a motor-driven exciter, a steam-driven exciter, the jet condenser and pump mentioned above and two small circulating pumps. There are five boilers supplying steam to a loop header. The turbine, two Russell engines and an auxiliary header are supplied from this main header.

During this test boilers 3, 4 and 5 were made to supply steam to the turbine being tested. Both sets of boilers were operated at as nearly the same steam pressure as possible. The water delivered to boilers Nos. 3, 4 and 5 was weighed in calibrated barrels. The drip from the steam header and from separators at the Russell engines and at the throttle of the machine was collected and weighed.

At the conclusion of this efficiency test boilers 3, 4 and 5 were cut out of service and the entire load of the station was thrown on boilers 1 and 2. With the plant thus operated enough fire was allowed to remain under boilers Nos. 3, 4 and 5 to maintain a steam pressure equal to that carried by boilers Nos. 1 and 2. The weight of water fed to boilers 3, 4 and 5 during this test was assumed to establish a rate of leakage and radiation from boilers and piping which would apply to the efficiency test.

In determining the steam consumed by the turbine the drip caught at the Russell engines at the trap in the steam header, at the separator, at the turbine throttle, and the amount due to leakage and radiation in the boiler, as shown by the leakage test, was subtracted from the water fed to the boilers. This result corrected for the quality of the steam was assumed to equal the dry steam supplied to the turbine.

The electrical output was measured by carefully calibrated instruments.

All the load possible given to the turbine aggregated only a little over half its normal capacity.

Following are the results of the tests:

1. Average load ....553.3 kilowatts
2. Per cent. of rated load..........55.33 per cent.
3. Duration of test ....4 hours
4. Steam pressure at turbine throttle..136.4 gauge
5. Steam pressure at turbine inlet....:. 61.9 gauge
6. Vacuum turbine exhaust ....26.59 inches
7. Barometer 28.93
8. Vacuum at turbine referred to 30-inch barometer 27.66
9. Revolutions per minute 1,800
10. Total water used ....55,662 pounds
11. Total drip 450.6
12. Boiler leakage ....5,344.6 pounds
13. Moisture in steam by calorimeter..2.82 per cent
14. Dry steam supplied to turbine per hour ....12,115 pounds
15. Actual consumption of dry steam for kilowatt-hour .... 21.90 pounds

The guaranteed steam consumption for one-half load, 28 inches vacuum, was 24 pounds per kilowatt-hour, and the result of the test showed that the actual steam consumption was 2.1 pounds less than the guarantee.

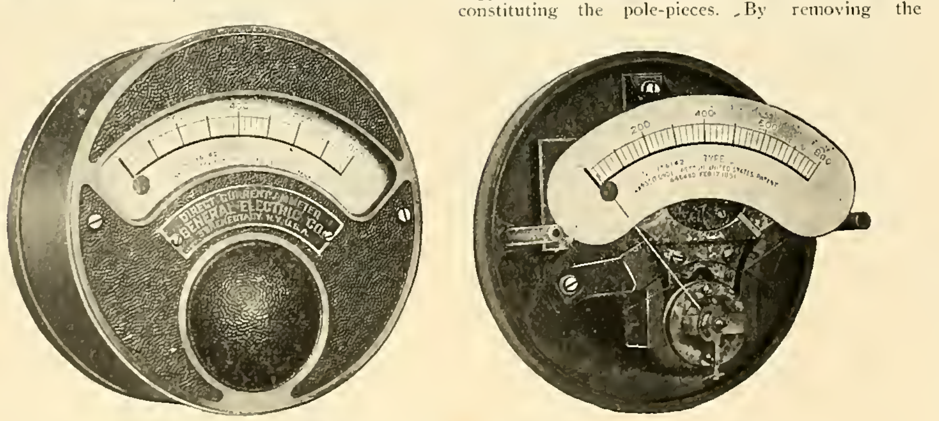
A New Line of Instruments.

A new line of ammeters and voltmeters for direct-current switchboard use has just been placed in production by the General Electric Company. These instruments, which are to be known as type D, are constructed on the D'Arsonval principle. A small coil of wire mounted on a light cylindrical aluminum frame is pivoted in jeweled bearings, so as to move freely in a small annular space between a soft iron core and the pole-pieces of a permanent magnet.

The operation of these instruments is rendered dead-beat by the foucault currents generated in the aluminum frame as it passes through the field of the permanent magnet. This damping quality prevents injury to the pointer from violent load fluctuations and permits rapid and accurate readings, as the pointer comes quickly to rest after each change in current value.

Continued accuracy of type D instruments is assured by the unusually high torque, light moving elements and the very small air gap between magnet pole-faces and the iron core, combined with the permanency of the magnets, which are made from the best obtainable grade of magnet steel and subjected to special processes of hardening and aging, which fixes its magnetic characteristics.

The round cast-iron case which encloses the instruments protects it from the effects of stray fields and makes it dustproof. Inspection or repair of type D instruments is easily made. The soft iron core, together with the armature and jewel supports, are assembled within the soft steel shell constituting the pole-pieces. By removing the screws which hold the shell to the magnet pole faces, the entire mechanism may be removed.



A NEW LINE OF INSTRUMENTS.

The scales of type D instruments are uniform throughout their entire range and very legible. The standard finish is dull black with raised portions polished copper, making a very pleasing and durable surface.

Type D voltmeters are made self-contained in capacities up to and including 750 volts. The ammeters are self-contained up to 60 amperes capacity. Larger capacities are furnished with external shunts, which are made of a special alloy having practically a zero temperature coefficient. All instrument shunts above 1,000-ampere capacity are now provided with a thermo-electric attachment. This attachment consists of a metal strip having one end electrically connected with one end of the shunt, with the other end in close thermal contact with the other end of the shunt, but insulated from it electrically. The ammeter leads are connected to the shunt and to the metal strip at the two insulated points. This prevents the superimposing of secondary thermo-electric currents upon the primary current, which is due to the fall of potential in the shunt and the amount of which fixes the value of the indication of the instrument. Ammeter shunts with this attachment will be found free from temperature errors due to generation of thermo-electric current.

"Combat Igniter" Sparking Battery.

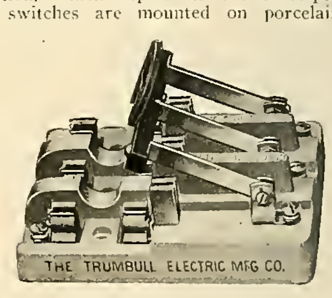
The accompanying illustration shows the six-volt 60-ampere-hour "Combat Igniter," especially designed as a sparking battery for automobiles. It is made by the Commercial Battery Company, 204-206 Michigan Street, Chicago. The cover is made of heavy hard rubber, constructed so as to form

"COMBAT IGNITER" SPARKING BATTERY.

a well to hold any of the electrolyte that may get on the top when replenishing or charging. The handle is made of spring wire and is detachable. All the connections inside are very strong, being cast and completed at the factory. The cell is enclosed in a very neat quartered-oak box, with instructions printed on a "transfer" just underneath terminals in front. There is no metal about the battery that acid can reach or corrode. The makers report that it is proving very efficient and most satisfactory, and assert they are producing not the cheapest but the best sparking storage battery at the lowest price.

New Trumbull Combination Switches.

The Trumbull Electric Manufacturing Company, Plainville, Conn., has brought out the convenient combination switch shown in the accompanying illustration, which represents the three-pole type. These switches are mounted on porcelain bases



A NEW COMBINATION SWITCH.

and are available up to 30 amperes and 250 volts. They are arranged for National Electrical Code fuses. Catalogue numbers and descriptions follow:

No. 704, double-pole, 3½ inches by 6 inches, for wires entering from top; No. 705, three-pole, 4½ inches by 6 inches, for wires entering from top; No. 724, double-pole, 3½ by 6 inches, for wires entering from bottom; No. 725, three-pole, 4½ inches by 6 inches, for wires entering from bottom.

Fatal Electric Railway Wreck in Illinois.

One of the worst interurban railway wrecks in Illinois took place on the morning of August 30th about a mile west of Charleston, Ill., on the Mattoon and Charleston Electric Railway. The accident occurred on a sharp curve and was between a passenger car crowded with travelers going to Charleston, and an express car and trailer. The impact was so hard that the motor car and trailer were telescoped. Of the ninety passengers that were on the car, fifteen were killed and all the rest were more or less injured. The wreck is said to have been caused by a misunderstanding of orders. The telephone is used to dispatch trains on this road, and according to late reports the cars should have met on a switch nearer Charleston than where the wreck occurred.

CORRESPONDENCE.

Continental Europe.

Paris, August 10.—Casablanca, on the Mediterranean, which is the scene of the recent trouble in Morocco, is now in communication with Paris by radio-telegraphy, and messages are exchanged constantly between the two stations. On the cupola of the French consulate at Casablanca is mounted a mast which is connected with high-power radio-telegraph apparatus located within the building. At Paris the station is erected on the flat ground of the Champ de Mars and the aerial wire is placed on the Eiffel Tower. Owing to the great height of the tower the signals can be sent and received over long distances. For some time past the tower has been used as the base of operations of this kind, and signals were exchanged with the port of Bizerta on the Mediterranean coast near Tunis with very good results. Messages were also sent to Brest on the channel coast and to Belfort on the eastern frontier. London and Berlin are among the other points with which messages can be exchanged at present. The apparatus of the station is lodged in a shed at the foot of the tower. An iron rod supported like a lightning rod runs down the side of the tower and is used for the antenna. Wire connection from the transmitting station on the ground to the war and marine department headquarters in the city enables messages to be now constantly exchanged from these offices with Casablanca so as to transmit orders for the troops and receive news from the seat of operations. It is curious to note that in spite of the greater distance and the fact that the Pyrenese Mountains lie in the way, it is easier to send messages to Casablanca than to Bizerta. The exact reason for this is not as yet explained.

A considerable increase has been made lately in the large hydro-electric station of Italy, known as the Ferrari Gallieri hydraulic plant. This station was started some years ago upon the high-tension direct-current system and 16 generators of the Thury type were erected, these machines being all connected in series and giving a total of 16,000 volts and a constant current of 50 amperes, each generator delivering 1,000 volts. Since then it has been decided to increase the plant and to add three-phase 5,000-volt alternators. At present there are 10 turbine alternators mounted in the station. These machines are rated at 500 kilowatts each. In the plant have been erected two separate switchboards, one for the 5,000-volt current and the second for the 25,000-volt lines. Step-up transformers of the water-cooled type are used. The three-phase power line runs through the surrounding district for the light and motor supply.

The new laboratory for the production of radium salts which has been annexed to the imperial establishment for the prepartion of uranium salts at Joachinsthal is now undertaking to treat large quantities of radiferous residues so as to secure large quantities of radium salts in the future.

Not long since the Swiss Federal Council ratified the agreement which was made between the postal and telegraph department and the administration of the federal railroads by which the railroad stations can be used for public telegraph messages. In this case an additional rate of 10 cents per message is charged. Before this many of the railroad stations did not take public messages.

The government of French Indo-China has recently opened a new telegraph line which connects Indo-China with Siam. This line runs between the towns of Bassac and Oubone.

According to recent figures it appears that the imports of rubber into France have increased considerably within the last few years. Bordeaux especially receives large shipments and holds a prominent place on the market. The cargoes of rubber come from the African regions of the Soudan, Conaky, Gambia and others. The figures given are as follows: For 1904, imports in long tons, 1,183 tons; for 1905, 1,330 tons, and for 1906, 1,716 tons.

A. DE C.

Great Britain.

London, August 23.—It is evident that the directors of the Metropolitan Railway Company and the Great Western Railway Company of London are still exercised in their minds as to how to deal with the surplus rolling stock which they have from their steam-working days. The District company is not in the same plight, for practically all its steam stock should have been scrapped years ago. But the other two companies have a fair quantity in first-class condition. The Great Western Company already runs some of its old stock upon the city lines by means of electric locomotives. Similarly the Metropolitan company runs electric locomotives upon its outer city lines and is also converting some new ordinary stock into electric working. That the locomotive working is to be extended is evident by an additional order for 10 electric locomotives which has been placed by the Metropolitan company with the British Thomson-Houston company, three of which have just been delivered. These for the first time have a box-wagon-shape cab, are of the double-truck type and weigh 47 tons. The control is of the Sprague-Thomson-Houston multiple-unit system, similar to that used on the trains. Each of the four axles is fitted with a 200 horsepower G. E. motor, of the one turn armature type. The length over cab and head stocks is 30 feet, the width over all eight feet seven inches and the height from rails to top of cab 12 feet 3 inches. The equipment is in all respects similar to the motor cars already in use. Each locomotive on a 600-volt circuit is capable of handling a 120-ton passenger train on the level at 35 miles per hour and of starting with this load on a one-in-44 grade. They are also said to be capable of hauling a 250-ton freight train up a similar gradient.

The Home Office has just issued a draft set of regulations in connection with the use of electrical energy upon premises coming within the workshops and factory acts. These are intended to apply to all pressures above 130 volts continuous and 65 volts alternating. In an official communication accompanying the regulations the secretary of state for home affairs stated that while realizing the possibility of danger at lower pressures he has been guided by the fact that the serious accidents which have come to his notice have been at pressures exceeding those named. The effectiveness of the regulations may be measured by the conviction on the part of those responsible for them, that the dividing line between the conditions which will render a shock merely trifling and those which will render it fatal is so narrow that it becomes necessary to provide, so far as is practicable, that no shock shall be received at all. The regulations, however, are open to criticism and suggestion for 40 days. A few of the regulations may be briefly mentioned. Every circuit arranged to carry more than 750 watts must be separately protected. Where one point of a system is connected to earth no single pole switch other than a link for testing purposes shall be placed in any cable connection thereto. At the working platform of every switchboard and switchboard passage way, if there be bare conductors, there is to be an unobstructed passage way seven feet high and three feet wide for low and medium-pressure cables and eight feet high and four feet wide for high and extra high pressures. Generally speaking, the rules hardly enter into technical questions, being designed primarily for the safety of the employes. Many of the proposed regulations are obviously necessary ones, and in the large majority of cases will have been put into effect voluntarily, but the effect of giving them the importance of official regulations will have a salutary effect in cases by no means rare, where poor work is likely to be permitted. The wiring rules of the Institution of Electrical Engineers and other official rules have been consulted in relation to the compilation of the new regulations.

It has now been definitely decided to hold a representative electrical exhibition either in Manchester or Salford during the autumn of next year. The idea originally came from Manchester, but was somewhat strongly opposed by a number of leading manufacturing firms on the ground that 1908 was too soon to hold another electrical exhibition after the one held in London in 1905. The firms in question were members of the National Electrical Contractors' Association. Manchester, however, is fast becoming such an important manufacturing center that the hint was plainly given that the district felt powerful enough to carry an exhibition unaided, especially in view of the boom in Lancaster trade at the present time. Consequently the Manufacturers' association has, fortunately, taken the matter up officially and will take a leading part in the organization of the 1908 show. The city electrical engineers at Manchester and Salford, respectively, will act as consulting electrical engineers to the scheme, the full details of which have yet to be worked out.

Apparently as a counterblast to the announcement that the Marconi Wireless Telegraph Company will inaugurate a transatlantic wireless telegraph service very shortly comes a communication from the company owning the Poulsen patents that its arrangements for a similar service are in a very forward state and that communication is expected to be made between a permanent station on the west coast of Ireland and a temporary station in Canada by the end of the present year.

G.

New York.

New York City, August 31.—The Public Service Commission has designated Marvyn Scudder to inspect and examine the accounts, records and memoranda kept by the Interborough-Metropolitan Company, and all books of original entry, all ledgers, all balance sheets, and any and all books showing or purporting to show the assets and liabilities of the corporation. The company has already refused to produce its books, and it is expected that the matter will be taken to the courts and the constitutionality of the act under which the commission was appointed will be determined.

In 1886, when the New York Central greatly increased its terminal facilities, it was decided to use the left-hand method of operating trains. For several weeks past arrangements have been in progress to reverse this method, so as to allow of greater flexibility in handling the baggage. Sunday, August 25th, was the day when the change was to be made, and at 4 a. m. the first train went through on the new system sucessfully. The suburban service was crippled for a time by the change.

The New York and Queens County Railroad proposes to develop a large tract of meadowland near Flushing Creek, where the company will erect one of the largest car barns and repair shops in Queens County.

An opportunity to subscribe at par to an issue of $1,500,000 six per cent. collateral trust notes payable after two, three or five years, has been offered to stockholders of the American Light and Traction Company.

Herman Barth, a young electrician of 521 Sixth Avenue, Manhattan, has been arrested and charged with the installing of a device which will make the meters of the New York Edison Company run backward. The device has been sold mostly to saloonkeepers, and it was the practice to place the device over the meter late Saturday night, as there is no danger of an inspector getting into the saloon over Sunday. The device was guaranteed to reduce the electric-light bills 50 per cent. The device consists of a large electromagnet, which is placed over the case of the meter so that the north pole of the meter's motor will be under the south pole of the electromagnet and likewise with the south pole of the meter's motor. Reversal of the field produces a corresponding reversal of the motor of the meter and its dial train. The strength of the electromagnet can be set either to retard the motion of the meter or to reverse its direction. There is a legitimate device used to regulate the pressure of gas, preventing it from blowing out more than is actually needed to supply a particular jet, and some people have been fooled into thinking that electricity blows the same way. This device was called a "regulator" to "save electricity" and consequently its inventor had little trouble in finding a market for his invention, the price of which was $200.

E. H. S.

Ohio.

Toledo, August 31.—The F. Bissell Company has completed some improvements which have added materially to the comfort and convenience of its store. The offices have been removed upstairs and room made for the proper display of wares on the first floor. This step was deemed necessary because of a determination to push the retail business, which has heretofore been a secondary consideration with the concern. The new offices will be model when completed. The store when the finishing details are done will be one of the finest in the state.

An application has been made by G. D. Ridenour and J. C. Gillett to the state board of public works for a lease of the abandoned Hocking Canal, or the outer slope of the towpath between Carroll and Nelsonville, for use for electric-railway purposes.

The capital stock of the Ohio Electric Railway Company has been increased from $100,000 to $25,000,000. It is understood that the properties of the Indiana, Columbus and Eastern Traction Company, the Cincinnati Northern Traction Company and the Lima and Toledo Traction Company will be taken over by this company.

Grading on the road that is to connect Toledo with St. Louis will probably reach Napoleon this fall. Work is progressing rapidly.

The standpipe valves of the Fremont (Ohio) waterworks will be operated by electrical devices. It is probable that the Yaryan service will be installed.

Scarcity of teams has caused the Bucyrus-Marion electric-railway people to increase the pay of teamsters to $4 per day.

The advisability of installing radio-telegraphy on the lakes was discussed at a meeting of the Pittsburg Steamship Company this week. Boats have been greatly discommoded by the telegraph strike.

H. L. S.

Indiana.

Indianapolis, August 31.—A new interurban road is being promoted to connect Logansport with Rochester and Lake Wanatau. It is proposed to secure power for the new road from the Rochester light and power plant. In addition to the passenger traffic, it is proposed to ship immense quantities of ice from the lake.

H. E. Huntington, one of the chief promoters of the Grand Central Traction Company, announces that all the right-of-way through the several counties for an interurban line from Indianapolis to Evansville has been secured and the deals closed up. He says that construction work will begin about the first of October.

The Chicago, South Bend and Indiana Railway Company has ordered plans for the construction of a modern interurban station at Front and Main streets in Mishawaka.

Action has been begun by the city authorities of Hammond to annul the 50-year franchise, granted some three years ago to the Hammond, Whiting and East Chicago Street Railway Company. Better cars and service are demanded.

The town of Bicknell, with a population of 3,000 people, is in darkness owing to the inability of the Town Board and the Bicknell Light and Power Company to agree on terms of a franchise. The company has furnished incandescent street lights for the last 18 months under individual contract with property owners, where lights were desired, operating under a franchise granted by the county commissioners two years ago. Two weeks ago the company turned off the street lights, and left the town in darkness till a franchise from the Town Council could be procured, permitting the company to extend its service to all parts of the town, and requiring the town to pay for street lights. It is understood that a new company is being organized to apply for a franchise in the immediate future. This movement will be opposed by the old company.

The City Council of Washington, Ind., has ordered a special election to be held on October 2d to vote on a proposition of repairing and improving the city electric-light plant, which is estimated to cost $50,000. A considerable number of the taxpayers advocate selling the property to a private company for whatever can be obtained for it.

Because of disagreement among small and large creditors of the Converse Electric Light Company, the concern has been placed in the hands of a receiver. Bonds were recently issued for the purpose of paying off all small creditors, but they were not sold. L. O. Arnold has been named as receiver.

The Lowell Light and Power Company has incorporated for the purpose of constructing and equipping electric-light and power plants throughout this and adjoining states. The directors are Edgar L. Shank, J. M. Jones and Clifford Wiley.

S. S.

Illinois.

Peoria, August 31.—The Harter Electric Company has been incorporated with a capital of $50,000 to manufacture electrical appliances and devices. The principal office is in Chicago and the incorporators are Fred W. Uppatel, George A. Schmidt and Ralph J. Taylor.

The Illinois Traction Company has contracted for a new 3,000-kilowatt turbine generator for the power house at Riverton. The power house now has a capacity of 6,500, and the new generator will increase it to 9,500. The General Electric Company will install the new unit. The traction company will also erect at Buffalo a new substation, making four in use between Springfield and Decatur.

During the severe storm of this week the telephone exchange at Kilbourne was struck by lightning and totally destroyed by fire.

The Illinois Traction Company has secured a 100-year lease of the ground now occupied by the Springfield Consolidated Railway Company as car barns. Large barns and a large passenger station will be erected on the property, which is only three blocks from the business center.

Net earnings of the Illinois Traction Company for the year ended July 31st show an increase of $20,275.95 over the previous year.

A rumor was in circulation that the Illinois Traction Company would trade off the city car lines here for the car lines in the city of Springfield. The same persons who own the utilities in the city of Springfield control the Peoria Gas and Electric Company here, and the traction company runs its cars over the lines there under a lease. The rumor has since been denied by those in charge of the companies' properties.

V. N.

Southeastern States.

Charlotte, N. C., August 31.—The Bowman Transfer and Storage Warehouse Company, a local concern recently chartered in Richmond, Va., will make use of electric omnibuses, cabs and trucks for the handling of passengers and freight in the city of Richmond. Samuel H. Bowman is president.

Two shifts of men, 1,000 for day work and 500 for night work, are employed at the Whitney electric plant on the Yadkin River, near Salisbury, N. C. The power will be on about January 1st, and from the rapids and waterfall in the company's 14,000 acres of land a total of 100,000 horsepower is expected to be derived. The present development will afford about half the total available power.

The Southern Cotton Oil Company is making some important tests at Gastonia, N. C., to determine the relative cost of ginning cotton by electricity and by the old steam methods. E. R. Camp of the Charlotte division of the company is interested in the work. The company may make a general substitution of electricity for steam in its numerous plants south.

The South Carolina Public Service Corporation, a $10,000,000 company, has applied for a perpetual franchise in the town of Greenwood.

The Carolina Light and Power Company is developing a large waterpower at Anderson's Falls, near Langley, S. C.

A report has gained currency that all attempts at a merger of the lighting and heating plants in Louisville, Ky., have been abandoned for the present. This is said to be a direct result of money stringency. The merger will not be abandoned permanently, it is said.

Seven transformers weighing 20,000 pounds are being installed in the transformer station of the Cape Fear Electric Power Company at Fayetteville, N. C. This development at Buckhorn Falls will furnish light and power for a number of the largest cotton mills in the state.

A. F. Hart & Co., Hickory, N. C., have been awarded the contract for the building of the plant of the Hickory Power and Electric Company, including the dam, which will be built to supply 5,000 horsepower. The work will be completed by January 1, 1908. The Horseford Shoals property, three miles from Hickory, which was sold recently for $25,000, is to be offered for sale again, a local company having raised the bid 10 per cent.

J. D. Pitts and associates are planning a cotton mill at Glen Alpine, N. C., to be operated by electricity from the Catawaba.

L.

Northwestern States.

Minneapolis, August 31.—The new Selby Avenue tunnel in St. Paul has been thrown open to the traffic of the Twin City Transit Company. The work has been going on for nine months and is an important engineering feat for the Northwest. The slope in the tunnel is seven per cent., and is a reduction from 16 per cent., which was the incline of the surface line.

The Rockwell City (Iowa) Electric Light and Power Company has sold its plant to F. S. Moore.

A new company will be organized to push the project of building an electric line from Sidney, Iowa, to Council Bluffs.

Bonds for $15,000 have been voted at Washburn, Wis., for the purpose of purchasing the local lighting system.

The Northwestern Interurban Railway Company will be incorporated by J. L. Lambrecht of Minneapolis and associates for the purpose of building several trolley lines in Northern Minnesota and North Dakota, including one from Grand Forks, N. D., to Crookston, Minn.

The Dakota Power Company has been organized to develop the power of Rapid Creek, near Rapid City, S. D. About 10,000 horsepower will be generated.

A waterpower plant may be constructed for furnishing power for the municipal electric-light plant at Gary, S. D.

Harry Hoffman has resigned as superintendent of the electric-light plant at Valley City, N. D. About $12,000 worth of new machinery is to be purchased for the plant.

R. A. Roberts of St. Louis has begun surveying for an interurban line which he proposes constructing from Muscatine to Davenport, Iowa.

Messrs. Lambrech and Murray of Minneapolis, who are planning to build a third-rail line from Crookston, Minn., to Grand Forks, N. D., have enlarged their plans and now propose to extend it as far west as Carrington.

The entire street-railway system at Des Moines, Iowa, is to be double tracked. It is estimated that the work will cost close to half a million dollars. Of the 80 miles of line in the city only about a quarter consists of double tracks.

Plans have been completed for an addition to and a remodeling of the plant of the Union Light, Heat and Power Company's plant at Fargo, N. D. The improvement will cost about $30,000.

The Western Supply Company received the contract for new machinery for the electric-light plant at Valley City, N. D. The cost will be about $10,000.

The Davenport (Iowa) and Manchester Railway Company has incorporated with George T. Baker as president and F. E. Rank, secretary; capital, $15,000.

The Prentice (Wis.) Light, Power and Water Company has filed articles of incorporation, with a capitalization of $3,000. A. F. Zeigler heads the list of incorporators.

R.

Pacific Slope.

San Francisco, August 28.—The local street-car service has been further improved by the operation of additional lines and more night cars. It is thought that the small semblance of a car strike that is still remaining will be abandoned, although a few of the leaders of the carmen still assert that they are in the fight to stay.

The Board of Supervisors of San Francisco will defend the city in the suits brought to restrain the supervisors from proceeding with the construction of a municipal street railway on Geary Street, using the $720,000 specially appropriated for the purpose.

The Board of Supervisors has awarded the contract for furnishing light to the municipality to the San Francisco Gas and Electric Company for the ensuing fiscal year. The company is to light the streets with no less than 4,210 gas lamps and 1,616 electric arc lights. Of the arc lamps 1,366 are to burn all night and 250 may be extinguished at midnight. The rates are as follows: For each separate arc light per night, $0.20713. For electric current for public buildings and for power purposes, per kilowatt-hour, $0.04. Each separate gas lamp per night, $0.087. For gas for public buildings, per 1,000 cubic feet, $0.60. The total payments made to the company must not exceed the amount of the appropriation, $275,000.

The new system of the City Electric Company in San Francisco will be in operation in October, and many contracts have been signed for commercial lighting. The two 2,500-kilowatt turbo-generator sets have been installed at the new reinforced concrete power station on the corner of Beach and Mason streets. The boilers and switchboard are being erected and the salt-water condensing system installed.

At the last meeting of the directors of the San Jose-Los Gatos Interurban Railroad Company and of the Peninsula Railroad Company J. T. Burke of the Southern Pacific was chosen to fill the vacant directorship, and he was unanimously elected to the presidency of both companies. F. E. Chapin was re-elected to the vice-presidency and the remaining directors are W. C. Andrews, A. E. Wilder and Gus Lion.

The Great Western Power Company, which is spending several millions of dollars in the construction of a great electric power generating plant on the Feather River in Plumas County, Cal., is also engaged actively in work near Antioch.

It is announced from Willows, Cal., that the Snow Mountain Power Company has made excellent progress on the hydraulic work for its electric plant. The big sawmill of the company is running night and day cutting lumber for the flume to be built. The line of this flume is now being surveyed.

The City Council of Pasadena, Cal., has passed an ordinance calling for bids for a double-track electric-railway franchise on Colorado and other streets.

The electrical smelter at Heroult-on-the-Pitt, near Redding, Cal., has begun operations. Pig iron is produced by the Heroult process. Ten men to a shift are required at the smelter in addition, of course, to the force of miners. The plant will not operate commercially until a short railroad has been built.

The Noble Electric Steel Company has been incorporated with a capital stock of $1,000,000. H. H. Noble is president; E. V. D. Johnson, vice-president; C. B. Morgan, secretary.

The Fresno Home Light and Power Company, recently incorporated with $250,000 capital stock, will erect a $280,000 plant. The principal place of business is Fresno, Cal.

The Colt Automatic Air Brake and Trolley Company has filed articles with a capital stock of $300,000.

Work has commenced on a big dam at Gold Lake for the Sierra Mercantile Mining and Power Company, a corporation that proposes to furnish power to operate a short line of electric railroad between Marysville and Reno through the Yuba Pass. A similar dam is to be constructed at Long Lake in Plumas County, and the pipe laid down Gray Eagle Creek, which will converge at the power plant with a similar pipe line down Fraser Creek from Gold Lake, where all the waters will be combined and utilized. The contour of the ground permits of this being done with facility.

The Nevada-California Power Company is rapidly constructing its high-tension transmission line from Palmetto to Rhyolite, Nev. Current is to be transmitted for light and power purposes at 100,000 volts. F. G. Baum, who is connected with the company, has brought out a new style of high-tension insulator which will be tried out on this line.

A.

PERSONAL.

W. B. Vot, has been appointed superintendent of the Sheboygan (Wis.) Light, Power and Railway Company.

Abraham White's successor as president of the United Wireless Telegraph Company, the concern operating the De Forest system, is Col. C. C. Wilson of Denver.

C. H. Edwards, manager of the Northwestern Telephone Exchange Company's system at St. Paul, Minn., has resigned his position, and C. W. Reese of Omaha, Neb., has been promoted to fill the vacancy.

Cleveland papers announce the engagement of Mr. Leroy P. Sawyer and Miss Jessamine A. Pike, both of Cleveland, Ohio. Mr. Sawyer is treasurer of the Buckeye Electric Company of Cleveland and is popular in the electrical field. His fiancee is a vocalist and musician of considerable note and belongs to the leading society circles of Cleveland.

Mr. A. C. Bell, until recently in charge of the patent department of the Stromberg-Carlson Telephone Manufacturing Company, at Rochester, N. Y., has resigned that position and will enter the patent-law offices of Mr. Charles A. Brown, 1550 Monadnock Building, Chicago. Mr. Bell's scientific training was secured at Cornell University, of which institution he is a graduate. He has had experience both as a patent solicitor and as an engineer since leaving college. Mr. Bell will be engaged principally in the work of soliciting patents in Mr. Brown's office.

Prof. F. B. Crocker of Columbia University, New York city, has been appointed secretary of the American local committee of the International Electrotechnical Commission. A meeting of the committee will no doubt be held soon and a plan of action decided upon.

R. W. Bailey has been appointed general superintendent of the Peoria (Ill.) Railway Company. Mr. Bailey came from Alton, where he was superintendent of the Alton division of the East St. Louis and Suburban system for the last year and a half. The position is a new one, and Mr. Bailey will have charge of the detail work in connection with both the interurban and the city lines.

Charles J. Haines, father of J. Allen Haines, vice-president of the Western Wire Sales Company of Chicago, died suddenly of heart disease in a downtown Chicago store on August 29th. Mr. Haines was a pioneer resident of Chicago and a prominent business man of the city. He was 61 years of age. The younger Mr. Haines is well known in the electrical fraternity and has many sympathizing friends.

William O. Tague, professor of experimental electrical engineering at Purdue University, Lafayette, Ind., has resigned his position to accept the general management of the Brookline Motor Car Company of Brookline, Mass. Professor Tague has been at Purdue for several years in charge of the engineering laboratory and has done special work in connection with automobiles and electric power. His successor has not been named.

ELECTRIC LIGHTING.

Stanton, Neb., has voted $5,500 in bonds for a lighting plant.

Contracts have been awarded for the construction of an electric-light and water plant at Dawson, Minn.

The Hico (Tex.) Electric Light and Power Company has been incorporated with a capital stock of $10,000.

Atwood Benton is about to begin the construction of a $135,000 electric power plant at Hot Springs, Ark.

An election is to be held at St. Paul, Neb., on the proposition to vote bonds for the construction of an electric-light plant.

The City Council at Aberdeen, S. D., has granted a franchise to C. F. Freehauf for 25 years for an electric-light system.

The Union Central Light and Ice Company has secured a franchise at Hubbard City, Tex. A $50,000 plant will be installed.

The Union Light, Heat and Power Company is planning on $30,000 worth of improvements to its power plant at Moorhead, Minn.

In Terrell, Tex., the City Council has passed an ordinance authorizing the issuance of bonds to the amount of $15,000 for an electric-light plant.

The City Council of Tacoma, Wash., has decided to construct an electric power plant to furnish 10,000 horsepower. The product is to be sold at one-half cent per kilowatt-hour.

Low water in the Grand River, Michigan, the lowest in years, is handicapping many lighting and power plants temporarily. At Ionia the lighting wires are connected with the Commonwealth Power Company's line to Jackson, where current is generated by a steam plant, the city plant being entirely out of business because of the low water.

ELECTRIC RAILWAYS.

The Oklahoma City Street Railway Company will build a $180,000 power house at Belle Isle.

According to statements by officials of the New Haven rapid progress is being made in the installation of electricity on the New York division. If present plans are carried out all trains west of Stamford that run into the Grand Central Station will be operated by electricity. This means both local trains and the fast Boston trains, except the Colonial express and the Federal express, which do not use that station. The change from steam to electric locomotives at Stamford, it is estimated, will not take more than two minutes.

The Russellville and Ozark Mountain Traction, Light and Power Company is planning a power plant to be erected between Russellville and Dover, Ark.

The Harvard (Wis.) and Lake Geneva electric railway has been sold to the Elgin, Belvidere and Rockford Company. About $60,000 will be expended in additions to the power plant at Walworth.

POWER TRANSMISSION.

In the state of Washington W. H. Lewis has filed a water-right location notice in the county auditor's office for power in eastern Lewis County at the junction of the Cispus River with the Cowlitz, proposing to flume 4,000 cubic feet of water per second to the place of use, 15 miles from the river junction.

Announcement is made of the completion of the 900-foot dam for the Whitney Reduction Company on the Yadkin River, eight miles from Salisbury, N. C. The dam is 46 feet in height and 45,000 horsepower will be developed for transmission to mills and factories and for lighting a dozen towns, the power to be available before the end of the year.

Reports from Eugene, Ore., say that engineers at the head of the McKenzie River are making surveys for some unknown corporation for a big electric plant. It is said that water will be taken from Clear Lake and will be tunneled through a mountain to a great generating station, where a 900-foot fall will be secured with a capacity to generate 50,000 horsepower.

The Commonwealth Power Company of Battle Creek, Mich., is troubled by a scarcity of water at its plants at Allegan, Otsego and Plainwell. The streams supplying these plants are very low, and further difficulty is expected unless several inches of rainfall bring relief soon. The cities most affected are Battle Creek and Jackson. Auxiliary steam plants may be called into use.

PUBLICATIONS.

Rossiter, MacGovern & Co. of New York city have issued a new list of electrical machinery, boilers, engines, dynamos and motors dated August 1st, which supersedes all previous lists.

Catalogue No. A12 of the Ward Leonard Electric Company, Bronxville, N. Y., describes and illustrates self-starters for electric motors. The motor is stopped or started by simply pressing a button—"it does the rest." Wiring diagrams are added. The reversing motor-starters, shown in Catalogue A10, can be used to start in either direction of rotation. A renewable spring switch is supplied to open the circuit with a quick break, and magnetic blowouts are used in sizes above 10 horsepower.

The N. E. L. A. Bulletin, Vol. I., No. 1, published by the National Electric Light Association, has made its appearance, dated August. The new publication, besides serving as a bulletin of current events of interest to members of the association, will also be a question box. Matters of timely interest upon which members wish prompt information will be given attention. The bulletin will be published regularly about the fifteenth of each month, and all members of the association and other central-station men are at liberty to contribute to its columns. Communications should be addressed to the secretary, Engineering Societies Building, 29 West Thirty-ninth Street, New York.

SOCIETIES AND SCHOOLS.

Additional electrical machinery and switchboards are being installed in the electrical engineering department of the Louisiana State University. These improvements will afford the university one of the best and largest laboratories and engineering schools in the South. One board will be for a polyphase generator for one, two and three-phase currents while another is a plug distributing board for single and polyphase currents, and the third is a similar board for direct current. This arrangement affords the students any desired kind of current for experiment and tests.

MISCELLANEOUS.

Zinc electrodes in the form of pencils, about six inches long, placed in the suction chamber of a surface condenser employing sea water for cooling, have done away with the galvanic action between the iron base and the other metals in the condensers, which led to the rapid corrosion of the iron. This has apparently ceased entirely since the zinc pencils were introduced, although the latter are eaten away rapidly.

TRADE NEWS.

The General Electric Company is erecting a number of large factory buildings on land purchased by the company at Erie, Pa.

The Northwestern Electrical Company of Seattle, Wash., which has been incorporated with a capital stock of $250,000, will build a plant for the manufacture of electrical appliances.

D. C. & William B. Jackson, engineering experts, announce the removal of their western office from Madison, Wis., to the Commercial National Bank Building, Chicago. An eastern office will be opened in Boston this month. Mr. William J. Crumpton will be in immediate charge of the Chicago office. These gentlemen are prepared to do consulting engineering for electric and allied properties and include in their line of work plans, specifications, supervision or construction, examination and reports.

The Sarco Fuel Saving and Engineering Company of New York is finding a large demand for its Sarco CO_2 recorder. In addition to indicating at sight the amount of carbon dioxide (CO_2) in the flue gases, this machine records the information on a chart, so that the engineer can read at his leisure from the daily record just what furnace economy the fireman has practiced at any particular time. The company is also getting out the Caldwell automatic mechanical coal shovel, which differs from mechanical stokers in that it is independent from and can be applied to any grate. The shovel periodically projects a predetermined amount of coal over different parts of the grate surface and produces a very uniform distribution of the fuel. This company also makes a number of other devices tending toward boiler-room economy. Its officers are: President, H. Sanders; vice-president, C. O. Mailloux; general manager, John A. Caldwell.

BUSINESS.

Type K Allis-Chalmers direct-current motor has been designed to meet the mechanical and electrical requirements of an individual drive for machinery. It is explained to be equally well adapted to belt drive at constant speed and continuous service, or geared drive, variable speed aind intermittent service. The machine is very compact, the construction is rigid, and every detail has been worked out to the exacting requirements of modern service.

The July business of the Westinghouse Electric and Manufacturing Company was considerably above the average. The last information from East Pittsburg stated that the railway department alone showed a record for orders booked approximating about $2,500,000. Among these were two of more than ordinary importance. The Brooklyn Rapid Transit Company contracted for 400 electric-railway motors, 200 of which, of 200 horsepower each, are for the elevated railroad cars, while the balance, of 60 horsepower each, will be surface-car equipment. In connection with the elevated-car equipment the company will also furnish the Westinghouse multiple-unit control. The other large order comes from the Schoepf interests of Cincinnati, which control one of the largest urban and interurban electric-railway systems in this country, operating cars in Eastern and Central Ohio and Southern Indiana. This order includes a complete equipment of electrical apparatus for 24 sub-stations, consisting of rotary transformers, transformers and switchboard appliances as well as four Westinghouse turbo-generators aggregating 26,000 horsepower.

ILLUSTRATED ELECTRICAL PATENT RECORD.

Issued (United States Patent Office) August 27, 1907.

864,154. Device for Alarm and Detecting Burglary. Paul Brauer, Wittenberge, Germany. Application filed June 8, 1906.

The various parts of this device to cause alarm and secure photographs of burglars are set in operation by the intruder completing an electric circuit.

864,167. Insulating Conduit for Electric Wires. Anthony P. Hinsky, Hoboken, N. J. Application filed December 3, 1906.

A tubular conduit of fibrous material is provided in its outer surface with corrugations or ribs. The tube and covering are saturated with an insulating and preservative material.

864,228. Trolley Harp. Frank H. Brueggeman, Norwood, Ohio, assignor of one-half to the Acme Automatic Street Indicating Company, Cleveland, Ohio. Application filed April 23, 1906.

The sections of the harp have hollow heads.

864,232. Railway Switch. James D. Downes, Detroit, Mich., assignor of one-half to Charles R. Burke, Detroit, Mich. Application filed April 1, 1907.

The switch is fitted with electric contacts which close circuits, lighting signal lamps to show the position of the switch.

864,236. Automatic Gas Cut-off. James G. Fairbanks and William O. Rice, Marion, Ohio. Application filed March 7, 1907.

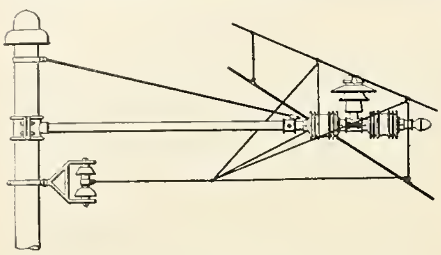
On failure of the gas supply, a pressure-maintained piston sinks, releasing a spring-actuated cut-off valve. Meanwhile an electric alarm bell is sounded.

864,251. Catenary Suspension Bracket for Curves. Elmer P. Morris, East Orange, N. J. Application filed October 20, 1906.

A brace is secured at one end to the cable and at the other end to the trolley wire, so that the lateral strains thrown upon it by the cable and wire respectively are in the same direction.

864,252. Catenary Suspension Bracket. Elmer P. Morris, East Orange, N. J. Application filed October 20, 1906.

Secondary insulators are arranged to trap the cable and prevent its making contact with uninsulated portions of its support. The working conductor is supported from the messenger in substantially a horizontal plane. (See cut.)



NO. 864,252.—CATENARY SUSPENSION BRACKET.

864,259. Electric Reciprocatory Device. John B. Rathbun, Hammond, Ind., assignor to Charles G. Kingwill, Hammond, Ind. Application filed May 9, 1906.

A number of coils arranged so that their fields are coincident are arranged for sending a direct current of electricity through one of them and an alternating current through another, so that the coils first reinforce each other in their magnetic effect upon the core, and then neutralize each other.

864,261. Electrical Cut-out Switch. William H. Ringwood, East Pittsburg, Pa. Application filed November 22, 1906.

A detachable cam connection for electrical poles has engaging projecting lugs on its walls, so that when one section is turned upon the other engagement of contact plates will occur. A fuse connects the contact plates of one section.

864,272. Space Telegraphy. John S. Stone, Boston, Mass., assignor to William W. Swan, trustee, Brookline, Mass. Application filed January 4, 1907.

As shown in the circuit diagram, a resonant circuit includes a condenser with a local receiving circuit connected across its terminals, and has in series an audion, a source of unidirectional electromotive force and a circuit of low resistance and high inductance connected in shunt to said rectifier. (See cut.)

864,297. Storage Battery. William Gardiner, Chicago, Ill., assignor to Cornelius P. Stringfield, Chicago, Ill. Application filed December 23, 1905.

The plate consists of a series of trough-like juxtaposed sections, each open at one side, and with its other sides provided with apertures covered by a porous strip, against which the active material bears.

NO. 864,344 —FLUID-PRESSURE SYSTEM.

864,306. Electric Switch-operating Device. Frank A. Johnson and David A. Robbins, Danville, Ill. Application filed October 22, 1906.

Swinging contacts carried by the trolley span-wires may be engaged by a movable contact carried on the car, to close a circuit to operate the track switch.

864,332. Telephone Attachment. Albert S. Perry, Yukon, Okla. Application filed March 2, 1907.

Auxiliary contacts in the telephone box are controlled by a push rod.

864,341. Annunciator. Frederic Sidler, West Pullman, Ill. Application filed November 14, 1904.

A pawl extending from an armature actuated by an electromagnet in the call-bell circuit advances a ratchet wheel.

864,344. Fluid-pressure System. Samuel B. Stewart, Jr., Schenectady, N. Y., assignor to the General Electric Company, Schenectady, N. Y. Application filed May 20, 1903.

The rheostat arm is advanced by a pilot motor to start the pump motor when the line pressure falls below a set value. (See cut.)

864,348. Electric Welding Clamp. William E. Williams, Chicago, Ill. Application filed July 21, 1905.

Two electrode blocks, carrying contact pieces, are mounted to move in a line toward each other. The contact pieces move so as to grip the work at the welding point. (See cut.)

864,362. Burglar Alarm. Nelson L. B. Doull, Los Angeles, Cal. Application filed December 11, 1905.

This burglar alarm is a combination of a lock, a battery, an electric bell and casings inserted in the door frame opposite the lock and latch bolts, carrying plungers which normally complete a circuit with the bolts through the lock mechanism.

864,382. Support for Telephone Receivers. John S. Mills, New Grenada, Pa. Application filed January 21, 1907.

Attached under the transmitter-arm bolt is an angle arm ending in a telescoping bracket which holds the receiver in clips.

864,422. Trolley Guard. Charles Harkness, Providence, R. I., assignor to the Harkness Trolley System Company. Original application filed February 16, 1905. Divided and this application filed March 8, 1906.

A lever, weighted at one end, is provided at the other with upwardly diverging arms pivotally mounted on the bracket arm, on which it is movable both vertically and transversely.

864,427. Lamp Receptacle. Harry W. Lawrence, Denver, Colo., assignor to the New England Electric Company. Application filed January 5, 1907.

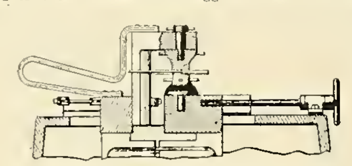
The socket comprises a porcelain base or block having an annular groove therein, which has a number of outward extensions. A threaded shell having outwardly bent ears is inset in the groove.

864,446. Controlling Mechanism. Herbert W. Cheney, Norwood, Ohio, assignor to Allis-Chalmers Company and the Bullock Electric Manufacturing Company. Application filed June 30, 1906.

The controller drum has "off," starting and running positions, and a spring which tends to move it to "off" position when in starting position, but exerts no influence when in running position.

864,454. Testing System for Telephone Lines. William W. Dean, Chicago, Ill., assignor to the Kellogg Switchboard and Supply Company, Chicago, Ill. Application filed June 29, 1903.

An operator's busy-test system capable of being applied to the well-known Kellogg cord circuit is detailed.



NO. 864,348.—ELECTRIC WELDING CLAMP.

864,519. Apparatus for the Electric Operation of Type-setting Machines. Heinrich Drewell, Hanover, Germany. Application filed August 25, 1906.

The characters are controlled by the combination of brushes making contact with a conducting roller through perforations in non-conducting strip.

864,520. Trolley Wire Hanger or Ear. Harry G. Dyer, Gloucester City, N. J., assignor of one-half to William J. Van Meter, Gloucester, N. J. Application filed September 7, 1906.

The trolley wire is carried up in a curved path, while a part of the hanger presents a straight under-run for the trolley.

864,530. Device for Pulling Electric Cable and Wire. Daniel H. Garber, Indianapolis, Ind. Application filed January 25, 1907.

Two clamping shoes which grip the cable are forced together by a bell-crank lever, to which the pull rope is attached.

864,535. Electric Lamp Adjuster. Wilson S. Hawker, Dayton, Ohio. Application filed December 1, 1905.

An extendible tubular arm ends in hinged clips which clasp the lamp sockets.

864,542. Bracket for Electric Headlights. Charles E. Jones, New York, N. Y., assignor to the Dressel Railway Lamp Works, New York, N. Y. Application filed May 7, 1907.

The bracket holds the lamp with its center in the focus of the reflector.

864,571. Trolley Harp. Thomas W. Small, Cleveland, Ohio, assignor to the Acme Automatic Street Indicating Company, Cleveland, Ohio. Application filed December 5, 1906.

A contact-boss is carried at the side of and insulated from the harp, and connects with the car through a wire insulated from the trolley pole.

864,576. Alarm. Thomas H. Troland, New London, Conn. Application filed March 8, 1905.

Water escaping from an automatic sprinkling nozzle throws a contact lever over its center, completing an alarm circuit.

864,599. Insulator Tie for Electric Wires. James W. Beckett, Little Rock, and William R. Beckett, Rose Bud, Ark. Application filed May 21, 1906.

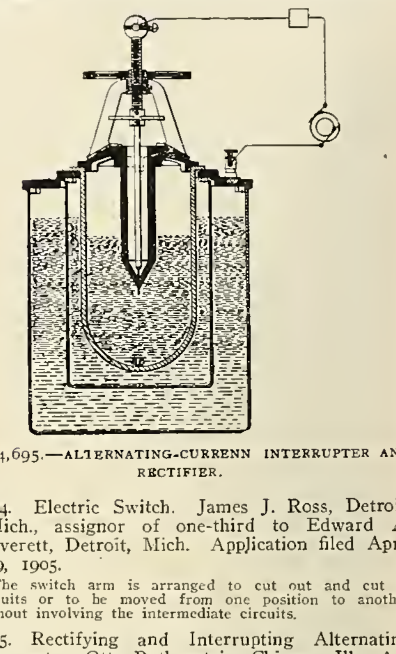
The wire is gripped by a clamping screw carried by a strap which encircles the insulator.

864,623. Driving Gear for Motor Vehicles. William H. Douglas, Belleville, N. J., assignor to Healey & Co., New York, N. Y. Application filed September 26, 1906.

The motor is supported on the axle and is connected to the pinions by double universal joints.

864,653. Electric Railroading. Isidor Kitsee, Philadelphia, Pa. Application filed April 15, 1907.

A system of four tracks has five overhead wires, the outside of the outside tracks being provided each with one wire connected to a common terminal of a generator, the inside of the outside tracks being provided each with one wire connected to the opposite terminal of the generator and the inside of the two inside tracks provided with a common wire connected to the first terminal of the generator.



NO. 864,695.—ALTERNATING-CURRENN INTERRUPTER AND RECTIFIER.

864,694. Electric Switch. James J. Ross, Detroit, Mich., assignor of one-third to Edward A. Everett, Detroit, Mich. Application filed April 19, 1905.

The switch arm is arranged to cut out and cut in circuits or to be moved from one position to another without involving the intermediate circuits.

864,695. Rectifying and Interrupting Alternating Currents. Otto Rothenstein, Chicago, Ill. Application filed November 1, 1906.

To prevent heating during operation, which would greatly diminish the "valve" effect of the aluminum, the outside vessel contains a refrigerating fluid; a second vessel of rectifying material, as aluminum, is provided with a binding or terminal post and contains a suitable electrolyte; a third vessel of inert material, containing a suitable electrolyte, is suspended in the second vessel. Annular rings of insulating material separate the vessels electrically.

864,713. Telephone Repeater System. Nathaniel G. Warth, Columbus, Ohio. Application filed January 25, 1907.

The principle is that of reproducing the incoming currents through a receiver in mechanical connection with a transmitter capsule, but a novel arrangement of circuits renders the receiver operative only to the received currents and not to the locally reproduced currents.

PATENTS THAT HAVE EXPIRED.

Following is a list of electrical patents (issued by the United States Patent Office) that expired September 2, 1907:

435,424. Electric Switch. C. W. Huntington, Baltimore, Md.
435,438. Telephony. T. D. Lockwood, Melrose, Mass.
435,440. Automatic Electric Annunciator. J. W. Luthe and A. E. Jeavous, Cleveland, Ohio.
435,447. Electric Conductor for Street Railways. L. M. Perkins, St. Louis, Mo.
435,471. Electric-railway Closed-circuit System. M. Wheless, Nashville, Tenn.
435,486. Conduit for Electric Railways. W. R. Elliott, Kansas City, Mo.
435,487. Electric Conduit. W. R. Elliott, Kansas City, Mo.
435,490. Automatic Electric Switch. T. M. Foote, Boston, Mass.
435,516. Electric Signaling Apparatus for Preventing Collisions Between Railway Trains. T. Perls, Wurzburg, Germany.
435,525. Regulator for Dynamo-electric machines. C. E. Scribner, Chicago, Ill.
435,526. Regulator for Dynamo-electric machines. C. E. Scribner, Chicago, Ill.
435,527. Regulator for Dynamo-electric Machines. C. E. Scribner, Chicago, Ill.
435,536. Electric Conduit. H. N. Curtis, New York, N. Y.
435,545. Automatic Regulation of Electric Circuits. G. B. Prescott, Jr., Newark, N. J.
435,550. Electrical Measuring Instrument. G. W. Walker, New York, N. Y.
435,559. Upward-pressure Contact for Electric Railways. J. A. Duggan, Quincy, Mass.
435,639. Electric Motor. H. H. Blades, Detroit, Mich.
435,640. Means for Supporting Storage-batteries on Railway Cars. H. H. Blades, Detroit, Mich.
435,641. Electric Railway Car. H. H. Blades, Detroit, Mich.
435,642. Electric Railway Car. M. W. Dewey, Syracuse, N. Y.
435,643. Method of Electric Welding. M. W. Dewey, Syracuse, N. Y.
435,662. Electric Railway. R. M. Hunter, Philadelphia, Pa.
435,679. Method of and Apparatus for Producing Musical Sounds by Electricity. G. Breed, United States Navy.
435,687. Means for Charging and Using Secondary Batteries. T. A. Edison, Menlo Park, N. J.
435,688. Process of and Apparatus for Generating Electricity. T. A. Edison, Menlo Park, N. J.
435,689. Telegraphy. T. A. Edison, Menlo Park, N. J.
435,690. Method of Making Armatures for Dynamo-electric Machines. T. A. Edison, Menlo Park, N. J.
435,700. Device for Controlling the Current of Electric Generators. H. W. Leonard, Chicago, Ill.

WESTERN ELECTRICIAN

EVERY SATURDAY

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Combined Working of Electric Power Stations and Gas Works.

By Dr. Alfred Gradenwitz.

In spite of the indifference shown in the beginning by gas works to the rapidly increasing number of electric power stations, it may be said that gas works and electric power stations may very well continue prospering side by side. In fact, the development of the former has hardly ever been hampered by the subsequent erection of an electric power station at the same locality, while in many cases a mutual assistance between these two kinds of power stations has been found extremely profitable. While the managing cost of both works can thus be reduced to some extent, the gas works will be able to supply the prime energy for the electric station at far cheaper rates.

An interesting instance of a combination of these two kinds of power plant is afforded by the community of Lichtenburg, near Berlin. The community had possessed for some time a gas works operated on a rather satisfactory basis, when in 1904 the construction of an electric power station was decided upon and carried out immediately. In this case the consumption of gas, so far from decreasing after the electric station had been opened, was even found to increase in the first year, while the electric power station showed so satisfactory a development as to require an extension after a short time.

As shown in Fig. 1, the electric station was erected immediately beside the gas works, suction gas generated from the coke of the works being chosen as prime energy. This gas at present operates two engines of 200 and two of 500 horsepower each, all of which have been supplied by the Maschinenbau-Gesellschaft, Nurnberg.

In Fig. 2 is shown a general view of the engine room of the power house at Lichtenberg. Each of the two smaller gas engines and one of the 500-horsepower engines is direct-coupled to a direct-current dynamo, the power station having been planned at the outset as an exclusive direct-current station. Shortly after its completion, however, the necessity of supplying more distant districts with large amounts of energy was felt, resulting in an alternating-current extension. For this reason the 500-horsepower gas engine last installed was directly coupled to an alternating-current generator, while a suitable converter was provided as mutual reserve for both kinds of current. The direct-current output of the works is assisted by two accumulator batteries of considerable capacity.

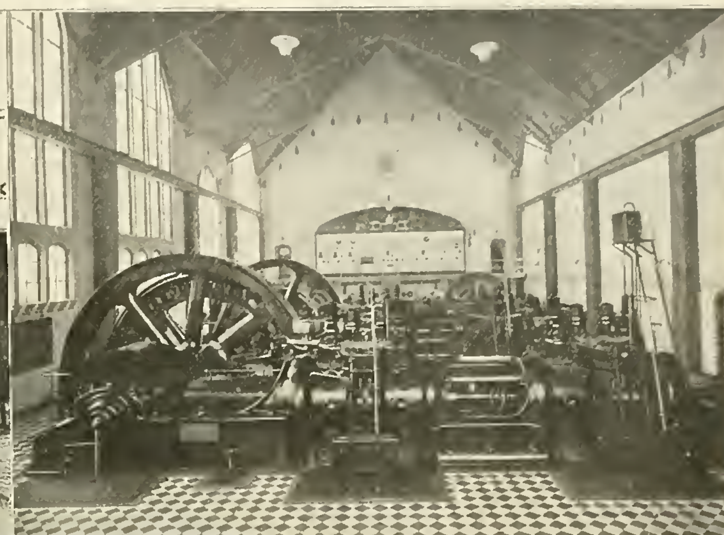
On the ground of a former estate situated in the neighborhood of the central station a converter station was erected at the same time the extension mentioned was carried out. This comprises provisionally two converters (Fig. 3) and an accumulator battery. This arrangement allows both of yielding alternating current to the outlying district and of feeding the existing direct-current system by the aid of converters.

The electrical energy generated at the electric power house was utilized in the recent extension of the gas works for operating, by means of electric motors, any machinery required for the operation of an up-to-date gas works. A total of eight direct-current motors (of the enclosed type on account of the great amounts of dust) was installed.

Fig. 4 shows a coal crusher operated through belt transmission by a 15-horsepower motor. Fig. 5 shows a discharging machine with electric traveling mechanism, in the gas works. The machine itself is actuated through belt transmission by a motor. A similar equipment was chosen for the charging machine in the same room.

Operation of the De Brower chute, shown in Fig. 6, is by means of a 3½-horsepower electric motor provided with gearing, reducing its number of turns at a ratio of 5 to 1, while the drive itself is effected from the intermediary shaft through belt transmission. There is further an elevator operated by a five-horsepower motor and a Bamag chute actuated by a three-horsepower motor, both through belt transmission.

All the above-mentioned plants have given satisfactory results in practice, illustrating the mutual benefit to be derived from a combination of gas works and electric power stations.



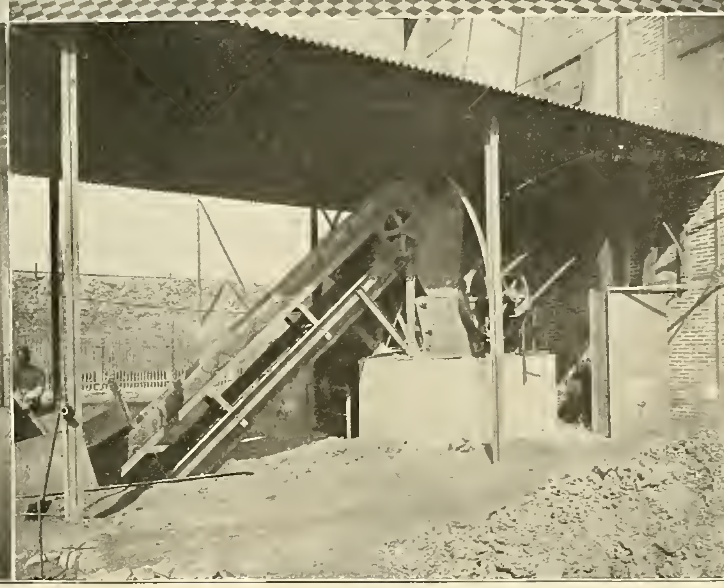


Fig. 1. Electric Power House directly beside the Gas Works.
Fig. 2. General View of direct-connected Gas Engines and Generators.
Fig. 3. Converter Station in connection with Lichtenberg Power House.
Fig. 4. Coal Crusher operated by 15-horsepower Motor.

COMBINED WORKING OF AN ELECTRIC POWER STATION AND GAS WORKS AT LICHTENBERG, GERMANY.

Advices from Tacoma, Wash., say that Pacific Avenue will follow the example of C Street and place cluster lights 100 feet apart along the curbs. Business men will beautify the thoroughfare. R. F. Anderson has assumed charge of the enterprise.

Electrical Progress in New Zealand.

Reporting to the governor of New Zealand on the Post and Telegraph Department of that country for the year 1906, Mr. J. G. Ward of Wellington, postmaster-general and minister of telegraphs, says that the year has been one of uninterrupted

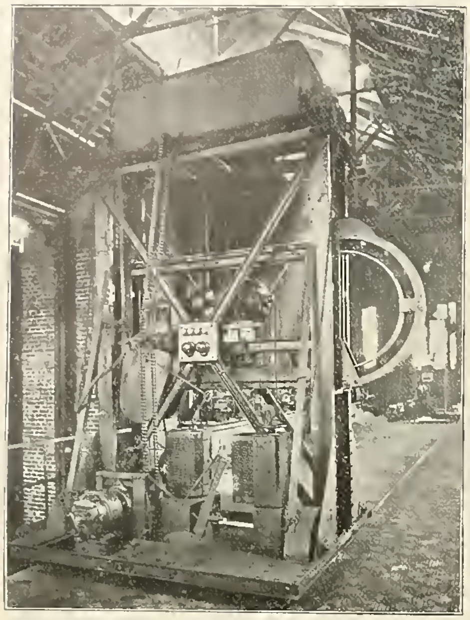


FIG. 5. ELECTRICALLY OPERATED DISCHARGING MACHINE IN LICHTENBERG GAS WORKS.

prosperity. The revenue of the department and the excess of revenue over expenditure were the highest yet attained. For the first time the revenue of the telegraph branch has exceeded the expenditure, and this by the substantial sum of £16,161.

The charges for continuous attendance at telephone exchanges having over 150 paying subscribers have been altered to permit of alternative rates being charged—viz., £7 per annum for business establishments and £5 for private residences, or £6 a year for each business and private connection.

The total value of the telegraph and telephone business for the year ended March 31st last, including miscellaneous telegraph receipts and government telegrams, was £325,007 15s. 7½d., as compared with £298,079 17s. 11d. for the previous year.

The working of the Pacific cable has been satisfactory. Delays due to weather conditions occurred occasionally on the Canadian land lines.

In the public-works' estimates for 1906-7, Parliament voted £2,000 for wireless telegraphy. Negotiations which had been proceeding with the commonwealth toward establishing wireless-telegraph communication between Australia and New Zealand and some of the outlying islands did not result in any decision to prosecute this work. It will probably be found the best policy, says Mr. Ward, to withhold any considerable outlay in connection with wireless telegraphy until something more definite is known as to what is likely to result from scientific research now proceeding.

Several orders in council for tramway extension

FIG. 6. DE BROWER CHUTE IN LICHTENBERG PLANT.

have been dealt with during the year on behalf of the Board of Control, and supervision maintained over the several tramway undertakings in the colony. A few applications for licenses for the electric lighting of boroughs have been received.

Alternating-current Coal Mining Installation of the McKell Coal and Coke Company.

After operating its Kilsyth (W. Va.) mine for a number of years, using electric haulage of the rack-rail type and employing electric power for various purposes in and about the mines, generating the current at 275 volts close by the bank mouth, the McKell Coal and Coke Company, which was a pioneer in the New River field of West Virginia, realized the necessity of supplying electric power for its new operations farther up Loup Creek.

The first plan considered was the placing of other power plants at each operation. Lack of water during a portion of the year was, however, an obstacle in the way of this plan, and further, it means a large increase in operating expense, each plant requiring its own engineers and firemen. Moreover the distance between the new operations and from the existing plant to the new operations is too great to allow of direct-current or low-voltage transmission. Further than this, the installation of such individual low-tension power plants would meet the requirements temporarily. The extent of the coal to be eventually mined and handled over the tipples is so great that the cost of distributing electric power over the entire territory from these stations in the form of direct current would largely offset the economy of its use.

The establishment of a central station from which power could be distributed to the many points needed was the logical solution of the problem, and naturally the location of this station, other things permitting, should be, as its name indicates, in the center of the entire property. This, as has already been said, was not feasible, owing to lack of suitable water supply, and that requirement led to the final choice of Kilsyth for the new generating apparatus. Besides being the nearest point to the power center where a water supply was available, it further offered the advantage of combining the new with the already existing power plant, which it is necessary, or at least advisable, to maintain in its existing shape for the present.

The power requirements of the McKell properties, like all mining operations, are steadily and constantly increasing, and this fact, with the present needs, fixed the size of the first unit to be installed for the transmission work at 500 kilowatts, with a station proportioned for a second unit within the same building, and space available for an extension of the building to accommodate a third unit, should it be found necessary. The main power house with its first unit is shown in Fig. 1.

The existing boiler plant, consisting of four horizontal tubular boilers, was increased by the addition of four 72-inch by 18-feet boilers of the same general type, having four-inch charcoal iron tubes. The engine is of the Allis-Chalmers Corliss type, 26 by 42 inches, running at 120 revolutions per minute, with a normal steam pressure of 115 pounds. This is direct-connected to a 500-kilowatt 24-cycle 6,600-volt three-phase Allis-Chalmers generator, revolving-field type, with 24 poles. It is separately excited by a 20-kilowatt Allis-Chalmers generator wound for 230 volts, direct-connected to a high-speed engine.

The switchboard consists of three panels of Vermont marble. A swinging bracket attached to the board carries an arc voltmeter with illuminated dial and a Lincoln synchronizer.

Lightning arresters are placed where the line wires leave the power house, though ventilating cupolas and disconnecting switches at the same point allow the cutting out of the entire equipment from the line wires when shut down.

The transmission line from Kilsyth to Sydney sub-station consists of three No. 00 copper wires carried on high-tension porcelain insulators, supported by iron pins. The three wires are placed in the form of a triangle, in cross-section, about 28 inches on a side. The top wire insulator is carried on an iron ridge pin and the other two are held by iron pins supported by a southern pine cross-arm three feet long, 26 inches from the top of the pole. The poles are largely second growth chestnut 35 feet in length.

From the Oswald sub-station to the Graham sub-station the same form of construction is used, but the size of wire is onl No. 4. The amount of copper installed is sufficient to supply double the present capacity of the sub-station with a line drop of 10 per cent. At each sub-station are located transformers reducing the alternating current to a voltage of 160 for conversion to direct current at 250 volts through rotary converters, all of Allis-Chalmers Company's manufacture.

At Oswald the sub-station is equipped with a 300-kilowatt rotary with equivalent transformer capacity. This sub-station supplies direct current for locomotive haulage, coal cutting and other minor

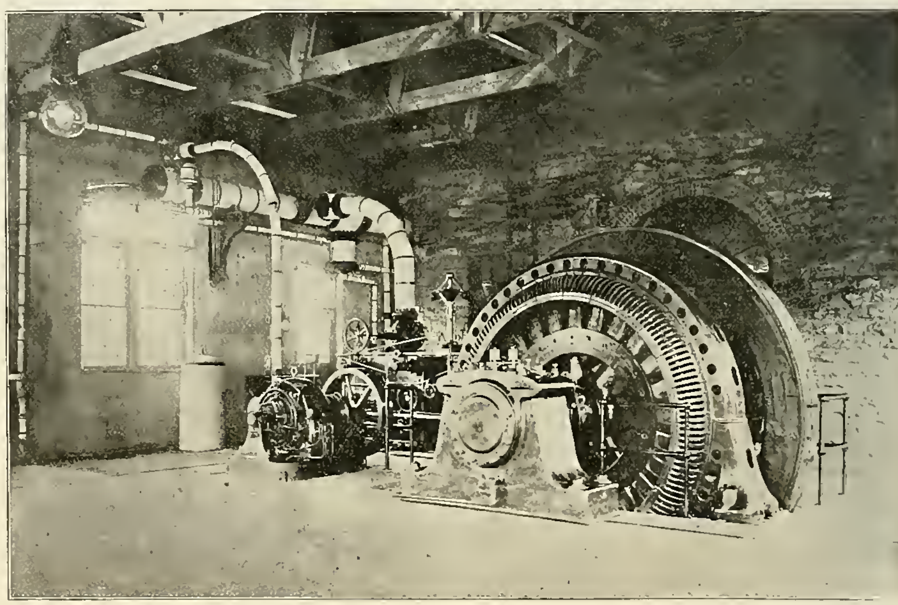


FIG. 1. KILSYTH POWER HOUSE OF THE M'KELL COAL AND COKE COMPANY.

uses in the Sydney mine close by the station, and also for the same uses in the Oswald mine, the bank mouth of which is across the stream from the sub-station. Fig. 2 shows the interior of the Sydney sub-station.

At Graham a 200-kilowatt rotary supplies the Graham mine. Each sub-station is designed for an increase in capacity to double the present installation, and each contains a four-panel switchboard. The alternating-current 6,600-volt current first passes through an automatic oil switch placed in a concrete cell at the rear walls of the building and controlled from the switchboard. The same panel carries three alternating-current ammeters and voltmeters on a swinging panel. The second panel carries an ammeter for low-tension alternating current and three single-pole double-throw main switches for the rotary. In operation these switches are thrown down for starting, connecting thus the rotary to half-voltage taps in the transformers, and the regular running position is up. Field break-up switches are placed on the frames of the rotaries themselves, as are also the equalizer switches for future equipment. The direct-current panels carry their usual direct-current generator and feeder equipment for two main circuits and an auxiliary direct-current lighting circuit. The main circuit and each feeder circuit are protected by circuit-breakers, and both alternating-current and direct-current lines are provided with complete lightning-arrester equipments. The incoming and outgoing lines pass through tiled openings in the rear walls and the alternating-current lines are provided with disconnecting switches. The sub-stations, like the main station, are of stone, with concrete floors and foundations.

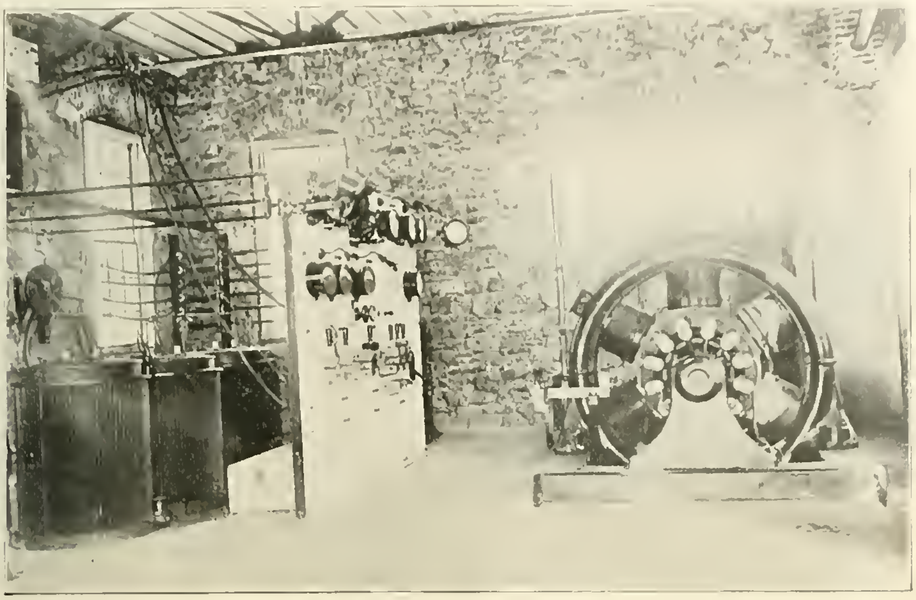


FIG. 2. SYDNEY SUB-STATION OF THE M'KELL COAL AND COKE COMPANY.

The sub-stations are located to reduce the direct-current distributing distance as much as possible and at the same time place them where the small attention required may be conveniently given by employes at the tipples, or on other portions of the outside works. The main circuit-breakers (direct-current) in each station are provided with a contact device by which a bell, located at any point where some employe is within sound, is rung and also lamps lighted when the circuit-breaker is out, giving both a visible and audible alarm.

The three mines are provided with Clifford-Capell fans, and owing to the heavy demand for power which these fans, when run at their full capacity, will make, they are operated by alternating-current motors entirely independent of the sub-stations. The Sydney and Oswald fans located at No. 4 and No. 5, respectively, are 11 feet in diameter, four feet four inches in width, with nine-inch shaft, and are rated to deliver 100,000 cubic feet of air each per minute against a three-inch water-gauge pressure. Under these conditions the fans would run at 230 revolutions per minute and require about 80 horsepower each. The Graham fan requires about 40 horsepower for driving. The fans are belted to the motors, which are standard three-phase induction type, controlled by compensators. Each motor is provided with large and small pulleys, allowing a variation in speed. Banks of lamps on the secondary of the transformers, normally burning, will show an interruption of the current by their darkness, and a visible signal will also be arrayed to show an interruption of the fan itself through the same cause or trouble with the motor or belt connection.

Induction or synchronous motors for various purposes, such as the operation of mine pumps, etc., may be placed practically at any points needed in the entire territory at a nominal copper cost, the voltage of 6,600 reducing the size of conductors so that the principal items of expense in such distribution is very materially cut down. Fig. 3 shows a set of motor-driven pumps in one of the mines.

It is equally feasible to place other rotary transformer stations at distant points on the property for direct-current distribution underground, and if such distribution is needed at points in the workings midway between the outcrops on the main creek and its branches and those on the head waters of Mill Creek the high-tension current may be carried overhead to a point above the center of such a needed distribution and thence down a bore hole to an underground transformer station similar to the sub-station already described.

The details of the electrical installation in these mines were furnished by Timothy W. Sprague and Charles K. Stearns, consulting engineers. The Allis-Chalmers Company furnished the principal power and electrical equipment.

Canadian Electrical Exhibition.

The Canadian electrical show was opened in the old Drill Hall, Montreal, on September 2d and will continue until September 14th. The exhibits were arranged very artistically and the illumination is brilliant. There are over sixty exhibitors, and nearly everything electrical is on exhibition, many of the devices, especially in the line of household heating and cooking utensils, being new to the general public. All the exhibits are contained in uniformly built booths, giving a systematic appearance. Each booth is painted white and there is a uniform arrangement of signs. Each sign and each railing separating the booths is made to conform to the standard.

So far the attendance has been good, and public interest is increasing. Many of the largest electrical concerns in Canada and the United States are exhibiting, and the large staff of experts gives interesting demonstrations of the various devices. Of special interest to the ladies is the large electric kitchen exhibited by the Canadian General Electric Company. Here electrical devices for the household are shown and their uses demonstrated.

Many prominent men of the Dominion are taking a lively interest in the show. On the evening of September 5th the visit of Hon. Lomer Gouin, provincial prime minister, was made a special feature. The premier and his party were escorted through the various exhibits by W. McLea Walbank, president of the exhibition company; R. S.

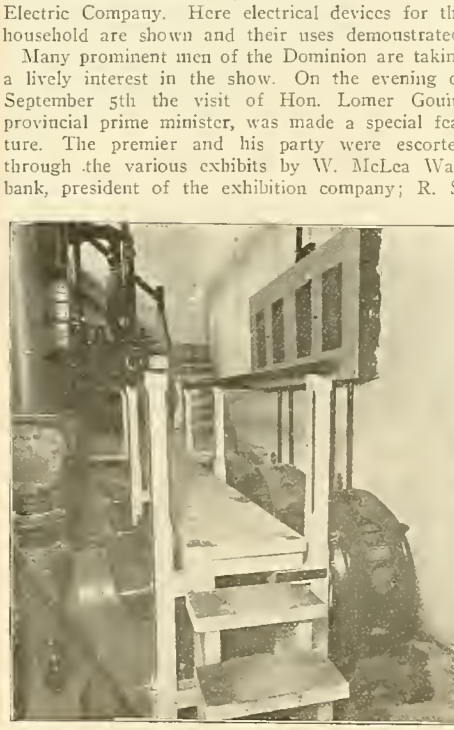


FIG. 3. INDUCTION MOTORS DRIVING PUMPS IN M'KELL COAL PLANT.

Kelch, managing director; J. W. Pilcher, secretary and treasurer; H. D. Bayne and J. A. Milne, directors.

Music is furnished in the exhibition hall by the band of the Sixty-fifth Mount Royal Carabineers. During the show several conventions will be held in Montreal, including the Canadian Electrical Association, the Canadian Street Railway Association and the Maritime Electrical Association.

Aside from the brilliant illumination, artistic decoration and numerous entertainment features, which make the show a success from the popular viewpoint, there is much to interest the electrical student and engineer, as the latest developments in the field are shown.

Following is a nearly complete list of the exhibitors:

Adams-Bagnall Electric Manufacturing Company, enclosed arc lamps.

Allis-Chalmers-Bullock, Limited, electrical and hydraulic machinery and appliances.

Aluminum Company of America, aluminum cables and joints.

American Conduit Company, conduit construction.

American Instrument Company, electrical measuring instruments. The Packard Electric Company, Ltd., agents.

Babcock & Wilcox, Limited, water-tube boilers and fittings.

Bell Telephone Company of Canada, telephone exchange.

Canadian Buffalo Forge Company, electric blowers, etc.

Canada Electric Company, electric and gas fixtures.

Canadian Fairbanks Company, Limited, electrically driven machinery.

Canadian General Electric Company, Limited, electrical machinery and apparatus of all kinds.

Canadian Pneumatic Tool Co., Limited, electric drills.

Canadian Rand Company, Limited, motor-driven air compressor.

Canadian Westinghouse Company, Limited, electrical machinery and apparatus of all kinds.

Crocker-Wheeler Company, motors, generators, A. C. and D. C. The Packard Electric Company, Ltd., agents.

Dominion Electric Manufacturing Company, Ltd., electrical specialties, conduit fittings, switches, switchboards, fixtures.

Dawson & Co., J. A., electric-light, power and railway supplies.

Dossert & Company, solderless connectors and terminals for wires and cables.

Economical Electric Lamp Company, turn-down lamps.

Fibre Conduit Company, fibre conduit.

Forman, John, electrical supplies.

Gest, G. M., conduit construction.

Garth Company, fixtures and fittings.

Jandus Electric Company, enclosed arc lamps. The Packard Electric Company, Ltd., agents.

Linde-British Refrigeration Company, Ltd., motor-driven refrigerating machine.

Locke Insulator Company, high-voltage insulators.

Macdonald, A. Roy, plain and moulded mica.

Marconi Wireless Telegraph Company, sending station, receiving station.

Martel-Stewart Company, Ltd., electric signs.

Midland Electric Company, electrical supplies.

Montreal Light, Heat and Power Company, electrical appliances.

Montreal Steel Works, Ltd., electric-railway truck and track work.

Munderloh and Company, general electrical supplies.

National Electric Lamp Association, Canadian Member, Sunbeam Lamp Company.

Northern Electric and Manufacturing Company, Limited, telephone and fire-alarm apparatus and supplies.

O'Leary, W. J. & Company, auto electric switches, telephones, etc.

Pringle, R. E. T. Company, Limited, electrical supplies.

Phillips, Eugene F., Electrical Works, Limited, wires and cables.

Packard Electric Company, Limited, electrical machinery, instruments.

Reynolds-Dull Flasher Company, carbon gravity flashers.

Robb Engineering Company, Limited, direct-connected lighting plant engines and parts thereof.

Sayer Electric Company, electrical supplies and novelties.

Shawinigan Water and Power Company, photographs and drawings.

Stratton Rotating Engine Company, rotary engine connected to dynamo.

Sunbeam Lamp Company, incandescent lamps of all kinds.

Thomson, Fred, & Company, electrical apparatus and demonstrations of electrical phenomena.

Wire and Cable Company, electrical wires and cables.

Concrete Poles for Transmission Line.

W. D. Boyce, owner of the Marseilles Land and Water Power Company of Marseilles, Ill., has decided on the use of concrete poles for his transmission line from Joliet to Peru. This fall only part of the line will be built as a test. The concrete, after being well mixed, is placed in long molds made of seasoned lumber and is then properly tamped and allowed to dry. In each mold are placed from eight to ten half-inch steel rods for reinforcement that extend from bottom to top of pole. After the concrete is thoroughly set the poles are each tested before being used. In testing each pole is subjected to a load of 700 to 2,000 pounds, according to its size and length. These loads are much in excess of what the poles will carry in service.

The poles are made in several sizes. The smaller ones are 30 feet long, and nine inches square at base and six inches at top. These weigh about 2,000 pounds. The larger ones are 45 feet long and 14 inches square at base and six inches at the top, weighing about 7,000 pounds each, and support a load of 3,000 pounds. All the poles taper gradually and have an obelisk appearance. The cost of the poles is estimated at from $8 for the smaller to not exceeding $25 for the larger sizes. The poles will be set 150 feet apart.

Large Draw Spans Electrically Operated.

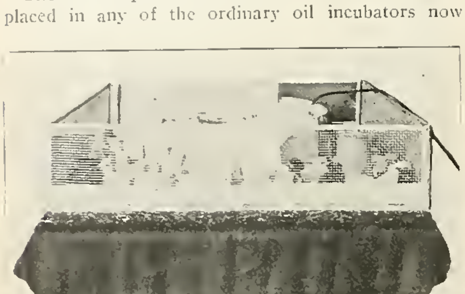
The Illinois Central Railroad bridge between Omaha and Council Bluffs over the Missouri River is said to have the two longest draw spans in the world. The draw mechanism on this large bridge is electrically operated, and there is a complete electrical signaling and interlocking equipment. The length of each draw span is 520 feet and the weight of each is 5,500,000 pounds. The time consumed in bringing the spans to right angles is one minute and 30 seconds. The electric draw, signal and interlocking equipment was designed by Weeks, Kendall & Newkirk of Kansas City, Mo.

Chickens Incubated by Electric Heat.

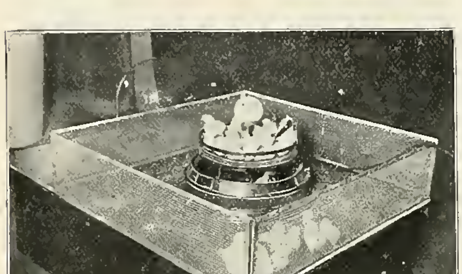
By Frank C. Perkins.

During the recent annual convention of the American Poultry Association at Niagara Falls there was an interesting display of electric incubators showing chickens being hatched by means of current supplied from the Niagara power plants. In these novel electric incubating devices the necessary heat for hatching the chickens was provided by incandescent lamps controlled by thermostats and by electric diaphragms or heating disks with german-silver wires embedded in asbestos base, these conductors also being operated in series with thermostat.

The "electroplane" is so arranged as to be easily placed in any of the ordinary oil incubators now



Electric Brooder.



"Electrehen" for Nature Study

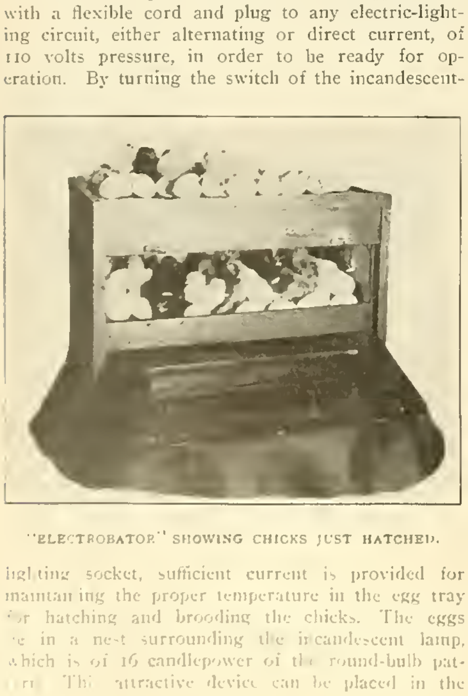
CHICKENS INCUBATED BY ELECTRIC HEAT.

in use throughout the country, its purpose being to supply electric heat in place of the oil heat usually used, at the same time not in any way interfering with the use of the incubator should oil fuel be desired.

By means of this device all of the disagreeable features of oil incubators are avoided, there being no fumes, smoke or offensive odors, and the device is made safe and attractive for use in the home.

The "electrobator" is a purely electrical incubating device, and therefore differs from the attachment above described for use in oil machines. In the upper part of the "electrobator" is located an electroplane, similar to that above mentioned, equipped with a thermostat for controlling the temperature and maintaining the heat constant at 103 degrees Fahrenheit. This thermostat is very sensitive and delicate in adjustment, there being a variation of only a fraction of a degree at any time in the electrobator. An electric condenser is provided on the electroplane, placed in parallel with the terminals of the thermostat, so as to avoid sparking at the contacts, which are of platinum.

The "electrehen" was designed and constructed by the writer for use in nature study in schools and kindergartens, the electric lamp providing all of the necessary heat for incubating the eggs and for brooding the chicks after they have been hatched. It is only necessary to connect the machine, which is contained in an oval glass case mounted on a gun-metal or oxidized-copper base, with a flexible cord and plug to any electric-lighting circuit, either alternating or direct current, of 110 volts pressure, in order to be ready for operation. By turning the switch of the incandescent-



"ELECTROBATOR" SHOWING CHICKS JUST HATCHED.

lighting socket, sufficient current is provided for maintaining the proper temperature in the egg tray for hatching and brooding the chicks. The eggs are in a nest surrounding the incandescent lamp, which is of 16 candlepower of the round-bulb pattern. This attractive device can be placed in the furnished parlor or library of an electrically equipped home, in the window of a store or in the display rooms of a department store, working day and night without attention, as the current maintains practically a constant temperature with but slight action on the part of the thermostat.

A drawer is provided, which is partly drawn from the base, and the electric chicks run about in the fenced enclosure, about three or four feet square, making an attractive feature for a window display to hold the attetnion of the passerby. Electric incubation, even on a large scale, is thoroughly practical, and undoubtedly will be utilized to advantage in the country as well as the city where current is available.

This form of load is very attractive for the electric-lighting companies, and the rates obtainable are as low as for power and heating purposes. The service being for 24 hours per day and for 21 days' continuous run for each hatch, it is a most desirable and constant load from the central-station point of view.

The electric brooder shown in the accompanying illustration was designed to take care of chicks after hatching. The temperature is maintained at 90 degrees to 95 degrees for the first week, and after the chicks are older the regulator is adjusted to from 80 degrees to 85 degrees, and finally the artificial heat is dispensed with entirely.

OBITUARY.

William J. Phelps.

William Joshua Phelps died at Grace Hospital, Detroit, Mich., on September 3d. He had had some trouble with one of his ears and went to the hospital to get relief by a mastoid operation. This was apparently successful, and he seemed to be recovering when he suddenly fell into a condition of coma. The doctors attributed it to a pressure on the brain and opened the wound again to remove this, but found nothing to justify the condition.

Mr. Phelps was born in Elmwood, Ill., November 19, 1866. He was a graduate of Knox College, Galesburg, Ill., and became an electrical engineer and inventor. The best known and most useful of his inventions is the Hylo lamp, and he was the pioneer of the turn-down lamp art, which has grown to be an extensive business. He also invented the motorless flasher, which has been a great help in the electrical advertising field. He was a member of the American Institute of Electrical Engineers, the American Society for the Advancement of Science, the Society of Illuminating Engineers and the Detroit Engineering Society. He leaves a wife and two children, a brother and sister and both his parents as well as a large circle of admiring friends and acquaintances in the electrical trades.

H. W. Hill.

Mr. H. W. Hill died a few days ago at his home in Lakewood, near Cleveland, Ohio. Too close attention to business without sufficient relaxation brought on his physical collapse. Mr. Hill was founder and president of the Hill Clutch Company, which manufactured many of the devices invented by him. Before coming to Cleveland in 1886 he was engaged in large engineering enterprises, one of the most noted being the building of the lighthouse at Key West, Fla. His age was 54.

E. R. Coffin.

Edward R. Coffin, son of Mr. C. A. Coffin, president of the General Electric Company, died in Omaha, Neb., last week. He was suddenly taken ill while traveling from San Francisco to New York and was removed to a hospital at Omaha, where he died after an operation for hernia. He was only 34 years old and was a man of great ability and seemed to be destined for an important place in the affairs of the business world. He was vice-president of the Electric Securities Corporation and was a director and officer of many other companies.

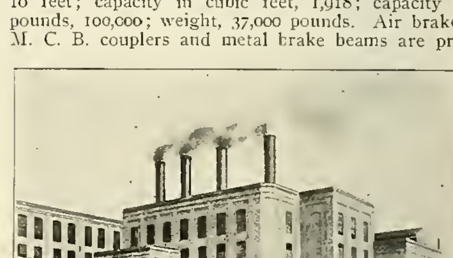
Coal-handling Facilities for the West Allis Works

A group of buildings belonging to a great industrial plant in which no detail of modern shop equipment has been neglected is that of the West Allis Works of the Allis-Chalmers Company, located on the outskirts of Milwaukee. The power house, containing every known improved apparatus and labor-saving device, has only recently been built and will supplant the original station used before the works were extended. The power to be supplied to the works from this central station is mainly electrical, but the boiler plant will at times be utilized to furnish live steam directly to the erecting shop for use in connection with the testing of steam turbines. The station has a capacity of 12,000 horsepower.

A power-house equipment like that described necessarily demands every facility in the supply and handling of fuel. The accompanying illustration shows an exterior view of the new power house with a train of special Allis-Chalmers gondola type coal cars backed into the boiler house ready for unloading. These cars form the latest feature of the handling system provided at West Allis. The coal is dumped directly from the cars into the coal pocket below the track and thence fed to a coal crusher, which delivers directly to an elevator of the bucket and link type. The elevator empties into a rubber belt conveyor, which discharges over the entire length of the coal bunker.

This coal bunker is of the Berquist suspension type, with a capacity of 700 tons. The down spouts are operated from the floor and feed the coal directly into the stoker hoppers. They are 72 inches in diameter and have bifurcated ends, each spout feeding two stokers.

The cars shown in the picture are provided with hopper bottoms to facilitate rapid dumping. They are similar in type to those recently purchased by the Grand Trunk Railway and form part of a line designed and built for Allis-Chalmers Company by the Pressed Steel Car Company, Pittsburg. This type of car is used to convey coal from the docks on the lake shore at Milwaukee to the works at West Allis, thus insuring constant service at all times. Following are their characteristics: Length, 31 feet 5 inches; width, 10 feet 1½ inches; height, 10 feet; capacity in cubic feet, 1,918; capacity in pounds, 100,000; weight, 37,000 pounds. Air brakes, M. C. B. couplers and metal brake beams are pro-



STEEL COAL CARS AT WEST ALLIS POWER HOUSE.

vided. The wheels are made of 33-inch stock; pressed steel beams and open-hearth axles are used.

The method used in removal of ashes is also carefully worked out so that the operation may be accomplished with the least possible expense. The ashes are raked forward into the ash hoppers in front of the stokers below the floor. The hoppers each have a capacity for a day's run at full load and are equipped with double cut-off gates, emptying directly into cars traveling on a narrow-gauge track under the boilers. The ash cars are of the side-dumping type, delivering into a narrow hopper from which the ashes are fed to an elevator discharging at the top of the boiler house into an ash-bin having a capacity of 100 tons. From this bin the ashes are dropped into standard-gauge cars which are provided with side discharge and have capacities each of 50,000 pounds. These cars are also a part of the Allis-Chalmers Company's rolling stock and used exclusively for conveying ashes from the works to places along the railroad track where they can be used for filling.

Electric Drive in Southern Cotton Mills.

Within a radius of about 35 miles, with Charlotte, N. C., as a center, just 67 cotton mills have contracted for electric power to be supplied by the Southern Power Company's plants along the Catawba River. Many of these mills are already using electricity with excellent results, while the others will use it as soon as the transmission lines are completed. On the other hand not a few mills have their own electric generating plants, utilizing the power of some river or small stream wherever a sufficient fall is available. The cotton mills, it is said, are saving several million dollars annually in the immediate section by the change of motive power.

Lectures on Illumination.

Members of the engineering department of the Holophane Company will be open this year, as last, to a limited number of engagements for lectures on "Illumination." These illustrated lectures have created wide interest among the electric-light and gas companies, for the benefit of whose solicitors and customers they are generally given. They are in no sense lectures on the prismatic system of lighting, but treat the fundamental principles of illumination broadly, combining primary instruction in the practical engineering of light with non-technical expositions of good and bad practice of the art.

A. J. MARSHALL.

Last season Mr. Lansingh gave 21 lectures, Mr. Lauritzen eight, and Mr. Marshall 69, the last-named speaking in all of the principal cities of the central and western states in a tour which lasted over nine months. Mr. Marshall's work in this department was particularly notable. In his nine months' tour he traveled over 28,000 miles, gave 69 lectures and addressed approximately 17,000 people. Each lecture was given under the auspices of the local gas or electric company of the city visited and was widely advertised in the newspapers by reading notices and display advertising, the latter not infrequently running from one-quarter to a full page and continuing several days previous to Mr. Marshall's arrival. Announcements or special invitations also were sent to technical societies, architects, gas and electrical engineers, merchants, window trimmers and others whom the lighting company deemed interested.

The lectures were without exception successful in focusing popular attention upon the importance of this subject. They were invariably well attended by people whom it was desirable to interest. The greatest practical result of the lectures, however, lay in the more or less informal after-meetings with the commercial men and solicitors of the several companies, who displayed an eagerness and desire for additional information which was eloquent testimony of the deep interest they felt. Not infrequently arrangements were made for private talks with the solicitors, these talks being in the nature of practical lessons in illuminating engineering, continuing several days. On a number of occasions also Mr. Marshall was called upon to act in his capacity of consulting illuminating engineer for the lighting company.

This branch of the Holophane Company's activities is a distinct departure in educational work along the lines of illuminating engineering. It is undertaken not as a source of revenue, but to assist those most vitally interested—the lighting companies—in bringing forcibly to the attention of their customers and salesmen the importance and mutual advantage of good illumination.

Improved Motor-driven Planing and Polishing Device.

A patent was recently issued to Vinzenz Spietschka of Cleveland, Ohio, for a motor-driven dressing device adapted to be held to its work by hand and particularly suited for planing, polishing and cleaning the curved walls of tanks or vats,

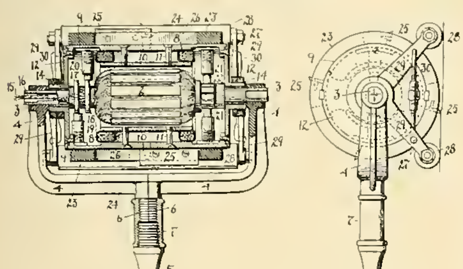


Fig. 1. Longitudinal Section. Fig. 2. End View.
MOTOR-DRIVEN PLANING DEVICE.

although it also is suitable for similar work on floors and other flat surfaces. The device is illustrated in the accompanying diagrams, of which Fig. 1 is a longitudinal section through the center and Fig. 2 is an end view.

A feature of the device is a direct-current motor with stationary armature and revolving fields. The armature (2) has its ends fastened into the arms (4) of the handle. The field-coils (8) are mounted upon the poles (10), and these are fastened to the cylindrical casing (9), which has end plates (12) provided with bushed hubs (14), so as to be capable of rotating about the ends (3) of the armature. The connections (15) for the motor extend through the bore (16), shown at the left end of the armature shaft and connect with the collector rings (17) and (18), upon which bear the carbon brushes (19) and (20) supplying current to the field coils. The wires (15) also connect to the brushes (21), bearing on the commutator (22) at the other end of the armature shaft, thus completing the armature circuit. The casing (9), which is the yoke of the field circuit, and its attached poles rotate about the armature when the current is applied to the motor.

Upon the outside of the casing can be fastened the various dressing tools, such as cutters, buffers or sandpaper. These are mounted upon a removable skeleton casing (23) provided with ribs (26), to which the cutters (25) are screwed so as to be readily replaced by other tools. The depth of cut is controlled by a guide frame (27) consisting of a pair of parallel rollers (28) supported by sets of diverging arms (29). These are placed at each end of the casing (9) and mounted free upon hubs (14). The angle between the arms (29) is adjustable by turnbuckles (30). The handle (5), its supporting arms (4) and the guide frame (27) can be easily removed to permit changes of tools or removal of the casings (9) and (23) for inspection of the motor or other parts. Sandpaper can readily be fastened to the surface of the casing (9) directly.

Novel Electric Portable Stove.

A new addition to the growing line of electrical household cooking devices has been brought out by Albert L. Marsh of Lake Bluff, Ill., who has secured a patent on his invention. The object of the invention is to provide a novel construction of portable electric stove or heater for table use in preparing food, especially as a toaster.

In the accompanying drawing, Fig. 1 is a plan

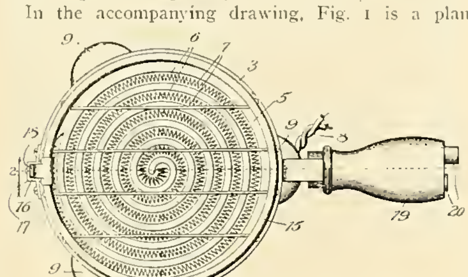


FIG. 1. PLAN VIEW OF MARSH ELECTRIC STOVE.

view, and Fig. 2 a section taken at the line (2) on Fig. 1 and viewed in the direction of the arrow.

The body of the stove, which is preferably of the circular form illustrated, consists of a metal ring (3) having inturned flanges (4) at intervals about its lower edge and a disk-shaped block (5) of fireclay or other suitable refractory material, having a spiral groove (6) formed in its upper surface and fitting inside the ring (3), in which it seats upon the flanges (4). Electrical resistance wire (7) is laid in the groove and tacked at intervals in its base, with the ends of the wire passing through the block (5) and connected with a flexible conductor (8), carrying on its free end the usual plug adapted to be inserted into the socket of an incandescent electric lamp for furnishing the current to heat the wire (7). This wire is shown in helical form to resist warping and tendency to fracture under the strains of expansion and contraction to which it is subjected.

The body is supported on legs fastened to the flanges (4), with interposed strips (10) of insulating material, these legs rising from a base (11), the preferred construction of which is that of a metal ring (12) having an inturned annular flange (13) through which the foot-portions of the legs are fastened to the base, with a disk (14) of non-heat-conducting material seating against the under side of the annular flange and secured by the fastening means for the legs. Thus the base affords an air-space underneath it, which, with the disk (14), renders it non-conducting of heat to a degree that enables the stove to be used on the polished surface of a table without danger of injury to the latter from the heat radiating from the body.

A circular grid (15) is removably and adjustably supported over the top of the stove body at a depending arm (16) fitting in a socket (17) provided on the outer side of the ring (3) and containing a spring (18) to permit the grid to be raised and lowered, and held in adjusted position by the pressure of the spring in the socket. The grid affords a support for any utensil adapted to be imposed on it for cooking its contents, and it also affords a toasting attachment.

On one of the legs is fastened a handle (19), of insulating material, containing an electrical switch, preferably of the common push button variety, represented at (20), connected with the conductor (8) for shutting off the current from the heater.

In use, with the current on, the wire (7) soon becomes highly heated, heating the walls of the spiral groove (6) to a glow, and the heat radiated from the wire and block (5) suffices for the cooking, heating and toasting purposes for which the heater is especially designed.

Charleston, S. C., Wan's Bids for Street Lighting.

Sealed proposals will be received at the office of the city electrician of Charleston, S. C., until 12 o'clock noon on November 15, 1907, for lighting the streets and public buildings of the city for a term of one, two or four years with electricity, gas or some other illuminating power equivalent thereto, or partly by one and partly by another.

The estimated requirements are 500 arc lights of the enclosed type to be supplied with alternating current of not less than 6.6 amperes under a pressure of not less than 70 volts, and the electric energy of each lamp 475 watts, with an illuminating capacity of 1,200 (normal) candlepower. Gas lamps to have 5-foot burners, gas to be delivered at pressure of not less than 13 inches, and to be of standard commercial quality. Detail specifications of lighting will be furnished all bidders upon application to the city electrician. Lights under the contract are to be ready for operation on June 30, 1908. A certified check for $350 is to accompany each bid, and every bidder must be prepared to furnish a bond satisfactory to the mayor to the penal amount of $25,000, conditioned for the performance of his part of the contract, provided his bid is accepted. Ion Simons is city electrician and R. M. Masters is chairman of the committee on lighting.

Safeguard Against Shipwreck from Shoals.

Mr. Albert F. Eells has been granted a patent of recent date on an electric device for sea-sounding. From the fact that sound produced within a vessel is indistinct in very deep waters but grows louder as the water becomes more shallow, the inventor makes use of this principle to determine the depth of water below the ship's keel.

Means are provided for making a continuous sound inside the vessel near the bottom plates, as by an electric hammer. This sound is transmitted through the walls of the ship to the surrounding water, and that which travels to the bottom of the sea is there reflected and echoed back to the walls of the vessel, where it actuates a telephone transmitter secured to the vessel walls. To the transmitter is connected a regular telephone circuit with

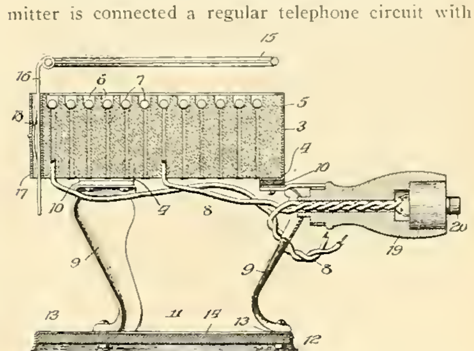


FIG. 2. SECTIONAL VIEW OF MARSH ELECTRIC STOVE.

the receiver in the pilot-house. In this circuit is also inserted a galvanometer with a scale indicating depths. The scale is provided with a contact so that as soon as the indicator reaches it and shows a dangerous shoal a local circuit is closed and an alarm sounded. The whole device is quite simple and is said to be a valuable safeguard against shipwrecks due to striking shoals, or at least to be a means of avoiding delay from becoming stranded.

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DEPARTMENTS.

DATES AHEAD.

Canadian Electrical Show, Power Building, Montreal, September 2d to 14th.

Colorado Light, Power and Railway Association (annual meeting), Savoy Hotel, Denver, Colo., September 18th, 19th and 20th.

Central Electric Railway Association (regular meeting), Columbus, Ohio, September 26th.

New York Electrical Show, Madison Square Garden, September 30th to October 9th.

American Street and Interurban Railway Association and affiliated societies (annual convention), Atlantic City, N. J., October 14th to 18th.

IN A TABULAR statement showing the number and characteristics of central stations in Germany the Elektrotechnische Zeitschrift of Berlin reports one, of 220 kilowatts capacity, operated by wind power. A number of private plants, with storage-battery auxiliary, are operated by windmills, but a public central station, even of small size, depending on wind power is certainly unusual. Further particulars would be of interest.

WHAT WITH the underground electric railway and the greatly increased use of the motor 'bus, it is reported that the hansom cab seems to be in a fair way to disappear from the streets of London, where for sixty years or more it has been such a conspicuous feature of city life. From Birmingham comes the news that a company which has been engaged in the manufacture of hansom cabs has decided to go out of business because of the great falling off in the demand for these vehicles. The extension of street-railway systems generally in Great Britain and the great number of automobiles in use throughout the kingdom are also assigned as reasons for the marked decline in the cab industry. When a Birmingham architect, Joseph Hansom, invented the vehicle that bears his name 70 years ago, it was considered very ingenious; as indeed it is. But apparently the hansom will ultimately follow the sedan-chair and the stage-coach into the dusty realm of transportation antiquities.

ONE USE of electric power which receives little attention but which nevertheless reaches considerable proportions in the aggregate, being withal of unusual interest, is in the construction of large buildings, bridges and other structures. A striking example is now at hand in Chicago, where a large mail-order house is erecting a building of mammoth proportions, being 900 feet long, 270 feet wide and nine stories high. With basement and subbasement the floor area is considerably over 2,000,000 square feet, or nearly 50 acres. The edifice is being constructed of reinforced concrete, manufactured on the spot, and in the various concrete-making and building operations no less than 1,500 horsepower in electric motors is employed. These motors are supplied with current from the central-station mains and they operate a tramway, the derricks for handling material, belt conveyors, cement mixers and the wood-working machinery of a lumber mill where the various molds for the concrete are made. It is one of the conspicuous advantages of electric power that it is particularly well adapted by its flexibility and comparative immunity from fire risk to extensive building operations of this character.

WHAT SHOULD be the clearance between street cars passing on double tracks in a city street? In the rehabilitation of the street railways of Chicago this question has received much attention, both from the Board of Supervising Engineers, which has the matter in charge, and from press and public. The question is whether the space between passing cars shall be so narrow that no one can stand in it, or whether it shall be wide enough to permit an adult to stand between passing cars in safety. If the latter solution is adopted, how wide a clearance shall be selected?

By official action taken on July 30th the Board decided that the distance between track centers be fixed at 9 feet 8½ inches. It is proposed that the new cars be nine feet wide, which would leave a clearance of but 8½ inches. If an adult person was caught in this space he would be severely injured and perhaps killed. The question excited so much attention that the action of the Board was brought up for reconsideration on August 22d, but after an interesting discussion the former action of the Board prevailed, and the distance between track centers remains fixed officially at 9 feet 8½ inches. Mr. C. V. Weston, representing the city, and Mr. H. B. Fleming, representing the Chicago City Railway Company, voted for this distance, and Mr. Bion J. Arnold, chairman of the Board, and Mr. J. Z. Murphy, representing the Chicago Union Traction Company, voted against it. But inasmuch as Mr. Murphy was not a formal member of the Board, his vote did not count, and the motion to reaffirm the previous action prevailed. Mr. Arnold was in favor of the 8½-inch clearance when the matter was first taken up, as related in the Western Electrician of August 17th, but on further consideration decided that a much wider distance, say 20 inches, should be adopted. The opposing views of the members of the Board were sustained by formal statements, and it will be of interest to glance briefly at the arguments presented.

Mr. Arnold explained that when he concurred in the first decision he thought that it was not practicable to establish a greater distance, owing to the posts of the elevated structure in the downtown district, the space required for teaming traffic and the width of the streets. But on further study he concluded that the arguments in favor of the narrow space were not sufficient to warrant a permanent decision in favor of a street-railway system having an unnecessary element of danger in it. By reducing the width of the cars to 8 feet 6 inches and increasing the distance between track centers to 10 feet 2 inches, a clearance of 20 inches could be secured without increasing the distance between curb and car. He advocated this standard as insuring greater safety. The distance between track centers is 10 feet 2 inches in New York city, and by adopting the "pay-as-you-enter" type of car, he thought that 8½-foot cars would be wide enough in Chicago. Mr. Arnold also called attention to the fact that the street-railway company in St. Louis, after using the narrow clearance, is widening the distance between passing cars to 20 inches on all new track.

Mr. Weston's contention was that to insure a width ample for safety the clearance should be three or 3½ feet. But this is impracticable. A lesser clearance might do for a clear-headed person, but a nervous or excited person or one of large size would be quite certain to meet with injury. Better meet the issue squarely and have the public understand that it is just as dangerous to get between the tracks as to stand upon them. There should be no invitation to persons to take doubtful refuge between the cars. "Unless we can provide ample space between passing cars to make it entirely safe for all persons to stand between them, we should contract the space sufficiently to make it prohibitive for anybody to attempt to stand between tracks at a point where two cars are passing." Mr. Weston cited minimum clearances of 12 inches in Detroit, 3 inches in Buffalo, 7 inches in Cleveland and 6½ inches in Philadelphia. Narrow clearances seem to be accepted street-railway practice.

Mr. Fleming agreed with Mr. Weston. He believes that there will be fewer accidents and safer operation by running the cars with a minimum possible distance between them. It is not possible to get a really safe clearance without widening the streets. If the width of the car is reduced as proposed, and the cross-seat type called for in the ordinance is adhered to, the width of the car aisle will be reduced to such an extent as to be impracticable.

Mr. Murphy said that no man measures 60 inches in circumference, and that a clearance of 20 inches would save life. Although a large man, he has stood between freight cars when switching at 20 inches clearance. The law calls for 30 inches on steam railroads. No man who keeps his head will be killed or sustain broken bones by a 20-inch clearance. Mr. Murphy added that he believed in reasonably small cars for city work.

The above is a fair summary of the arguments presented, and it will be seen that a good case can be made out for either side. The Board in its wisdom has decided for the small clearance, but there remains in the minds of many persons a feeling of uneasiness—a feeling that something else should be sacrificed if necessary in order to retain sufficient space between passing cars for a human being to stand with reasonable safety.

Organization and Administration of Board of Supervising Engineers.

On August 30th the Board of Supervising Engineers, Chicago Traction, adopted a plan of organization for engineering, inspecting and auditing during the work of rehabilitating the street railways of Chicago. This plan was drawn up by Mr. Bion J. Arnold, chairman of the board, in his capacity as chief engineer, and is of interest as showing the care bestowed upon the organization of a great engineering work of this character. The main features of the plan are as follows:

The chief engineer is responsible for the preparation of the plans and specifications, under Section 34 of the Traction Ordinance, and is given the requisite authority and assistance to prepare them, subject to the approval of the Board. He is also to inspect the work, or cause it to be inspected, during its progress, and cause to be kept a complete record of construction and expenditures.

The organization for this purpose is as follows:

Chief engineer—B. J. Arnold.

Assistant chief engineer—George Weston.

Division engineer in charge of track and roadway—R. F. Kelker, Jr.

Division engineer in charge of electrical transmission and distribution—E. N. Lake.

Division engineer in charge of power stations, sub-stations and buildings—Not yet assigned; special engineer in this division, R. A. Sanborn.

Division engineer in charge of cars and car routing.—W. Thorn.

Division engineer in charge of tunnels—Not yet assigned.

Chief draftsman, in charge of drafting department—F. W. Steeg.

Auditor, in charge of division of accounts—L. R. Acton.

The chief engineer, should he deem it advisable, may call in suitable outside talent from time to time, or he may direct that certain plans and specifications be prepared in the offices of the railway companies or in other places, subject to the approval of the board.

It shall be a part of the work of the organization to collect data and compile information showing the requirements of the railway companies in order to enable them to provide facilities for properly taking care of their share of the local transportation of Chicago in a comprehensive manner. The chief engineer will work jointly with the chief engineers of the railway companies, so that the ideas of the companies can be harmonized and brought to one general plan before the work is finally presented by the chief engineer to the Board.

Complete information relating to material used and its cost and distribution, hours of labor and its cost and distribution, also relating to all bids for material, shall be furnished the chief engineer by the railway companies. Engineer-inspectors will be placed on the various jobs to inspect the work as to material and wormanship and to gather information necessary to verify the reports of the railway companies.

Electrical Exports for July.

Electrical exports from the United States in the month of July, 1907, amounted to a total value of $1,580,995, compared with $1,208,791 for July, 1906. There was a good increase both in electrical appliances and electrical machinery, comparative figures being as follows: Electrical appliances—July, 1907, $694,938; July, 1906, $577,086. Electrical machinery—July, 1907, $886,057; July, 1906, $631,705.

The following-named countries were the principal destinations of electrical exports from the United States for the month of July:

Appliances—Brazil, $165,918; British North America, $110,821; United Kingdom, $74,960; Japan, $67,417; Mexico, $67,203; Germany, $20,906; Cuba, $20,217; British Australasia, $19,931; Central American states and British Honduras, $17,358; Philippine Islands, $14,609; Belgium, $11,011; Argentina, $10,386; France, $8,017.

Machinery—Mexico, $159,279; United Kingdom, $150,016; France, $112,256; Japan, $105,941; British North America, $99,830; Brazil, $57,084; British East Indies, $46,273; British Australasia, $44,375; Argentina, $27,024; Central American states and British Honduras, $21,328; Cuba, $11,208; Germany, $5,495; Philippine Islands, $2,773; British Africa, $2,442.

Surveys have been begun for the interurban line to be built between Little Rock and Pine Bluff, Ark. Fourteen miles has already been laid out.

Factory Lighting.[1]

By J. T. Kermode.

The fact that many manufacturing concerns are vacating their old premises to enter buildings of more modern construction, with saw-tooth roof and windows on practically four sides, is evidence that better lighted workrooms are essential and that the demand for a higher standard of artificial illumination is rapidly increasing. The short hours' use and usually heavy demand on the station peak has brought about a condition where there is some question as to the advisability of factory lighting from a supply company's standpoint; it is, however, very important when combined with the supply of power. In conjunction with power business, considerable work has been done in Cleveland, where it has been the policy to make surveys, plans, specifications and to obtain bids for this class of wiring with special reference to the best and most economical method of illumination for the various kinds of work in different processes of manufacture.

The average factory requires artificial light during 10 to 20 per cent. of the working hours, not including overtime or night shifts; therefore, the illumination should be sufficient and the lamps so arranged that the quality and quantity of work accomplished during these hours can be as well and economically done as that which is performed by daylight. The amount of light required varies, first, with the size of room, relative position of machines and the general shop conditions, and, second, with the character of work to be done. The treatment that will effectively light a clothing factory cannot be efficiently applied to industrial plants, where the atmosphere is filled with smoke and dust.

Experience has taught us that no general rule can be laid down to govern the many different situations that present themselves, but each factory must be studied separately to determine the amount of light, style of illuminant and the method of its installation, to give the best results. For instance, large units cannot be successfully operated in roundhouses or car shops. The principal parts of locomotives that need special attention are so located that to be of value the source of light must be reflected from each side of the engine. Five 100-watt Gem lamps, spaced 15 feet apart, at an elevation of seven feet, will light in a very satisfactory manner one side of two engines. Oil torches, so commonly used in cabs, boiler and floor pits, can be conveniently substituted with portable incandescent lamps.

In foundries, forges, steel mills, structural-iron works and boiler shops, where the walls are dark and the work does not require concentrated light, a lamp is needed that will give good general illumination. Enclosed arc lamps, giving a white light, combined with shadows, are undesirable for this class of work, as the dark walls and dense atmosphere absorb a large percentage of their penetrating powers.

The color and brilliancy of light produced by the flaming arc has attracted the attention of many manufacturing concerns, and, notwithstanding the cost of lamps and carbons, they are being extensively used to light large areas.

In a large mill operating steel presses 16 enclosed arcs were installed. On account of the dense atmosphere these lamps were hung below the tops of the presses, resulting in heavy shadows being cast around each machine. The 16 enclosed arcs were recently substituted by six flaming arcs. With slight changes in the wiring these arcs were placed 22 feet from the floor, resulting in the entire shop being flooded with a warm, bright light. The use of flaming arcs reduced the connected load 4.5 kilowatts. Averaging two hours' use a day, these lamps would save 234 kilowatt-hours per month, which, at the usual prevailing lighting rate for current, would more than compensate for the cost of carbons, without considering the increased amount of illumination.

It is generally conceded that the best uniform illumination can be obtained by distributing small units over the space to be lighted, but this is not always practical, for one must consider the building construction, and purpose for which the space is to be used.

The use of higher candlepower arc lamps for factory lighting is rapidly increasing, and the advantage that can be obtained by their use and efficiency must be recognized. The efficiency with which the light is produced and utilized are two important factors with which a supply company is intimately concerned.

In machine shops it is common practice, together with large units for general illumination, to furnish each workman with a single incandescent lamp, which when new, and at average height from his work, usually gives a fair amount of light. Oil and dust soon reduces the illumination one-half. But it is not expected that the amount of work should reduce in the same proportion. Some reasons why this practice has become so popular are:

First—That up to a few years ago the majority of industrial shops were equipped with generating apparatus, but the cost of electric lighting was charged against the operation of the shop and not against the cost of electricity as it should have been. Invariably I have found that where light is obtained in this manner the generators, feeders and branch circuits are heavily loaded with inefficient apparatus and there is no incentive to economize on current.

Second—Wherever a large installation is necessary the manufacturer usually employs a man to look after the operation, repairs and additions to the electrical equipment. These men, as a rule, are not familiar with the improvements that are continually being made on the various devices that go to make up a modern electric installation. Consequently inefficient light facilities are unintelligently installed.

Third—Employes have been educated to believe their work cannot be successfully performed unless each individual is furnished with an incandescent lamp, and realizing the flexibility of electricity it seems comparatively easy for one to convince the foreman that an additional lamp should be added here or there, resulting in an overlamped room for the number of machines operated and a poorly lighted room at an excessive cost.

In machine shops where lathes, drill presses, planing machines, milling machines, screw machines, punches, etc., are used good general illumination of uniform intensity is required. Nernst or Gem lamps are well adapted for this class of lighting.

The size and number of lamps to be used depends upon the size of the room, height of ceiling, color of walls, location of machines, belts and shafting. In estimating the size and number of units it might be of service to consider 50 watts per operator, or machine, as an average amount for all ordinary machine work and general illumination. For special machines or work that needs bright light, individual incandescent lamps with reflectors should be used. Machines that are automatic in their operation are many times provided with unnecessary individual lamps. Appreciating that these machines do need good light for changing their adjustment, the use of portable lamps that can be connected to receptacles near each machine will, if intelligently used, save current.

The general evenness of illumination, with the absence of glare, together with the easy shadows and searching quality of the light produced by mercury-vapor lamps, makes them especially adaptable for factory lighting by direct current. Unfortunately the alternating-current lamp up to the present time has not been successful, due to its inability to start readily.

Manufacturers of clothing require an even, shadowless, well-diffused light of considerable brilliancy. Nernst lamps with prismatic reflectors can be utilized for this purpose with a comparatively low consumption per operator.

The difficulties that exist in factory lighting are familiar to all men engaged in the sale of electricity for power purposes, and it should be the duty of each central station to educate its men to successfully overcome these conditions by encouraging the use of lamps, shades and reflectors that have been produced for scientifically converting wasted energy into useful light. Recent discoveries in the production of electric lighting are of revolutionary nature, the same principles which have been utilized in the cheapening of gas light, that is, the use of the peculiar properties of rare earths and metals, have been appropriated by the electrical interest, and the recent developments indicate the efficiency of electric lamp will be doubled in the near future.

Recently I read an article in which a supply company recommends the use of gas for factory lighting that they might be successful in retaining power business.

Is there a more exaggerated case of false economy than that of requiring people to work by poor illumination? In comparison with the cost of labor the cost of lighting is trifling. Take, as an illustration, the case of a skilled workman receiving $3 or $4 a day (say, an average of 30 cents an hour, or one-half cent a minute), figure the cost of a 16-candlepower lamp burning 10 hours, and see how many minutes of the man's time it requires to pay for the light. Yet there are thousands of skilled mechanics handicapped with insufficient and ill-directed light.

In presenting this paper my idea has been to bring out the fact that industrial plants can be lighted by electricity in a satisfactory manner and at an expense that would compare favorably with any other form of illumination, provided the equipment consist of units of the highest efficiency, installed according to modern practices. Electricity supply companies should devote more time to practically demonstrating to manufacturers the benefits to be derived from the use of higher-efficiency units, with the idea of introducing a more intelligent mode of factory lighting as a valuable factor in assisting to secure and retain power business.

1. Paper read at the Toledo convention of the Ohio Electric Light Association on August 20th. The author is connected with the Cleveland (O.) Electric Illuminating Company.

ELEMENTS OF ELECTRICAL ENGINEERING.

By Geo. R. Metcalfe.

XXXIII.—Electric Railways.

The idea of applying electric motors to the propulsion of vehicles, such as street cars, etc., was suggested in the early part of the last century by a number of experimenters, but the first commercial electric-railway installation which approached anything like present practice was installed in Richmond, Va., in 1886. The growth of electric railways can be appreciated from the fact that in the 20 years following the establishment of the first electric road practically every street railway in the United States is electrically equipped. In addition, interurban railways have come into existence since the application of electric propulsion and now aggregate many thousands of miles in extent. At the present time the adoption of electricity upon main-line railroads is engaging the attention of electrical engineers, and considerable progress in this direction has been made, so that today electricity has invaded every branch of railway transportation.

Up to the last three or four years electric railways have invariably been equipped with direct-current apparatus, but more recently alternating-current systems have been devised which have proved very successful competitors of the direct-current system where long distances and heavy trains are involved. Electric railways may therefore be properly classified into direct-current and alternating-current systems, according to the kind of motors used on the cars, and may be further classified as overhead or underground trolley roads, or as third-rail roads, according to the kind of line construction adopted.

All electric railways operate upon constant-potential circuits and use series-wound motors. The standard direct-current potential for railways is 500 volts, although in some cases as high as 650 volts and even higher is used. In alternating-current generators no standard voltage has been adopted, and no special necessity for any standard exists, as any voltage desired can be adopted, according to the length of the line, etc., and the trolley voltage is reduced to the required voltage for the car motors by means of transformers carried on the car.

The direct-current overhead-trolley system, which is in most general use, will first be described. The accompanying diagram illustrates the elementary principles of a simple direct-current railway. Current from the positive pole of the generator is led out to the trolley line and from the trolley wire is taken off by the trolley and is thence carried to the motor. After passing through the motor the circuit is connected to some metallic part of the car truck and is led to the track through the car wheels. The negative pole of the generator is connected to the track, thus completing the circuit of the generator. The track is used for the return circuit on account of the saving in copper conductors, of which it takes the place, and in order to make the track a continuous conductor each joint in the rails is bridged by copper wire, known as a bond, which is securely riveted to the rails.

The simple system of distribution just described could only be applied to a road of very short length, and is, in fact, hardly ever used, as constant-potential distribution at 500 volts cannot be economically carried for more than five or six miles from the generating station. If this distance is exceeded the amount and cost of copper required for conductors becomes excessive. It would be cheaper to build a second generating station than to carry the 500-volt distributing system more than about six miles in either direction from the first station.

In order to provide for roads of greater length a mixed system of alternating and direct-current distribution was next devised. In this system, which is now the standard method of distribution for all direct-current roads, the power is generated at one or more central stations in the form of alternating current of comparatively high voltage. This alternating current is distributed to sub-stations located about 12 or 15 miles apart, and as voltages of from 16,000 to 32,000 are carried on this high-potential distribution, a large amount of energy can be transmitted to the sub-stations over very small wires. In each of the sub-stations the alternating current is converted into direct current by means of rotary converters, and this direct current, at 500 volts pressure, is distributed to the section of the road extending six or seven miles to either side of the sub-station.

This system, therefore, comprises two distributions, one high-tension distribution from the central station to the sub-stations, and a secondary 500-volt direct-current distribution from the sub-stations to the trolley line. This system of distribution has proved admirably adapted to street railways and interurban railways of considerable length where the traffic is handled in single cars which run only at considerable intervals. For very heavy service, however, where it is required to run a number of cars in trains at very high speed and at frequent intervals, the amount of current required is so large as to necessitate the use of very heavy copper conductors, and, moreover, the cost of the sub-stations increases rapidly with the amount of current handled.

To still further decrease the cost of distribution for high-speed long-distance roads, of heavy traffic, several systems using alternating current throughout, including alternating-current motors on the cars, have been devised. Both single-phase and three-phase railway systems are in use. The single-phase system requires only a single trolley, while the three-phase system requires double trolleys and double overhead wires. The latter conditions have probably been the chief reason why the three-phase system has not been adopted at all in this country. It has been successfully introduced on a number of European railways, especially on mountain roads, where steep grades are negotiated.

The single-phase alternating-current system which is being introduced in this country on a number of heavy railways includes very high voltage distribution to transformer sub-stations where the voltage is lowered by step-down transformers and fed directly into the trolley line. As these sub-stations contain merely a transformer, and have no moving machinery of any kind, their cost is very slight and they require no attendance whatever. Alternating-current trolley voltages of from 6,600 to 11,500 volts are in use, and a transformer carried on the car reduces the trolley voltage to whatever working voltage is required at the motors.

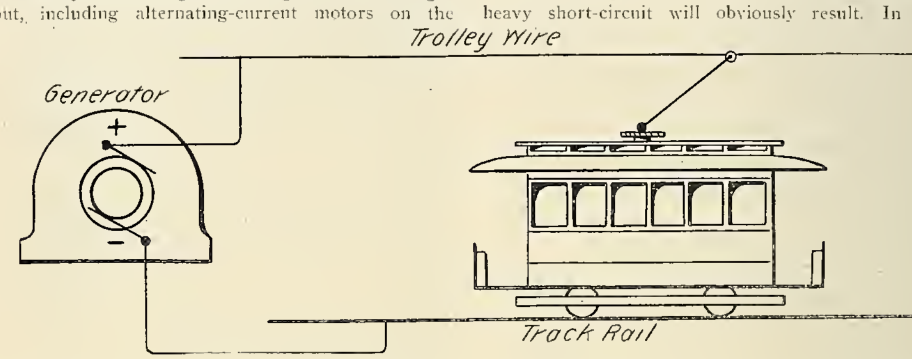
In special cases, where 500-volt direct current is employed in heavy railroad service, what is known as a third-rail system of distribution has been adopted. In the third-rail system the overhead trolley wire is replaced by a third rail located a little distance beyond the running rails and elevated slightly above them. This third rail is insulated from the ground and from the track, and current for the motors is taken from it by means of shoes supported by the car trucks and bearing upon the third rail. The shoes perform the same function as the overhead trolley, and the third rail the same as that of the overhead wire. The use of third-rail construction is sometimes adopted on account of the impracticability of using overhead conductors large enough to have sufficient current-carrying capacity, as well as on account of the difficulty of using on one train the large number of trolleys which would be required for such heavy currents. The third-rail system, however, is only suited to roads operating entirely upon private right-of-way, and even under this condition it involves some difficulties which, together with the high cost of construction, will probably preclude its use except in certain special cases.

Another system of distribution which is in very limited use is the underground-trolley system. This system was devised merely to meet the conditions where all overhead wires are absolutely prohibited. It is in use in but two or three of the largest cities in this country, and its cost of construction, which amounts to from $80,000 to $125,000 per mile, absolutely prohibits its use except where enormous traffic exists. In the underground-trolley system the tracks are not usually employed for the return circuit. Instead of this a positive and a negative trolley line are carried upon insulators and are situated in a conduit located entirely beneath the street surface. These underground lines are in the shape of flat copper bars, which are located on either side of a slot opening into the roadbed. This slot is about three-quarters of an inch wide and in it run the supports by which the underground trolley is suspended from the bottom of the car. The underground trolley runs between the two parallel conductors and carries shoes on either side, which press against them. The two sides of the trolley are thoroughly insulated from each other, as there is 500 volts difference of potential between them. One of the principal difficulties in connection with these open conduits is the liability of their filling up with surface water in case of heavy rains.

The bare conductors in the conduit are supported as high up as possible, but if water fills the conduit up to the level of the conductors a heavy short-circuit will obviously result. In designing a conduit for the underground-trolley system it is therefore essential to make the conduit of sufficient size not only to contain the necessary conductors but to act as a sewer to carry off the surface water of the street before it can reach the level of the conductors in the conduit.

A number of closed conduit systems have been invented, with a view to overcoming the difficulties of drainage and short-circuits to which the open conduit is liable. These have never proved commercially successful, however, and have never advanced beyond the experimental stage. The general arrangement of all the proposed closed-conduit systems is to have the conductor entirely buried in the ground and to have small blocks of metal inserted at intervals of a few feet on the surface of the street between the tracks. These contact blocks are connected to the buried cable through magnetically operated switches, which are normally open, so that ordinarily there is no current on the contact block. Beneath each of the cars electromagnets are located whose function it is to operate the underground switches connecting the contact switch with the underground cable. These contact plates are therefore alive only when the car is directly over them, and current is taken from them by means of a shoe extending under the length of the car and bearing upon the contact rods. The contact blocks must therefore be placed somewhat closer together than the length of the shoe under the car, in order that at least one block is constantly in contact with the shoe. Several systems similar to that just described have been tried experimentally, but, owing to the high cost of construction as well as the liability to derangement and inaccessibility of the underground moving parts, none of them has as yet been commercially adopted.

[*To be continued.*]



ELEMENTARY PRINCIPLES OF A SIMPLE DIRECT-CURRENT RAILWAY.

Note.—This series of articles, intended to survey, briefly, the whole field of applied electricity for light, power and heat, was begun in the Western Electrician of February 2, 1907.

Douglas & Co. of Cedar Rapids, Iowa, large manufacturers of corn products, including corn oil, cake, germ oil, meal, gluten feed and starch for laundry, domestic and manufacturing purposes, have equipped their plant for operation throughout by means of electric-motor (group and individual) drive. The latest addition to the equipment comprises approximately 650 horsepower in Allis-Chalmers induction motors, some of which are of the vertical type, specially adapted to the operation of corn-product mills. These machines are to operate at standard speeds for driving individual and grouped machines, according to the character of the work.

QUESTIONS AND ANSWERS.

Effect of Higher Voltage on Meter Registration.

[In answering, to the best of its ability, the questions put to it, the Western Electrician makes no pretense to infallibility, and is glad to print the views of others. Indeed, one object of this department is to stir up discussion; it is an "open court"—the more contributions the better. We therefore take pleasure in printing the following from Mr. William Bradshaw, detail engineer of the Westinghouse Electric and Manufacturing Company, who evidently refers to the answer to the following question printed in the Western Electrician of July 6th: "What effect will it have on a meter calibrated at 110 volts, 60 cycles, when put onto a 115-volt 60-cycle circuit? Will it make the meter run or register faster?"]

Mr. Bradshaw writes:

In reference to the above editorial which appeared in the July 9th [6th?] issue of the Western Electrician the writer wishes to take exception to a portion of the same as well as add the effect of changes of voltages on percentage registration under load.

As stated in the editorial, a meter will probably run slightly faster if subject to over-voltage if the increase in voltage is sufficient and the meter is operating at light load, such as four per cent. of full load or less. However, with a well-designed meter which has been calibrated at 110 volts there will be no tendency to run faster at 115 volts, and no tendency to "creep" with less than 140 or 150 volts. The tendency to "creep" is not dependent upon the torque of the meter, but upon the design of the magnetic circuit, especially the shunt portion. If the meter is of the type in which the greater portion of the magnetic lines created by the shunt circuit are shunted across the air-gap and do not pass through the disk, any normal change in voltage will not have any tendency to make the meter "creep." The reason of this is that a compensation for friction of the bearings is obtained by slightly unbalancing the shunt magnetic circuit so as to give a rotating field of small value which tends to drive the disk in the forward direction.

A meter using a shunt magnetic circuit of the above type will only increase this unbalancing in direct proportion to the increase in the total shunt field, and consequently the unbalancing will be the same percentage of the total shunt field as formerly, and the meter will not have any tendency to "creep" until the change in voltage is a very large percentage of the normal voltage. When this change has become sufficient to make the meter run faster on light loads its effect is such a small percentage of the driving torque of the meter under a load of any value that it is correct to say that it is felt at light loads only.

The editorial has entirely overlooked the most important effect of change in voltage on the percentage registration of a meter, and that is the damping due to the shunt field which cuts the disk. In a meter where a large percentage of the total shunt field cuts the disk this shunt damping is very marked, and in some meters will amount to as much as one per cent. in change of registration for a five per cent. change in the voltage of the circuit. This shunt dampening always increases with increase of voltage, and the meter will run slower with an increase in voltage and run faster with a decrease in voltage.

This shunt dampening is present in all makes of alternating-current integrating meters, but may be reduced to a negligible value in a well-designed meter. With a well-known standard meter when set for correct registration at normal voltage it will fall off in registration about 0.2 of one per cent. for an increase of 25 per cent. in the line voltage, and will increase one-half to one per cent. in registration for a decrease of 50 per cent. in line voltage.

The change in registration for the modern integrating wattmeter is so very slight between 80 per cent. to 125 per cent. of normal voltage, that it would be difficult to plot a curve showing the difference in performance of the meter when operating on either of these extremes.

It will be noted that the effect of a change in voltage, such as the values quoted in this editorial, is negligible, so far as registration is concerned.

The effect due to shunt dampening which shows up when the meter is under load and the voltage changes will be greater in percentage than the unbalancing effect which shows in tendency of meter creep at light load only under changes of voltage.

Current Required by Induction Motor.

H. M. C., Green Bay, Wis.: How much current or how many watts should a standard make 220-volt three-phase 60-cycle induction motor take at no load—a 15-horsepower motor? How many watts at 230 volts, at 240 volts and at 260 volts? Also, how many watts at full load at the above voltages?

ANSWER.

The information required can no doubt be obtained from the various manufacturers. It is to be remarked that the variation of current and watts with impressed voltages will depend largely on the particular type of induction motor. In general, at no load the variation would follow the magnetization curve very closely. At full load the conditions are slightly more complicated. In addition to the change in excitation there is a variation of the torque with the square of the voltage.

Electric Elevators.

F. F., St. Paul, Minn., wants to know the title of any books on the market dealing with the subject of operation and care of electric elevators.

ANSWER.

We have been unable to find such a book published in English and would appreciate a communication from any of our readers who may know of one. The bulletins published by manufacturers of this class of machinery are probably not comprehensive enough for F. F.

The following books in German treat of this subject: "Die Elektrischen Aufzüge zur Personen- und Warenbeförderung" (The Electric Elevators for the Use of Passengers and Freight), by Ed F. Walker, pp. 144, with 100 illustrations and six plates. Published by H. Buschmann, Leipzig: 1901.

"Elektrisch Betrübene Krane und Aufzüge" (Electrically Operated Cranes and Elevators), by Siegfried Herzog, pp. 463, with 981 diagrams. Published by A. Raustein, Zurich: 1905.

Secondary Connections of Transformers.

C. H. S., Southbridge, Mass.: I would like to ask if it is possible to connect up three transformers on a three-phase 2,300-volt circuit with secondaries designed to give 110, 220, 330, 440 volts, so as to result in a combination whereby I could obtain 250 volts from the secondaries, either single-phase or three-phase?

ANSWER.

The answer to this question is in the negative. The nearest three-phase delta pressure obtainable with the transformers mentioned is 220 volts. The Y connection of 110-volt coils gives 191 volts delta. The nearest single-phase pressure by combinations of the three transformers is about 290 volts.

Resistance of Telegraph Relays.

J. H. G., Harrisburg, Pa.: With reference to the query of W. T. H., Hammond, Ind., in your issue of August 31st, permit me to say that now and then one hears of railroad men who have charge of the telegraph but who really know very little about the electrical part of it, being promoted to that department on account of being excellent trainmasters. Such men may become impressed with the "superiority" of "low-resistance" relays and proceed to connect the two coils of the 150-ohm relay in multiple, reducing, of course, its resistance to 37.5 ohms. Perhaps this is what W. T. H. is driving at. The 150-ohm relay, as you point out, meets all requirements except on very short lines.

Battery-propelled Cars in Germany.

Accumulator cars have been running since February on three German railway lines. The arrangements have been made by the Prussian railway department, which controls the Hessian Railway. The new cars run four or six times a day, and the maximum speed is 28 miles an hour. The carriages are three-axle cars built for this purpose. The batteries consist of 180 cells of about 200 ampere-hours capacity, each weighing 121 pounds and containing four positive and five negative electrodes, a car battery weighing about 10 tons and yielding 68.5 kilowatt-hours; that is, seven watt-hours per kilo (two and one-fifth pounds) of all weight complete. Each car travels about 37 miles a day. The full car weighs 38 tons.

Guarantee Seal for Incandescent Lamps.

The purchaser of an incandescent lamp, unless he buys of the reliable dealers, has no guarantee except his own inspection of the appearance of the lamp, that it may not have already been in use and burned some hours, thereby decreasing its subsequent life. For the unwitting buyer's protection, Dr. Edward Schiff of Vienna has proposed a lamp seal like that shown in the sketch,

SEAL FOR INCANDESCENT LAMPS.

which may be put on at the factory and will assure the user that he is getting all the life of the lamp. As shown, through a hole in the lamp base is passed the seal-wire which carries an insulating plate covering the central contact stud. When the ends of the wire are sealed, the lamp cannot be used in an ordinary socket.

Central Electric Railway Association Plans Standardization.

At the meeting of the Central Electric Railway Association to be held in Columbus, Ohio, on September 26th it is planned to take up the question of standardization on all electric railways in Indiana and Ohio and to bring about as nearly as possibile uniform methods of operation.

In order to stir up interest in the meeting a number of Indiana electric-railway men made a trip to Detroit, Mich., last week in the private car Martha of the Indiana Union Traction Company. The car left Indianapolis on Wednesday and proceeded to Fort Wayne by way of Kokomo and Peru. From Fort Wayne the route was to Lima, Ohio, from Lima to Toledo and from Toledo to Detroit. The distance covered was 336 miles and was made in 11 hours, including stops. At each of the points named the car was switched to the tracks of a different road. In the party were Frank Norviel and C. C. Reynolds of the Indianapolis, Terre Haute and Eastern, H. A. Nicholl of the Indiana Union Traction Company, A. A. Anderson of the Indianapolis, Columbus and Southern, J. B. Crawford of the Fort Wayne and Wabash Valley, F. B. Carpenter of the Western Ohio and J. L. Smith and John Collins of the Toledo, Urban and Interurban Company.

Union Traction Reorganization Overthrown.

The plan of reorganizing the Chicago Union Traction Company as approved by Judge Grosscup has been overthrown by the United States Circuit Court of Appeals. The decision was rendered by Justice Brewer of the United States Supreme Court, with whom were sitting Judges Seaman and Baker of the Circuit Court. Justice Brewer said that however fair the reorganization plans might be, it was not the province of the courts to force the warring elements to agree. So the whole Grosscup plan was upset and the case was remanded.

The plan was to have the Union Traction Company and all its underlying companies consolidated into the Chicago Railways Company. This company was to accept the settlement ordinances and rehabilitate the properties, the security holders in the old companies to be taken care of according to terms named in the reorganization plan. Much of the holdings was deposited with a trust company to bring about the reorganization, but some of the security holders objected, and the hearing resulted in the overruling of Judge Grosscup's plan.

Unless the Union Traction interests can get together and agree upon some plan by which they can accept the settlement ordinance, the Chicago City Railway Company, according to the terms of the ordinances, is to take up the rehabilitation and operation of the North and West Side lines. At a special meeting of the City Council it is likely that the Union Traction interests will ask that the time for accepting the ordinances, which expires September 14th, be extended 30 days. Unless the Council has some assurance of agreement among the warring factions it is not likely that the time will be extended, in which case the situation will present a new phase.

Illumination Photometers and Their Use.[1]

By Preston S. Millar.

The illuminating engineer is concerned more particularly with instruments designed to aid the eye in determining the illuminating effect of light. These may be classified broadly as photometers dependent upon visual acuity, and those in which the

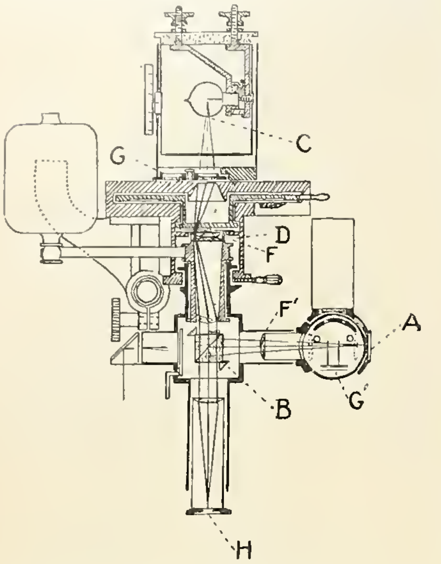


FIG. 1. BECKSTEIN PHOTOMETER, SECTOR TYPE.

illumination to be studied is compared to that produced by a standard light source.

Visual Acuity Photometer.

The principle of visual acuity, as generally applied, depends upon the detection of the vanishing point of an effect produced by the light to be studied. In some cases it is the disappearance of a figure or character; in others the disappearance of a contrast. Such instruments, being based upon the ability of the eye to see or distinguish objects, yield results which are proportional more nearly to those qualities of light which make for visibility than to its intensity. They are known as visual acuity photometers, or illuminometers.

There are fundamental difficulties with this extinction method which render it unsuitable for important work. These are the inability of the eye to judge of the point of disappearance with precision; the susceptibility of the eye to the influence of environments and conditions; the necessity for reducing the light to low intensities at which the "Purkinje effect" operates to distort results; and the errors encountered in effecting this reduction.

The decided advantages which this method can boast are simplicity, absence of expensive adjuncts, and minimum demand for technical knowledge and skill on the part of observers.

Illumination Photometers.

The only photometers which may be relied upon in engineering work to yield values are those in which a comparison light source is used, and reliance is placed upon the ability of the eye to judge equality of illumination. The essential features of such photometers are:

First, a photometric device.

Second, a comparison light source.

Third, a means of varying the intensity of the

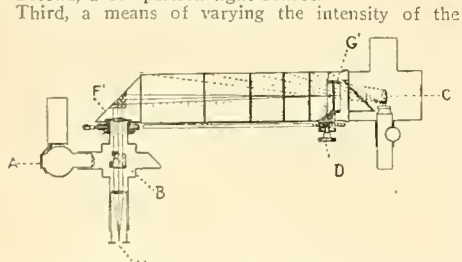


FIG. 2. BECKSTEIN'S FORM OF WEBER PHOTOMETER.

illumination produced upon the photometric device by the comparison light source.

Fourth, a test plate upon which the unknown light falls.

Photometric Devices.

These may be divided into three groups: First, arrangements of prisms whereby surfaces illuminated by the comparison and the test light sources may be viewed in one field with indistinguishable line of separation. Such devices are characterized by maximum sensibility and ease of comparison, but are generally difficult and expensive of construction. Particularly with low intensities they are superior, working with fair sensibility on intensities quite below the range of other devices. The Lummer-Brodhun photometer is a notable example of devices of this kind.

Second, screens of varying translucency, the opposite sides being illuminated by the comparison and test sources, respectively, and being viewed through prisms or mirrors in contiguous fields. The Bunsen photometer is the well-known example of this class of photometric devices. Various adaptations of the Bunsen photometer are used very largely in photometric work in this country. In general they fall but little short of the prismatic devices of the first class in respect to sensibility and ease of comparison and are simple and inexpensive of construction.

Third, the various devices whereby the illumination intensities produced by the comparison and test-light sources, respectively, are viewed in contiguous fields with well marked line of separation. In this class may be found the Bouguer screen, the Ritchie wedge, the translucent blocks of Elster and Joly and other means of comparing illumination intensities, all of which are simple and inexpensive of construction but lack in sensibility and ease of comparison.

Comparison Light Sources.

These are found in great variety in photometric work. They may be classified broadly as flame sources and incandescent electric lamps. Among the flame sources two deserve special mention. The pentane lamp, the legal standard of light in Great Britain, is used largely by gas companies in laboratory practice as a primary standard of light. The Hefner amyl-acetate lamp, the legal standard of light in Germany, is used largely in Germany as a primary standard of light and is used somewhat in this country in both laboratory and portable photometers. In addition kerosene, benzine and gas burners have been used in photometers as secondary standards of light. The pentane and Hefner lamps as primary light standards give results of considerable precision when used in the laboratory under carefully controlled conditions and manipulated by those who are expert in their use.

With the incandescent lamp used as a secondary standard of candlepower most favorable photometric conditions may be obtained. Its use, however, necessitates a source of current supply and a means of determining with fair precision the voltage at which it burns, or the current which it consumes. Under these conditions it may be relied upon to

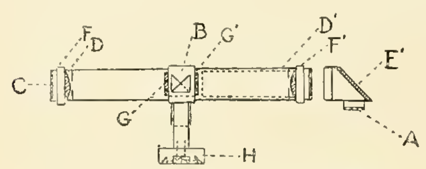


FIG. 3. BLONDEL AND BROCA'S PHOTOMETER.

remain constant for a limited period, during which time it constitutes the most reliable, accurate and satisfactory comparison light source.

Means of Varying the Intensity of Illumination Produced Upon the Photometric Device by the Comparison Light Source.

This has been accomplished by a variety of methods, some of considerable ingenuity. These may be classified as follows:

First, variation in distance, applying the inverse square law.

Second, rotating disks, relying upon Talbot's law.

Third, inclination of an illuminated surface, applying Lambert's law of the cosine.

Fourth, variation of the intensity of the comparison light source.

Fifth, the use of absorbing media.

Sixth, the use of variable diaphragms, generally with diffusing screens.

Seventh, dispersion lenses.

Eighth, polarization method.

Of the above the variable distance method is, in the opinion of the writer, superior in that it possesses accuracy, reliability, ease of verification, calibration according to a known law, simplicity, a wide range and universal applicability. No other one method possesses all of these advantages.

The rotating sectored disk is an excellent means of varying the intensity of light, but lacks somewhat in simplicity where it alone is relied upon.

The variation of the inclination of a plane with reference to the light incident upon it, or to the angle at which it is viewed, is an unsatisfactory method; first, because unless a perfect diffusing surface is obtained the cosine law will not apply; second, because any surface which approximates a perfect diffusing surface is likely to change in character, and third, because the scale calibration of an instrument in which this is used becomes very narrow with low intensities, so that the slightest displacement of the plane will produce a marked difference in the illumination.

Two methods of varying the intensity of the comparison light source have been used; in the one, adjustable opaque screens expose a greater or lesser portion of the luminous body. This method is particularly applicable when flame comparison sources are used. The other method consists in varying the intensity of the source itself—with flame sources, by wick adjustment and with electric lamps by varying the current flow. This method is unsuitable for use with flame sources, because it is necessary to wait some time after an adjustment is made before a constant luminous intensity is obtained. With electric lamps it is objectionable because the satisfactory range throughout which the method may be applied is of necessity small, since with very low intensities the color value becomes altogether objectionable, and with higher intensities the lamp must be operated at so high an efficiency as to endanger its constancy.

Absorbing media offer an excellent and very practicable means of varying the light intensity, but

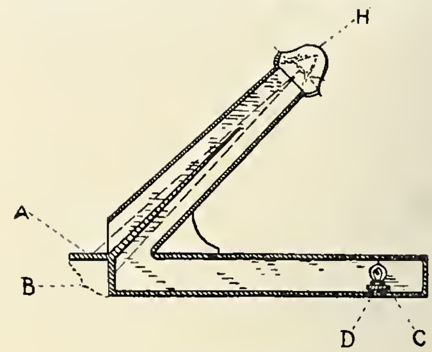


FIG. 4. BURNETT'S PHOTOMETER.

must be selected carefully in order to guard against errors due to selective absorption. While it is possible to construct absorbing screens which may constitute a complete device for varying the intensity, yet this method has found its best application in varying the intensity by large steps where supplementary means are provided for effecting finer variations.

The comments in the previous paragraph apply as well to the use of absorbing screens with variable diaphragms.

Dispersion and polarization methods are but little used in this country in photometry of the class now under discussion.

The Test Plate.

In general work the intensity of the light incident upon a given surface is the only quantity which it is practicable or even desirable to measure. This is not proportional necessarily to the illumination effect, which varies as well with the point from which the surface is viewed, with the color of the light and with the color and character of the surface.

Whether or not the light falling upon the photometric device varies only with that incident upon the test plate depends upon the design and location of that plate. The requirements for a theoretically correct test plate are:

First—A plane white surface, which when viewed from the point of photometric observation, obeys Lambert's law of the cosines with reference to intensity of illumination produced by light incident upon its surface at any inclination and from any direction.

Second—A material which will not introduce errors due to color differences.

Third—A plate which may be placed at any angle.

Fourth—A location such that neither the body of the observer nor instrument parts shall obstruct light which would otherwise fall upon the plate.

The character of the surface upon which the effect is studied, naturally influences the results materially. It is necessary to secure a plane surface which shall be as nearly as possible a perfect

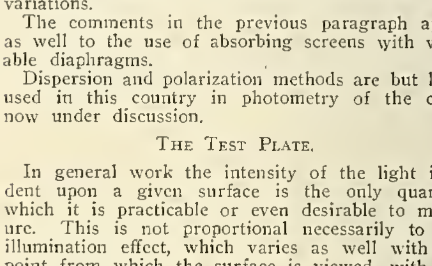


FIG. 5. MARSHALL'S PHOTOMETER.

diffuser of light, in order that light incident upon it at any angle may be credited with its true intensity, and only its true intensity. Unfortunately there is no available surface which accurately meets these requirements.

Until it shall be found possible to use a true diffusing surface, results must vary with the direction from which the test plate is viewed, unless it is studied by reflected light from a point directly above the center of the plate, or by transmitted light from a point directly beneath the center of the plate. The first is obviously impossible, because it would necessitate interference with light which would otherwise fall upon the test plate. It follows, therefore, that the correct method is

[1] A condensation of a paper presented at the convention of the Illuminating Engineering Society, Boston, July [illegible]. Mr. Millar is one of the engineers of the Electrical Testing Laboratories, New York city.

to consider transmitted light from a point directly beneath the test plate.

It is, of course, desirable to measure all of the light which would be incident upon an object at the point to be considered. In all interior lighting systems there is more or less diffused light, all of which has some illuminating value. In order to measure all of the effective light, there must be no objective interference with light incident upon the plate at any angle.

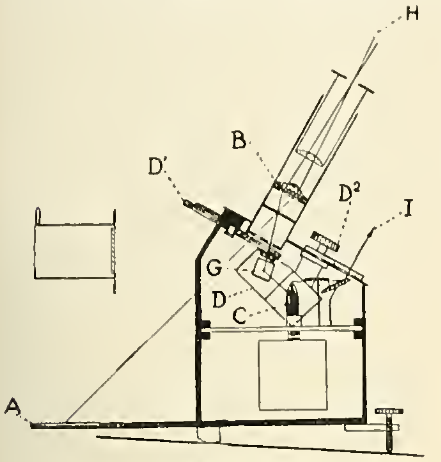


FIG. 6. MARTENS' PHOTOMETER.

The introduction of differences in color values complicate photometry seriously. If the light from the mercury-vapor lamp were to be studied upon a red surface, its illuminating effect would be no criterion of the light intensity. Hence the only color which is practicable is white, of as great purity as may be obtainable and as free as possible from selective absorption.

The Ideal Photometer.

It appears, therefore, talt in building a photometer, the designer has a choice of many photometric devices, comparison light sources and means of varying the light intensity and effecting the photometric comparison. With respect to the test plate, there should be no choice. It should have a plane white diffusing surface; it should be translucent and viewed from directly beneath its center; it should be capable of location at any angle, and should be so located that all instrument parts and the observer are beneath or behind it.

In the ideal photometer such a test plate would be found combined with the most sensitive photometric device, the most reliable comparison light source and the best means of varying the intensity. These features should receive first consideration, for reasonable precision ought to be the first desideratum. Next in importance come portability, simplicity of operation and reasonable cost. If there were any necessity for sacrificing reasonable precision in order to secure other desirable qualities, some compromise might seem advisable, but since this is not the case there can be no objection to adherence to the ideal, as set forth above.

Descriptions of Various Photometers.

As there is an insistent demand for an illumination photometer which shall be both reasonably accurate and thoroughly practicable, it is felt that a discussion of the instruments which have been designed with this end in view will be of interest. In the following paragraphs will be found brief descriptions of 11 photometers. Only the essential features of each are touched upon. The cuts are lettered similarly in order to facilitate comparison. Thus (A) indicates the test plate, (B) the photometric device, (C) the comparison lamp, and (D) the means of varying the intensity.

Fig. 1 shows a plan of the illumination photometer, designed by Walter Beckstein. The test plate (A) is placed at the point where it is desired to study the illumination. This plate may be rotated throughout a vertical plane about the photometric device (B) as an axis. (B) is a Lummer-Brodhun cube through which the lower

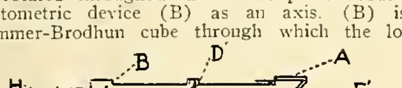


FIG. 7. MASCART'S PHOTOMETER.

surface of test plate (A) is viewed. Through the prisms (B) may be viewed also translucent plate (G), which is illuminated by the comparison lamp (C). Equality of illumination is obtained by viewing the plate (G) through a portion of lenses (F) which may be rotated. At (D) is placed a variable sector disk about the axis of which the beam of light is rotated by the lenses (F). The result of the photometric setting is obtained from the size of opening of sector disk (D), which is necessary in order to obtain equality of illumination. This device is in effect a rotating-sector disk, except that the beam of light, instead of the sector, is rotated, thereby facilitating precise adjustment of the sector disk.

Another illumination photometer, designed by Walter Beckstein, and of which a plan is shown in Fig. 2, is a modification of the Weber photometer and simpler in construction and less costly than that just described. The test plate and prism arrangement are similar, but the comparison lamp (C) is a benzine lamp, and equality of illumination is obtained by movement of translucent screen (G) by means of rack-and-pinion device (D) along a tube, its intensity of illumination varying inversely as the square of the distance from lamp (C). Results of photometric settings are read off directly from a scale along the tube through which plate (G') travels.

Fig. 3 shows a plan of the photometer designed by Profs. Andre Blondel and Broca. That portion of the light which is transmitted through test plate (A) is reflected from the 45-degree mirror (E') through lens (F') upon ground-glass plate (G') (which forms part of the photometric device). Before lens (F') is placed "cat's-eye" diaphragm (D'). A comparison light source (C) which is not described is placed to the left of the apparatus. Its light passes through lens (F) and falls upon ground glass (G). This is varied in intensity by the adjustable "cat's-eye" diaphragm (D). The photometric device (B) consists of crossed prisms through which ground-glass plates (G) and (G') are viewed from the binocular arrangement (H). Equality of illumination is produced by adjustment of variable diaphragms (D) and (D'), which are equipped with means for indicating the size of the aperture.

An illuminating power photometer, designed by Douglas Burnett, is shown in Fig. 4. The light which is to be studied falls upon test plate (A), which is one surface of a photometric wedge. The other surface of the wedge is illuminated by comparison lamp (C), which travels along the horizontal axis of the box. This lamp is moved by

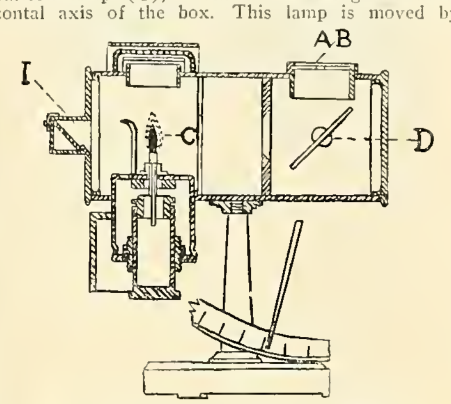


FIG 8. PREECE AND TROTTER'S PHOTOMETER.

means of a handle (D), which protrudes through the side of the box. The two surfaces of the wedge which constitutes the photometric device (B) are viewed from position (H) through a box which is divided by a partition which constitutes a well-defined line of separation between the two surfaces of the wedge. Results are indicated on a scale along the horizontal box which is calibrated directly in foot-candles.

Fig. 5 shows the arrangement of the "luminometer," designed by J. T. Marshall. The test plate (A) is also the upper surface of the photometric device (B). This consists of a screen of which the translucency is varied by different thicknesses of paper. It is illuminated from beneath by the comparison electric lamp (C), the intensity of whose light is varied by means of rheostat (D). Lamp (C) is operated from two dry cells within the instrument, a spring switch being placed in the circuit, so that the lamp is operated for a minimum time only. To effect a photometric setting, the flow of current through lamp (C) is varied until disappearance of contrast is obtained at screen (B) when viewed from above at an angle of about 45 degrees to its surface. The resistance of lamp (C) is then measured by a simple bridge method. The contact is moved along the exposed wire until the point of no deflection is obtained, and the foot-candles value is then obtained from the scale reading through an interpretation curve.

Fig. 6 shows a vertical section through the photometer designed by Martens. Test plate (A) which receives the light to be studied is observed through the photometric device (B), through which may be seen also the surface of plate (G), which is illuminated by comparison benzine lamp (C) through a pair of sliding mirrors (D). These mirrors vary the distance between lamp (C) and plate (G), being operated from rack-and-pinion device (D). Results are read directly from a scale over which plays a pointer attached to (D^2).

A modified design of the Mascart photometer is shown in Fig. 7, where the light to be studied falls upon a translucent paper (A), which constitutes the test plate. That which is transmitted passes through the 45-degree mirror (E'), a convex lens, and falls upon the upper half of a translucent screen (B). A comparison lamp (C) illuminates translucent screen (G). Light which is transmitted through this screen passes through a convex lens, the 45-degree mirror (E), the total reflecting prism immediately above (E), and falls upon the lower part of screen (B), where it is viewed from position (H). Both lenses mentioned have adjustable diaphragms (D) and (D), which are used to vary the intensity and effect quality of illumination upon screen (B). The adjustment of these diaphragms indicates the result of the photometric settings. Comparison lamp (C) is a flat-flame gas-

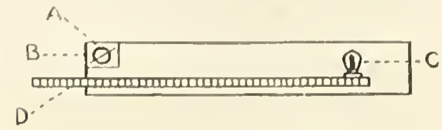


FIG. 9. RYAN'S PHOTOMETER.

oline lamp. The instrument is standardized by a Carcel lamp, whose light falls upon the test plate.

Fig. 8 shows a vertical section through the illuminating power photometer, designed by Sir William Preece and A. P. Trotter. The light to be studied falls upon surface (A), which is also a portion of the photometric device (B). The comparison lamp (C) illuminates bristol-board (D), which may be inclined at any desired angle. Through slits in surface (A), portions of screen (D) may be viewed. Photometric balance is made by equalizing the brightness of surfaces (A) and (D).

In the "candle-foot photometer," designed by W. D'A. Ryan, shown in Fig. 9, the light to be studied falls at A upon one surface of the photometric device (B), which consists of a translucent block, divided diagonally by a thin, opaque film. The comparison electric lamp (C) illuminates the other half of the block. The distance between this lamp and the block is varied by means of rod (D), upon which is calibrated a scale which indicates the results of photometric settings. The photometric device (B) is viewed through the side, equal portions of the two halves of the block being viewed.

In the Weber photometer, illustrated in Fig. 10, the light to be studied is received upon the portable test plate (A), which consists of white cardboard. This is viewed from eyepiece (H) through a simple Lummer-Brodhun cube (B). The light from the comparison benzine lamp (C) illuminates a traveling translucent screen (G), which is viewed from the eyepiece (H) through (B). A unique feature is the use of colored glasses in the ocular tube with a view to comparing illuminants of different color values with respect to those qualities upon which depends the ability of the eye to perceive objects which they illuminate. As has been stated, this is not necessarily proportional to the intensity of illumination.

The Weber photometer is now made in a more portable form and with some modifications.

Generally speaking, European instruments, as illustrated in the Beckstein, Blondel and Broca, Martens, Mascart, Preece-Trotter and Weber photometers, differ from American instruments as designed by Burnett, Marshall and Ryan, in that they are designed more particularly with regard to theoretical requirements than with regard to the utmost simplicity of operation and lowest cost. Many of the European instruments are relatively complicated, being combinations of a large number of parts, many of which would appear to the American mind to be unnecessary.

As respects the sensibility of the photometric de-

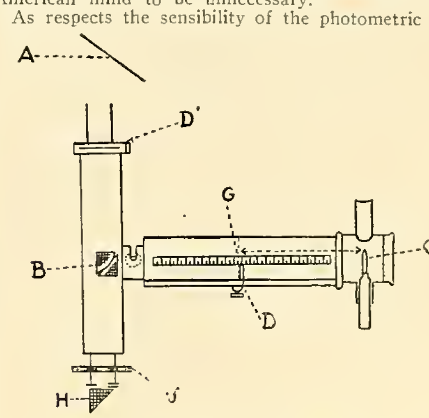


FIG. 10. WEBER PHOTOMETER.

vice, it was found from repeated settings with one of the instruments in which the photometric device is of low sensibility, that no higher accuracy than six per cent. could be obtained. The maximum variations in settings with this instrument were 15 per cent. below, and 10 per cent. above the average.

It was found that in one of the instruments in which a flame source was used, readings could not be relied upon within five per cent. because of flame variations due to drafts, changes in humidity, etc.

In measuring diffuse illumination, where much of the light comes from the ceiling and walls, it was found that with two of these instruments in which the design and location of the test plate were incorrect, results were obtained which were too low by 20 and 29 per cent. respectively. This was due to regular reflection and obstruction of light by the body of the observer or by instrument parts. With the same instruments, change from a black coat to a light coat on the observer, introduced differences amounting to 10 and 18 per cent.

As an illustration of the possibilities of errors entailed by reliance upon the direct comparison method in which a standard lamp is used directly in comparison with the test source, it was found that with one of the instruments, seven skilled observers, who, however, were not familiar with the particular instrument under test, obtained values which varied from 21 per cent. below to 34 per cent. above the value which was considered to be representative, namely, the mean of the results of the seven observers. The average variations of these observers from such mean was 13 per cent.

The Use of Illumination Photometers.

In the measurement of illumination, either of two general methods may be followed. The first is the direct comparison method, in which a primary standard of light is used, or a secondary standard of light is used as a primary standard, so far as the instrument is concerned. The Hefner lamp, more than any other light source, is used in this way. Or an incandescent electric lamp may be standardized to yield a certain candlepower and may be used, as is the Hefner lamp, for direct comparison purposes. Such a light source is located at a definite distance from the photometric device, and is calculated to produce a fixed intensity upon that device. This method has the great advantage that it permits an instrument to be more nearly self-contained, and to be used without reference to any other light sources. However, it is liable to serious objections in that all changes in reflecting surfaces or transmitting screens and changes in the comparison lamp, as well as any misplacement of parts, are likely to introduce errors for which no compensation is made. Furthermore, the method makes no allowance for the personal equation. The second, and superior, method is commonly known as the substitution method. This covers a multitude of photometric sins. Here the comparison light is strictly secondary, and is standardized and verified from time to time by other standards of light so placed as to produce upon the test plate illumination of known intensity. By this method changes which would introduce errors where the direct-comparison method is used, are compensated for either entirely or in part, since every effect which they produce upon the measurement of light from a test lamp will be proportional to the effects produced upon measurements of unknown intensities.

It is very important that instruments used in measuring light from any illuminants should be calibrated with reference to light of known intensity from illuminants of similar character.

One of the large difficulties in the practical use of an illumination photometer is to be found in the variability of light intensity in most commercial installations. If the installation consists of incandescent electric lamps, this can be dealt with best by operating the comparison electric lamp from the lighting circuit, when its variation will be similar in character, if not in degree, to that of the illumination to be studied. This is known as the "similar-circuit method." When an instrument is so designed that this cannot be done, or when the lighting installation consists of other than incandescent electric lamps, it is advisable to continue observations at each test point over a sufficient period to afford a fair average result.

With any of the photometers described in this paper it is probable that the skilled photometrist could approximate correct results, for he would locate the sources of error, determine their extent and apply such corrections as were possible. Most errors in photometry are occasioned by failure to recognize the limitations of instruments used. Instruments have been designed which apparently make so little demand for technical skill on the part of the observer as to give rise to the belief that photometry is as simple as is their operation. This has led to the publication of results which would appear to be utterly unreliable, judging from the instruments and methods employed in making the tests.

In closing, a few maxims are offered, which the illuminating engineer would do well to bring to bear upon photometric problems.

An instrument must be a good photometer before it can be a good illumination photometer.

Measurement of illumination is more difficult than the measurement of candlepower.

In obtaining a photometric setting one does not necessarily determine the value of the light studied.

Every photometer is to be regarded with suspicion until its accuracy is demonstrated. It is then to be regarded with suspicion until it is shown that no change has occurred since verification.

No photometric information is better than misleading photometric information.

Developments in Electric Incandescent Lamps.[1]

By Leon Gaster.

It is my object in this paper to give a short review of some of the most important improvements which have come before my notice during this year, and to exhibit the lamps mentioned in actual operation. I will start with the improvements of the carbon-filament, and bring before your notice the metallized, or, as it is also called, the graphitized carbon filament, by the aid of which lamps are made consuming on an average 2.5 watts per candle, with a useful life of about 600 hours. The lamps are manufactured for voltages varying between 100 and 130. I should also like to mention the use of the double-carbon-filament lamps, the two filaments being comprised in the same bulb, one large and one smaller filament, by the aid of which either the full candlepower or only a very small candlepower can be used, and the expenditure in lighting thereby reduced.

I will now pass on to the Nernst lamp. A recent improvement consists in fitting the lamps with a newly designed cut-out coil of high resistance, and it is claimed that by the use of this coil a great reduction of the premature failures of filaments will be secured. As regards the efficiency of the lamp, no very great further improvement has yet been secured.

Coming now to the metal-filament lamps proper, the osmium lamp, as produced by Dr. Auer von Welsbach, owing to the expensive nature of the metal used and partly to the difficulty in manufacture, and bearing in mind the improvements which have since been made by the same inventor by the use of tungsten, is now likely to be restricted to comparatively low voltages.

Tantalum is certainly the only metal-filament lamp which has proved to be successful commercially. There have not been, so far as I know, any particular developments made during this year which require to be recorded, except those in the direction of lengthening the life of the lamps when used on alternating-current circuits. It is as yet only made for voltages up to 125.

The next most important metal used in the manufacture of filaments, and with which much is expected to be accomplished, is certainly tungsten (wolfram). Several methods have been devised for preparing filaments by the use of this metal. One of the first methods was worked out by Dr. H. Kuzel of Vienna. By his process the metal is obtained in the colloidal state by means of an arc under water. The resulting paste of extremely fine metal is squirted into filaments, and afterward heated in order to make them better conductors. The lamps are manufactured in Vienna by Kremenetsky. From such tests as have been made it is ascertained that the lamps consume a little over one watt per candlepower, with a useful life of about 1,000 hours, with a loss of only 10 to 15 per cent. of the initial candlepower.

Another method of manufacturing tungsten filament is the joint invention of Dr. Alexander Yust and Franz Hannaman of Vienna. According to their process, the carbon filament is electrically raised to a high temperature in an atmosphere of gaseous tungsten or molybdenum compounds. The carbon then becomes coated with metal, and after burning out the carbon the filament appears quite homogeneous, even under the microscope. By another method the metallic powder is prepared by chemical means mixed with an agglutinant and squirted into the form of filaments, which are then freed from carbon as before. Messrs. Siemens & Halske have devised a process of stamning tungsten powder, sometimes mixed with another metallic powder, but without an agglutinant, in a tube of some metal which is easily drawn or rolled, such as tantalum or iron. Then, after electrically sealing the ends, they subject the tube to drawing or rolling processes. After the completion of the drawing process the outer skin can, if desired, be removed. This method obviates the necessity for the great care and treatment involved in the ordinary fusing process, but I have not heard whether the method is actually in use.

The next lamp using tungsten, and which is already used commercially, is the "osram" lamp, which is at present manufactured by the Deutsche Gasglühlicht Gesellschaft. The lamps burn with an efficiency of 1.2 watts per candle, having a useful life on an average of over 600 hours. The lamps are recommended to be burned for the present with the filament in a vertical plane, and can be equally well used on direct or alternating-current circuits. The Berlin Allgemeine Elektricitats Gesellschaft is also manufacturing some type of tungsten lamps, the process for the manufacture of which has not been divulged.

Turning now to the zircon wolfram lamp, I should like to draw attention to some of the improvements which have been made during the last few months. You will have an opportunity to see, for the first time, I believe, metal-filament lamps of voltages above 100 which burn satisfactorily in any position. The filaments are mounted on spring hooks made out of tungstenized carbon, the hooks having the effect of maintaining the filament rigid and in shape while in service, and of preventing the loops from touching, also of allowing of a greater number of filaments in the bulb, and, consequently, of reducing their length and that of the lamp. The lamps can be burned in any position, and the breakage of filaments is considerably reduced. On account of the elasticity of the spring hooks, the breakages of filaments have been reduced in transit and in service. Another improvement over the old type of lamp is the adoption of electrical soldering of the filament to the leading-in wires, thus doing away with the inconveniences caused by the use of graphite paste, which was a partial cause of the blackening, the giving off of gases and the defective contacts met with in the previous lamps. The improvement also avoids much extra labor, and also the danger of oxidation of the filament, if the paste is not very carefully burned away. The electrical soldering process takes place in the open, and an experienced operator can carry out the soldering of about 500 lamps daily. The firm of La Carriere in Paris is the inventor of this spring hook, and I understand that the filaments can now be mechanically mounted in such a manner that the operators do not have to touch them with their fingers, thus reducing the number of breakages in mounting the filaments. The latest type of 110-volt lamp contains only four filaments, of 0.025 millimeter diameter, giving out 24 hefner candles, or for 220-volt 48 hefner candles, necessitating only the use of eight filaments.

The helion lamp, of which very little information is as yet available, looks like an ordinary carbon incandescent lamp, mounted in the same sized bulb, and consumes 35 watts, giving out 30 candlepower. In the manufacture of the filament silicon is reduced from a gaseous form in combination with carbonaceous gases on the surface of a high-resistance carbon core. The inventors claim that this lamp operates at a high temperature without the carbon and silicon uniting to form carborundum, as might be supposed. The silicon shows no tendency to become molten or fluid at the temperature attained. The filament starts with a negative temperature coefficient less than carbon, but at about a red heat the coefficient changes distinctly to positive, and remains so as the temperature is further increased. The efficiency of the lamp is claimed to be 1.2 to 1 watt per candle, or it can run even at less. Although a useful life between 600 and 1,000 hours is claimed, a proper series of life tests could not be made, as there seems to be a difficulty in keeping the joints between the filament and the leading-in wires in good condition. For the proper working of the lamp, it is essential that mercury pumps be used for obtaining the vacuum, and great care must be taken in selecting the carbon core, so as to obtain homogeneity and purity, otherwise the results are considerably affected. Experiments are now being conducted by the inventors, using as a core the graphitized (metallized) carbon filament, and also with a special cement for the use of making the joints. One of the characteristic features of the lamp is that the length of the filament need not be increased over the ordinary carbon lamp. The filament is very pliable, and there will be no difficulty (if the present defects, which are chiefly of a mechanical character, have been overcome) in making lamps of low and high voltages and of reasonable candlepower. The lamp easily stands transport, and will be just as safe to handle as the ordinary carbon-filament lamp of today.

Iridium has also been used for the manufacture of lamp filaments. According to Gulcher's process, amorphous iridium is made up into a paste by the aid of an organic binding material. The filaments are squeezed from this paste and are made to glow in the air, and not in a receiver containing air in the diminished pressure or indifferent gases. The lamp is only produced for low voltages up to 24, and consumes between 1 and 1.5 watts per candle. Other metals, like vanadium, niobium, molybdenum, etc., may also be used in the future, but not much has been made public as yet regarding their use for filaments.

During a visit which I paid to W. J. Hammer of New York I saw a few sample lamps of Mr. Heany's invention, some using, I was given to understand, titanium for the filament, and others using a metallic alloy of tungsten and titanium in a dense, shining, coherent state.

Although we have seen that the metal-filament lamps can be made of relatively small candlepower at voltages above 100, and of high voltage up to 240, I am given to understand that it is not the intention of most of the manufacturers to sell for the present other lamps than those of high candlepower, above 30 candlepower, and intended for voltages varying between 100 and 130. This decision has a distinct commercial value, making the change from the carbon filament to the use of metal filaments gradual, so as to be properly appreciated and beneficial to the consumer, manufacturers and energy suppliers alike. It is well known that the carbon incandescent lamps are at present in many cases fixed at a low position, often

1. Abstract of a paper read before Section G of the British Association at Leicester, August, 1907.

situated in the direct angle of vision, and, therefore, detrimental to sight. The reason may be that, on account of the expense at which energy is supplied to the consumer, he could not well afford to enclose the lamps in properly diffusing globes, or to remove them a good distance away from the objects he wishes to be illuminated. With the advent of the new metal-filament lamps of relatively high candlepower, the lamp could easily be removed to above the level of the eyes, or enclosed in properly diffusing globes. We should thus obtain good illumination without additional increase of expenditure.

For those circuits where high voltage is used, and where it is advisable to introduce the metal filament, resort must be had to series wiring, which, as a whole, is not quite satisfactory, because as soon as one of the lamps breaks all the lamps in the circuit go out, and it is not so easy for the ordinary consumer to detect the broken lamp. Several devices have now been introduced to mitigate this drawback.

Speaking generally of the impressions which I received during my recent visit to America, I should like to inform the meeting that very great progress has been made in the recognition of illuminating engineering as a distinct branch of specialization in the engineering profession. I observed an extensive use of successful combinations of shades, lamps and lamp holders, by the aid of which combination the best and most efficient illumination is obtained. The Holophane shades and reflectors seemed to be very much used, enabling us to direct the light where it is mostly wanted, and producing any desired effect of illumination. I think that this combination of lamp, lamp holder and reflector, forming one suitable unit, is worthy of the careful consideration of the lamp makers in this country.

I should like to draw attention to the progress made in the use of vacuum tubes, and in particular wish to refer to the Moore vacuum-tube method of illumination. Two installations have already been erected in London, one outside the Savoy Hotel, and another at Salisbury House. The Savoy installation consists of a tube 176 feet in length, consuming 2,950 watts, using nitrogen gas for producing yellow light; power factor 70 per cent. The Salisbury House installation consists of a tube 85 feet in length, consuming 2,200 watts, with a power factor of 60 per cent. A white color is obtained by using CO_2. The use of CO_2 has enabled Mr. Moore to obtain with his tube the nearest approach to daylight yet attained, and I am given to understand that color can be matched in such a light with extreme accuracy. This is certainly a severe test for any method of lighting.

I should also like to draw attention to one fact in connection with illumination which seems to deserve greater consideration at the hands of manufacturers and large consumers of light, and that is the great value which ought to be attached to the adopting of proper methods of illumination. The advantages to be derived are: First, the sight of the workpeople will be improved and prolonged; second, the output will be quite appreciably increased, and third, which is very important, the quality of the work under proper illumination will be of the same high standard as when done in the daytime.

Before closing, I should like to refer to the work of the engineering department of the National Electric Lamp Association. Fifteen lamp makers in the United States have combined for the purpose, not of forming a trust, but with a determined object of improving the quality of the lamps they are manufacturing, and thereby maintaining a proper and high standard. Instead of each factory employing imperfectly trained chemists to analyze the chemicals which enter into the manufacture of lamp filaments, a well-paid and highly skilled chemist is employed in a thoroughly equipped laboratory to perform this work, and sufficient resources are put at his disposal to keep on making proper researches, and keep abreast with the latest discoveries. I may also mention in connection with the necessity of testing incandescent lamps the beautifully equipped electric testing laboratory which I visited in New York, which is so ably conducted by Dr. C. H. Sharp. In view of the fact that in this country a standard specification for carbon lamps has been framed, and has come into force on this July 1st, I hope before long that such a testing laboratory will also be established in this country, and will receive the proper support of the municipal authorities and companies supplying current for lighting purposes, enabling the consumers to get lamps of really good quality.

I should like to venture in indicating the lines upon which further researches might be conducted, and for that purpose I will refer once more to Mr. Hammer and his publications, and say with him that the ultimate solution of the problem of securing a satisfactory and efficient illumination may be obtained by means of the stimulation of phosphorescent and fluorescent substances in various ways, thus producing a cold light, a light, as he calls it, without flame and without heat. We must soon stop producing long and useless heat waves, and also, as far as possible, all radiation outside the visible spectrum, in the utilization of our illuminants.

"Helmet" Reflector for Window Lighting.

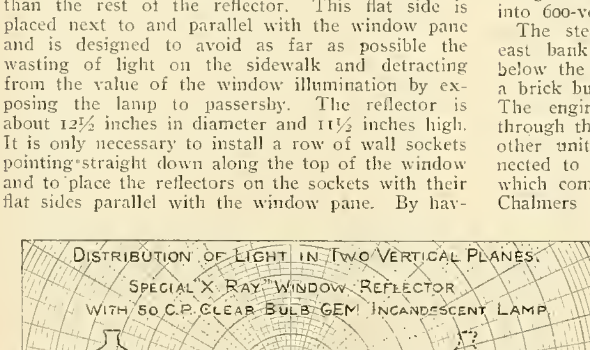
A reflector recently brought out by the National X-Ray Reflector Company of No. 247 East Jackson Boulevard, Chicago, is designated as the "Helmet" reflector. It is especially designed to meet the requirements of lighting high and shallow windows. It is suited to the lighting of all windows over 12 feet high whose depth is less than one half the height of the lamps above the bottom of the window, or where the lamps are as high above the level of the back of the window as the window is deep.

The reflector is intended to produce an approximately uniform illumination over the goods as ordinarily placed in show windows. It is designed to use a 125-watt Gem incandescent lamp, giving the user the advantage of a 25 per cent. increase in

EXTERNAL APPEARANCE OF "HELMET" REFLECTOR.

efficiency over the old-style carbon-filament lamp. It has the further advantage that it will also take a 105-watt tungsten lamp, so that the user can install these when they become more common. Future improvements in incandescent lamps have therefore been anticipated.

The illustration shows the external appearance of this reflector as viewed from one side. It has one side partially flattened and extended down lower than the rest of the reflector. This flat side is placed next to and parallel with the window pane and is designed to avoid as far as possible the wasting of light on the sidewalk and detracting from the value of the window illumination by exposing the lamp to passersby. The reflector is about 12½ inches in diameter and 11½ inches high. It is only necessary to install a row of wall sockets pointing straight down along the top of the window and to place the reflectors on the sockets with their flat sides parallel with the window pane. By having the lamps pendant, use can be made of the new tungsten lamp.



PHOTOMETRIC CURVES SHOWING EFFICIENCY OF THE "HELMET" REFLECTOR.

The high efficiency of this reflector for window illumination for the size of windows for which it is intended is shown in the accompanying photometric curves plotted from tests made by the Electrical Testing Laboratories of New York. In these tests the reflector was equipped with a 125-watt clear bulb Gem lamp, giving 50 mean horizontal candlepower. The reflector was held in position as used in practice with a standard 3¼ inch holder. The lamp was placed in such a position that the plane parallel to the loops of the filament made an angle of 45 degrees with the flat side of the reflector. One set of curves shows the apparent candlepower at various angles in a plane at right angles to the flat side of the reflector. The other shows the apparent candlepower at various angles in a plane parallel to the flat side of the reflector, or, in other words, the sideway distribution, as it would be installed in a window.

The first named curves would indicate that over 200 candlepower is given for a distance of 40 degrees to the left of vertical in the direction in which it is most useful in window lighting, while for a few degrees the candlepower is 436. The maximum candlepower is directed so as to give high illumination on the goods placed in the bottom and front of the window. As higher goods are usually placed farther back in the window a lower intensity is needed, and these requirements are met by the reflector. A very small amount of light is thrown outside the window on the sidewalk.

Besides window lighting a number of other useful applications of this reflector will suggest themselves to illuminating engineers—most notably the lighting of audience rooms of all kinds where the lamps themselves are concealed behind ground-glass skylights or beams, and where it is desired to throw the light sideway and forward and have as few rays directed back into the eyes of the audience as possible.

The makers are putting out this reflector with the claim that one 125-watt Gem lamp with this reflector will give the same results as three 55-watt common incandescent lamps used in the most efficient window reflectors for high, deep windows, while in the many cases where mirror troughs or other reflectors have been used one 125-watt Gem lamp is said to give the same results as four or five common 16-candlepower 55-watt lamps.

New Engines in the Twin City Rapid Transit Power House.

The Twin City Rapid Transit Company of Minneapolis, Minn., operates two power stations, one a hydro-electric plant with an output of 10,000 horsepower, and, operated in parallel with it in a station approximately 1,000 feet distant, a steam-driven electrical generating plant of 35,000 horsepower normal rated capacity. The output of these two plants furnishes power to 10 sub-stations in St. Paul, Minneapolis and adjacent towns, the maximum transmission distance being 25 miles, over which alternating current, three-phase, is carried at 13,200 volts, to be converted at the sub-stations into 600-volts direct current.

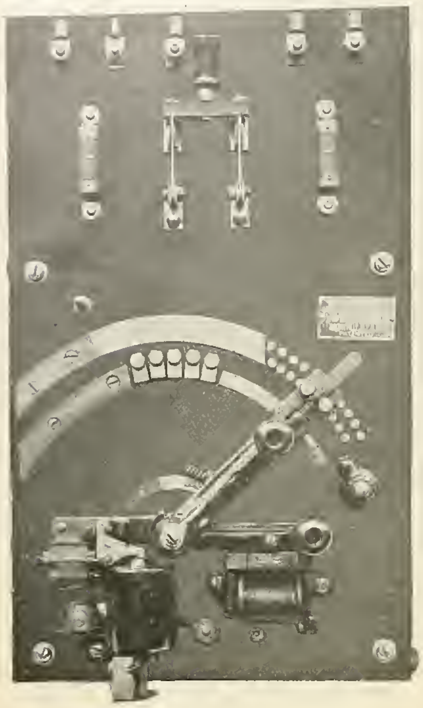
The steam-driven power plant, located on the east bank of the Mississippi River, stands just below the flour mills, in the center of the city, in a brick building 155 by 225 feet, and 93 feet high. The engine room, 67 feet wide and extending through the length of the building, contains, among other units, four reciprocating engines direct-connected to engine-type generators. These machines, which comprised the original installation, are Allis-Chalmers vertical cross-compound condensing engines 46 and 94 inches by 60-inch stroke. They have a normal capacity of 5,000 indicated horsepower. One of the four engines, the last to be installed, is equipped with an Allis-Chalmers barometric condenser, with the condenser chamber attached to the engine cylinder. This condenser has two barometric columns, one 16 inches in diameter for the removal of both air and water and one 20 inches, for an overflow. Cooling water is supplied by a 20-inch centrifugal pump.

Aside from its city lines, a portion of the Twin City Rapid Transit Company's output is utilized for the operation of the double-track electric line to Excelsior, on the southern shore of Lake Minnetonka, 19 miles west of Minneapolis. Two sub-stations of unusually large capacity for interurban lines have been built, and the feeding of these stations, together with the natural growth of the system into other extensions, necessary to meet the growing traffic, has rendered large generating capacity necessary in the main station.

The Nevada Consolidated Telephone Company, composed of Carson capitalists, has received the support of the board of City Trustees of Carson in the franchise matter, although a Salt Lake City company has been trying to secure a franchise. The Nevada Consolidated, which now has long-distance lines extending from Carson to a number of surrounding towns, will soon install a local system.

New Motor-controlling Devices.

The Ward Leonard Electric Company of Bronxville, N. Y., is continually increasing its line of "foolproof" motor-controlling devices. In its latest device, illustrated here, the resistance is entirely enclosed in a moisture-proof, fire-proof, sheet-iron casing. This controller is for use with variable-speed motors and is equipped with 20 steps of resistance for speed control by field regulation. The



NEW MOTOR CONTROLLING DEVICE.

no-voltage release magnet is independent of the shunt field current and the armature current.

It is in the overload device, however, that the rheostat is made "foolproof." The overload device is an independent, interlocking, overload circuit-breaker, giving protection against overload at all times and under all conditions, i. e., during ordinary running, during the act of starting or controlling the speed of the motor, or if the starting arm should become stuck on any starting point and the current then be switched on from the outside.

The National Electrical Code states, under rule 60, section G: "Overload release devices which are inoperative during the process of starting the motor will not be approved unless other circuit-breakers or fuses are installed in connection with them." The United States government specifications go further, for they positively state that an overload device which operates by short-circuiting or open-circuiting the retaining magnet of the no-voltage release will not be accepted.

The double-arm independent-throw circuit-breakers are universally specified because of the fact that after closing one side of the circuit-breaker, if the second side is closed and if overload exists, the side first closed will instantly open. The Ward Leonard Electric Company claims just such protection in the single-pole circuit-breaker which is part of this rheostat, for to close the circuit-breaker it is necessary to open the circuit upon the starting contacts, and in starting, if the lever is moved to the initial contact and short-circuit or overload exists, the circuit-breaker will instantly open upon its own independent contacts.

The circuit-breaker prevents the starting of the motor too rapidly and it teaches the operator just how to use a starter promptly.

Electric Heating and Cooking on Shipboard.

"Electric Heating and Cooking Devices for Marine Use" is the title of a handsome publication just issued by the General Electric Company as Bulletin No. 4523. The pamphlet is bound in a neat cover and contains illustrated descriptions of small apparatus particularly useful in ships' galleys, staterooms, smoking rooms, sick bays, etc.

A ship's lighting plant, usually of more than ample capacity for intermittent load, offers at once an available source of supply, which, utilized for cooking, heating, etc., would provide numerous real and profitable conveniences with small increase in cost.

The electric heater, on account of its compactness, neatness, easy regulation and simplicity, is ideal for stateroom use. The General Electric Company manufactures several forms, including luminous radiators and non-luminous air heaters. One or two-quart water heaters, electric wash bowls and electric shaving mugs are familiar conveniences, and electric flatirons in sizes from three to 24 pounds are supplied for the laundry. Among special devices particularly serviceable on shipboard may be mentioned electric soldering irons, glue pots, curling-iron heaters, surgeon-instrument sterilizers, heating pads, cigar lighters, etc.

Two distinct forms of heating elements are used by the General Electric Company, known as the cartridge and quartz enamel units. Both heating units are practically infusible and indestructible, but can be readily replaced if damaged by accident. The makers have taken great care in the design to insure the most efficient application of the heat and sufficient radiating surface so that nearly all the apparatus may be left in circuit indefinitely without fear of burnout.

Electrical Show at Madison Square Garden.

The electrical show at Madison Square Garden, New York city, takes place September 30th to October 9th. Plans are now formed for elaborate electrical decorations by the numerous large and small exhibitors. Among the exhibits will be nearly every invention or device used in a commercial or domestic way, and expert demonstrators will instruct the visitors.

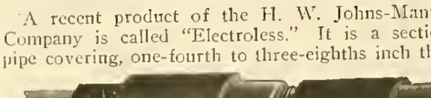
It is the intention of the Brooklyn Edison Company to fit up a perfect modern house, built in the Garden, with every appliance known at this date. It will be electrically equipped from cellar to garret. This includes electric stoves, electric flatirons and cooking apparatus of every kind. The Eastern Cahill Telharmonic Company will fit up the garden with wires and give to the visiting public electric music transmitted from a distance. Another exhibit will be the photophone. By attaching this instrument to any telephone one can see the person speaking on the other end of the wire. A demonstration of the efficacy of a recently invented burglar alarm will be given by a real live crook from Sing Sing, now reformed. The names of the directors are: George F. Parker, president; Walter Neumuller, treasurer; Dudley Farrand, Arthur Williams, W. W. Freeman, James R. Strong and James C. Young.

Resistance Devices up to 10-horsepower Capacity.

The National Rheostat Company, 115 Franklin Street, Chicago, has extended its line of resistance devices up to capacities able to take care of a 10-horsepower motor, securing a 50 per cent. range of speed. For some time the company has been making, in smaller sizes, a very compact form of rheostat available for use as a motor speed regulator, dimmer, field resistance, or for many purposes where a gradual control of the current is necessary. The resistance wire is wound on a ring of non-conducting fireproof material, and the contact arm bears directly upon the turns, insuring fine graduation and consequently a low potential difference, and no tendency to spark between adjacent coils. A very ingenious arrangement combines both overload and no-voltage release. A thumb-screw adjustment makes the former adjustable within wide limits. The overload break occurs in the presence of a strong magnetic field, serving to extinguish the arc quickly, and the arcing points are entirely different from the normal working contacts. In the 10-horsepower size the ring on which the resistance is wound is 18 inches in diameter, while the length of the cross-section of the ring is perhaps four inches. Complete with iron cover and steel base, the whole apparatus measures hardly 20 inches across and six inches high, and appears a veritable pygmy beside the usual resistance apparatus of such capacity.

A New Preventive of Electrolysis.

A recent product of the H. W. Johns-Manville Company is called "Electroless." It is a sectional pipe covering, one-fourth to three-eighths inch thick,



ELECTROLESS PIPE COVERING.

made of specially prepared asbestos paper in laminated form, thoroughly impregnated and coated with a high-grade waterproof insulating compound, which presents an effective barrier to the transmission of electric current. It is furnished in three-foot sections of various sizes to fit over underground lead and iron pipes. When used upon a system of pipes or lead-covered cables, "Electroless" protects them from the corrosion due to electrolysis, caused by extraneous currents, and also serves to guard them from rusting. The accompanying picture illustrates an application of Electroless.

Indiana Telephone Items.

The Home Telephone Company of Jeffersonville has petitioned the Board of Public Works for a franchise to construct and operate a telephone system in the city.

The Indiana Independent telephone companies have issued a bulletin saying that they have practically gained control of the local business in Indiana. The Independent companies in the state claim that the service is being given at too low a rate, and an effort will be made during the coming year to obtain more adequate rates for the service which is being given.

The Citizens' Telephone Company of Columbus has purchased and taken over the Grammar Telephone exchange, together with the telephone line in the Burnesville district. The Citizens' company recently purchased the Elizabethtown exchange, and is after other local lines and companies in the county, with a view of connecting up a large system.

A movement is on foot to organize a stock telephone company to take over the Hope Independent Telephone Company at Hope. The property is valued at $20,000. The movement is due to a recent increase in the rate, as well as poor service. If the new company is formed and obtains possession of the property the rates will be lowered.

Instructions have been sent out from the headquarters in Indianapolis by both the Central Union Telephone Company and the New Long-distance Telephone Company that rates from and after September 16th for night service will be the same as for day service on all the toll lines. The night rates heretofore charged by the Central Union were about two-thirds and that charged by the New Long-distance about one-half of the day rates. Overtime at the rate of one-third the initial period will be charged for each additional minute more than three.

The Central Union Telephone Company, which is moving into its elegant new building in Indianapolis, will add a new feature in the form of a typesetting machine. The machine will be used in composition for the numerous telephone directories of the company in Indiana. New directories will be issued every four months, and a list of the changes and additions will be printed every day. The typesetting of the directories for more than 300 cities and towns will be done on this machine, and the managers say the plan will effect a large saving and also furnish patrons with speedy information. S.

GENERAL TELEPHONE NEWS

The Arnett (Okla.) Telephone Company has been incorporated with a capital stock of $10,000 by C. O. Shaffer and others.

The Bagley Mutual Telephone Company, Bagley, Iowa, has been incorporated with $9,990 capital stock and is formed by six of the lines running into Bagley.

The annual convention of the New York State Independent Telephone Association will be held at Syracuse on Wednesday, September 25th. The convention headquarters will be at the Yates Hotel. R. Max Eaton, Niagara Falls, N. Y., is secretary.

Consideration of the Chicago Telephone Company's franchise extension ordinance was to be in order at a special meeting of the City Council on Thursday of this week. Numerous amendments to the ordinance as reported by the committee on Monday night were offered and further action was deferred until Thursday.

The New York Telephone Company announces that, beginning September 1, 1907, night rates on long-distance calls will be discontinued. It was found that long-distance traffic directly after 6 p. m. has become so heavy as to block the lines for several hours and thus give poor service to the patrons. The abolition of the night rates will distribute the traffic more evenly.

The Australian government contemplates inaugurating the automatic telephone, and all persons interested in the supplies needed may be put upon the mailing list of the telephone department and furnished copies of specifications, bid forms and other particulars by writing the postmaster-general, whose office is in Melbourne. It is said that the Australian government is about to ask for bids for 30 miles of telephone cables.

The Home Telephone Company of Alameda County, Cal., has its automatic system in successful operation in Oakland. About 1,000 subscribers' telephones have been connected with the two central offices in Oakland, where 3,000 subscribers have been secured and the service is being rapidly extended. A central office in Berkeley will be practically a part of the Oakland system. Nothing has been done as yet toward installing the new company's system in the city of Alameda.

CORRESPONDENCE.

Continental Europe.

Paris, August 26.—Carbons treated with metallic salts have been used in Germany with some success, especially for outside lighting. They are used either in the ordinary form of vertical lamp or in special lamps having the carbons placed at an angle at the bottom of the lamp. In all cases the voltage which is used is about 40 volts for the first kind and 45 volts for the second. Such lamps are used for public lighting. A considerable economy is claimed for these carbons and they consume from 0.23 to 0.28 watt per candle. As regards the color of the light, it is either yellow, white or pinkish, according to the nature of the metallic salts which are used. The yellow light is said to be the most economical. Such lamps have been made in 1,000 and 5,000-candlepower sizes. The carbons in this case will last from six to 20 hours. However, there is considerable smoke or fumes from the treated carbons which confines them to outside use.

Radio-telegraphy is found to be useful in determining the difference of longitude between two points where there is no telegraph circuit. Experiments have been carried on in this field by Albrecht in Germany and these proved to be quite successful. Potsdam and the Brocken were the points chosen in order to compare the results with the usual telegraphic method. The great radio-telegraph post of Nauen, lying at a distance of 19 miles from Potsdam and 110 miles from Berlin, was used as a source of the waves. The differences found between the new method and the usual one were of the order of one one-thousandth of a second of longitude. It is to be remarked, however, that atmospheric disturbances have a much greater effect upon the radio-telegraphic method.

One of the first memorial tablets to be erected to the memory of the late Professor Curie at Paris is a medallion which is placed on the wall of the laboratory of the Municipal School of Physics and Chemistry. It is the work of the sculptor Vernier, a personal friend of Professor Curie, and represents the latter in profile with the dates 1859-1906 and a short inscription.

The Academy of Science of Copenhagen has recently elected as foreign members Professors Gabriel Monod and Violle of Paris. Professor Violle of the Paris University is well known for his work in the field of photometry.

An interesting comparison of the different methods of lighting which are now in use commercially is made by M. Lockemann as regards the cost of lighting. For the price of one mark ($0.25) we obtain the candlepower which is given in the following figures for each of the usual methods of lighting: Wax candle, 29; stearic acid candle, 70; paraffine candle, 117; Schmitt gas burner, 418; Argand gas burner, 556; Edison lamp, 662; Nernst lamp, 1,064; alcohol lamp with incandescent mantle, 1,136; Argand oil burner, 1,205; tantalum lamp, 1,299; Bayen electric lamp, 1,818; Welsbach burner, 2,632; Lucas mantle, 3,704; Millenium mantle, 5,000. The result thus shows greatly in favor of the incandescent mantle lamp as regards economy. The life of the lamp is not considered in the above estimate.

Copper deposits have been discovered in the western part of South Africa in the Tsavo valley, and they appear to have considerable value, according to the reports of the prospectors connected with the Uganda Railroad. The principal deposit lies at 40 miles from the station of Tsavo, and here are found great quartz veins which run parallel with the railroad. Here the copper is nearly pure, or else contains sulphur. Gold is also found in the quartz veins. At Naivobi the ore which is taken from the recently discovered beds contains 30 per cent. of copper, and the prospectors state that it can easily be worked. A. DE. C.

Great Britain.

London, August 29.—In Aberdeen there exists a small mileage of underground conduits in which bare copper-strip cables are used. Since the early part of 1903 there have been periodical explosions, and investigations have followed as a natural course. Although the early explosions have been traced to the explosion of coal gas, due to a service cable failing in an end box, subsequent troubles have not been definitely traced. A series of tests was carried out in which a service cable, built into a manhole, was intentionally short-circuited. This demonstrated the possibility of an explosion in the absence of coal gas or any other explosive gas, for the manhole was lifted. The conclusion was arrived at from these experiments that the explosions could easily have been due to the sudden heating and consequent expansion of the air in the manhole. Experiments were next carried out with ventilated manholes, but it was found that a six-inch square hole cut in a 26 by 24-inch cover did not make any appreciable difference to the height to which the cover was lifted by the explosion. Fan ventilation, which has been found successful in other places where these conduits are used, is impracticable in Aberdeen, while experiments with bolted-down covers have also been unsuccessful. The results arrived at are, therefore, that without the presence of coal gas in the manhole an explosion will occur if a cable fails with a sufficiently heavy current behind it, while if coal gas be present, the explosion will be much more serious. The head of the gas department at Aberdeen has made the interesting discovery that coal gas may, by filtering through a sufficient thickness of earth, become quite odorless, but will continue to retain its explosive elements. The city electrical engineer reports that the only solution of the matter is the replacement of the conduit system by the solid system, and this has been agreed to by the Town Council.

Interesting figures are given in the annual report of the engineer to the City of London Corporation, in which he deals with a number of matters. He states that during the year 1906 the experiment which is being carried out in certain streets by the substitution of gas for electric lighting has resulted in a saving of about $2,500 in maintenance. Of course in this comparison he is comparing modern high-pressure gas lighting with arc lamps, with basket-pattern lanterns having very thick glass, installed 15 years ago. No doubt the new experiment and exhibition of street arc lighting which is to be conducted during the winter months will alter opinions in many quarters. In regard to overhead wires in the City—which, by the way, only has an area of one square mile—there are now nearly 750,000 spans crossing public thoroughfares, compared with 700,000 last year. Of course the National Telephone Company is largely responsible for this state of affairs, although it is a position forced upon it in the past. Complaints are frequently made of the obstruction to street traffic by the continual opening of street boxes, and it is to be noted that during 1906, in the City alone, the telephone manholes were opened on nearly 2,000 occasions; and this number does not include mere inspections.

Aluminum insulated cables have now been placed upon the market here by Messrs. Johnson & Phillips in sizes ranging from 0.05 to 1.0 square inch sections. Curiously enough, with the advent of these cheaper cables, from the metal point of view, there appears to have been a fairly substantial drop in the price of copper, which I see now stands at about $425.

In connection with my article a short time back upon the report of the committee appointed to deal with the interference caused by the Greenwich generating station of the London County Council, it is interesting to note the remarks of the Astronomer Royal upon the matter. In his annual report he strongly supports the recommendation that the whole matter should be reviewed in two years' time. The tremors caused by the vibration of the generating plant he thinks can be effectually damped out by making the film of mercury in the amalgamated trough as thin as possible, but he thinks there is a strong possibility that they cause the telescopes to oscillate to such an extent as to interfere with the delicate work of which they are capable, such as the observation of close double stars with the large telescope. He regards the recommendations of the committee as the minimum which is absolutely necessary, and thinks that a further reduction in the height of the chimneys may be required to safeguard the Greenwich meridian work.

The following figures taken from the accounts of the various electric railways in London throw interesting light upon the severity of motor-omnibus competition. The Central London Railway carried during the half year ended June 30th, 2,075,000 less passengers than in the corresponding period of 1906; the Metropolitan Railway carried 745,000 less; and the Metropolitan District 7,333,000 less. On the other hand the City and South London company's traffic increased by 1,004,000 passengers, and that of the Great Northern and City Railway by 1,417,000. But who carried the difference between these gains and the heavy losses on the other hand? G.

Dominion of Canada.

Winnipeg, Man., September 7.—Alexander & Budd supply light and power for the city of Calgary, Alberta. A rival company is making arrangements for the erection of a plant. The new power concern is to be established at Radnor, Alberta, and the promoters are the Alberta Portland Cement Company of Calgary.

The Winnipeg City Council has voted $20,000 toward paying the cost of one duct in conduits for the government telephone system to be built in Winnipeg. F. E. Cambridge, city electrician, can give particulars.

A sub-committee of the Winnipeg City Council has recommended to the council that at the next civic election the ratepayers be asked to vote on a bylaw for the raising of $200,000 for the construction of a conduit system in the central portion of the city in which electric wires for street lighting will be placed. Ducts in these conduits will probably be rented to the Winnipeg Electric Street Railroad Company and other companies using high-tension wires. The idea is to get all the wires in the city underground just as soon as possible.

The British Columbia Electric Street Railroad Company has planned a large amount of work in the vicinity of Vancouver, B. C. In order to demonstrate to the public the superiority of the "T" rail the company will retrack Hastings Street, Vancouver, with this rail, putting vitrified brick next to the rail. The company has also decided to put in a motor to swing the Lulu Island bridge, owing to the great delay occasioned each time the bridge is swung by hand power. The grading for the new pipe line, which is to add 10,000 horsepower to the present supply, is completed and a portion of the piping will be shipped to the grade at once. The rock work on the approach to the tunnel, through which the pipe line will run, is completed, and Messrs. Ironsides, Ranne and Campbell are driving the tunnel at the rate of 15 feet per day. The tunnel will be 14 by 6 feet. R. H. Sperling, Vancouver, B. C., is general superintendent of the company.

The receipts of the municipal street railway at Port Arthur, Ontario, for the month of August were $8,315.05, against $7,308.80 for the corresponding month last year.

At a recent meeting of the Winnipeg power committee the question of selling electricity to small towns between the city and the power plant at Lac du Bonnet was brought up. Application will be made to the Legislature for such rights. Cecil B. Smith, civic power expert, Winnipeg, is in charge. R.

Indiana.

Indianapolis, September 7.—Charles Murdock of the Fort Wayne and Wabash Valley Traction Company has gone to Philadelphia to attend a meeting of the officials with a view of closing a contract with an express company for the handling of express over the company's line between Fort Wayne and Lafayette. The United States Express Company is now operating over the line under a temporary contract. Several other express companies are also desirous of securing the concession.

The Central Indiana Lighting Company, which recently purchased the Columbus street-car system of Columbus, has discontinued the use of street-car checks and is now charging passengers a straight five-cent fare. Previously checks when purchased in quantities amounting to $5 were secured at the rate of three cents per check. The increase in the passenger rate is meeting with considerable opposition, notwithstanding the commendable improvements that are being made in the system.

The commissioners of Marshall County have ordered an election to be held October 5th to vote on a subsidy tax of $56,000 in Center Township in aid of the Logansport and South Bend Traction Company, which is building a line between Logansport and South Bend by way of Plymouth.

The important announcement is made from Hammond that the Murdock-Hanna street-railway syndicate has taken over the South Chicago City Railway and the Hammond, Whiting and East Chicago Electric Street Railway Company, and will hereafter operate them. It is also reported that Dwight E. Cameron and O. Gauthier, president and secretary, respectively, of these systems, have resigned. It is declared that the Murdock-Hanna syndicate has secured control of these lines for the purpose of obtaining ingress into Chicago for the Chicago, Lake Shore and South Bend interurban road now being constructed between South Bend and Indiana Harbor. This movement is regarded as one of the most important interurban movements that have taken place in Northern Indiana for several years.

As a result of a federal injunction the authorities of the city of Richmond were restrained from stopping the operation of cars by the Terre Haute, Indianapolis and Eastern Traction Company and the Dayton and Western Traction Company through Richmond. According to an ordinance adopted by the City Council, any attempt to operate cars after September 6th would have resulted in wholesale arrests of the crews. The injunction, however, was served on the mayor at midnight, and the merits of the question will be decided by a hearing of the case in the federal court at Indianapolis on October 7th.

The Board of Public Works of Richmond in a signed statement declares that the city's electric-light and power plant is not mismanaged nor the superintendent incompetent. The board admits there has been a series of accidents at the plant which have not been explained satisfactorily. The board intimates that while there is some belief that a conspiracy exists to damage the city's plant with a view of bringing it into disrepute and the sale thereof to a private corporation, there has been no real or tangible evidence upon which to base that belief. The citizens of Richmond are coming more than ever to the conclusion that a private lighting company controlled by an eastern syndicate will take advantage of the chaotic condition of affairs in connection with the municipal plant so as to prevail upon the City Council to consider the sale of the plant.

The Lowell Light and Power Company of Lowell, Ind., recently organized by Clifford Wiley of Chicago, which purchased the electric-light plant of the Lowell Electric Light Company, is making arrangements to build an entirely new and modern plant. S. S.

New York.

New York City, September 7.—The two cast-iron tubes of the Battery Tunnel from Manhattan to Brooklyn have proved so weak that it has been found necessary to strengthen them with a lining, which is practically another tube inside each original tube. The construction of the new tubes will mean that Brooklyn will have to wait many more months before the tunnel can be opened to the public. The most serious effect of this additional construction is to cut down the clearances for the cars by several inches. At an earlier date it was found that these same tubes had flattened out and had consequently cut down this clearance to a minimum, and it was found necessary to roud these tubes out and to put in special strengthening.

After a long conference with counsel of the Interborough-Metropolitan Company the authorities of that corporation have decided not to comply with the demands of the Public Service Commission, that it be permitted to examine the books of that company. The ground on which the demand is to be refused is that the commission, under the law of its creation, has not jurisdiction over holding companies.

The Public Service Commission of the Second District has announced that a series of conferences with the heads of the several mechanical departments of the leading railroads has been held to formulate plans and rules for the inspection of locomotive boilers and that these rules would go into effect at once. These rules provide for the time and methods of inspection of all parts, including steam gauges, safety valves, stay-bolts, etc.

Providing 50 50-horsepower motors was the only item to which the Coney Island and Brooklyn Railroad objected at the hearing which the Public Service Commission held on the recent order to the company to show cause why a certain number of improvements should not be made. Among the improvements to be made are the installation of new circuit-breakers on practically all of the cars, 100 drip pans and for 10 new combination cars to be equipped with 50-horsepower motors. Other orders related to a different sort of headlight and to the appearance of the numbers on the front of the cars. The Coney Island and Brooklyn Railroad is one of the first to be considered by the new commission, which will ultimately take up each and every railway and lighting system in and around the greater city. E. H. S.

Ohio.

Toledo, September 7.—Fall business among the local electrical establishments is not coming to the front as fast as some predicted that it would. The season is either considerably behind or else it will be lighter than usual.

The Lima and Toledo Traction Company is seeking an entrance into the city over its own right-of-way. Application was made last week for the purchase of a strip of state land needed to complete its right.

The Columbia Mutual Telephone Company at Elyria, Ohio, has purchased the exchange of the Elyria Southern Telephone Company, a toll company. The subscribers formed the mutual company and bought the system to avoid a raise in rates.

Chair cars and buffet service are in store for patrons of the Detroit United and Lake Shore electric railways between Detroit and Cleveland by way of Toledo. Estimates for the service are now being secured.

A proposition has been submitted by the Dayton Lighting Company to light the monument on North Main Street with 2,000 electric lights free of charge, the lights to be so arranged as to form the word "Dayton." Four streamers of electric lights will extend from the apex to the four corners of the base with a rope of light entirely around the base. It is probable that the city of Dayton will accept this generous offer to light the soldiers' monument.

The position of electrician has been provided by the authorities at Lima, Ohio, and will be filled by ex-Fire Chief Coates.

The total valuation of interurban roads in Ohio, according to the figures in the office of the auditor of state is $12,731,780, as against $11,664,041 in 1906, an increase of $1,067,739.

President Frank L. Beam of the Ohio Independent Telephone Association, Columbus, is enjoying a three weeks' vacation in Denver. H. L. S.

Illinois.

Peoria, September 7.—Springfield is getting ready for the state fair. This week the contract for placing the electric lights in the downtown district was let. The lights will be placed on each side of the street, about three feet apart, and arches will be built across the streets, which will make a canopy effect. The courthouse will also be completely covered with incandescent lights.

The Illinois Traction Company will put into [illegible] between Springfield and St Louis two new chair cars. These cars are larger and have a larger seating capacity than the regular car, being equipped with all the latest improvements, and provided with the regular passenger compartments, smoking room and baggage room.

The Central Union Telephone Company will be asked to secure a franchise through the village of Bartonville. The company says that it was on the ground before the village was incorporated and can see no reason why it should apply for a franchise.

Negotiations for the purchase of the express business of the Illinois Traction System by the Wells-Fargo Express Company are said to be in progress by the two companies. In the event of the express company taking over the business it will conduct it in the same manner as it does the steam-road business—the traction company will furnish the cars and haul them to the destination, but the express company will handle the business. The express company is now doing business with the interurbans in the states of Indiana and Ohio.

The Southwestern Electric Train Bulletin Company of Jacksonville has been incorporated with a capital stock of $50,000 to do a manufacturing business. The incorporators are Franklin A. Jennings, William L. Duff and William S. Phillips.

The City Council of the city of Quincy has granted the St. Louis, Terre Haute and Quincy Traction Company a 50-year franchise. The ordinance is very liberal and gives the company the use of some of the best streets. The company will lay two or three miles of track in the city limits and will have specially good accommodations in the business districts.

At a meeting of the Illinois railway and warehouse commissioners, Messrs. Willoughby and Kilpatrick reported that the fatal wreck on the Charleston and Mattoon electric interurban road was due to the lack of a system of dispatching. At the same meeting the commissioners instructed the secretary to at once notify all of the interurban railway companies organized and operating under the laws of Illinois to furnish the department with such rules and regulations for the operation of cars and trains on their respective systems as they now have in force. The company, as a result of the wreck, has gone into the hands of a receiver. W. T. Avery, cashier of the Mattoon Savings Bank, has qualified by filing a bond for $10,000. This takes with it the Mattoon City Railway Company and the Mattoon Light and Power Company. Mr. Avery announces that he will at once install a dispatching system to insure the passengers' safety. Many suits for damages are expected to follow. The directors of the three companies are E. A. Porter (president), Arthur W. Underwood (secretary), L. C. Rose (treasurer), P. S. Grosscup and Francis S. Peabody. V. N.

Pacific Slope.

San Francisco, September 4.—Louis Glass, vice-president of the Pacific Telephone Company, has been convicted of bribery of San Francisco supervisors, with the object of preventing the Home Telephone Company from securing a franchise for a competing system. According to the confessions of a number of the supervisors, they later took money from a representative of the Home company and granted the franchise for a comparatively small sum. E. J. Zimmer, whose testimony before the grand jury caused the indictment of Mr. Glass on charge of signing the check for the bribe money, refused to repeat his testimony before the first trial jury, and a disagreement resulted. On the next trial Mr. Glass was convicted on circumstantial evidence. He was committed to the county jail pending the hearing of a motion for an appeal and today was sentenced to five years in San Quentin.

The Southern Pacific Railroad Company has applied for an electric franchise in Alameda, Cal. It covers only the present broad-gauge and not the narrow-gauge roads, but several branch or feeder lines, along streets as yet untouched by railroads. The application is for an overhead-trolley system for 50 years, with five-cent fares between stations. There are two applications for the franchise, one made by the Central Pacific and one by the South Pacific Coast. The Central Pacific covers the broad-gauge, or north shore line, and the South Pacific Coast the south shore, or narrow-gauge route.

The Snow Mountain Power Company will enter the electric field at Napa, Cal., and also that of Vallejo and Oakland, in addition to supplying Marin, Sonoma, Mendocino, Glenn and Colusa counties. G. F. Connors of Calistoga, secretary of the St. Helena Gas and Electric Company, announces that by December 1st the lines of the company would be strung through the entire Napa Valley, and that not only every city and town would be supplied, but that Vallejo and Oakland will be furnished with light and power. At St. Helena the company will have a working agreement with the St. Helena Gas and Electric Company, whereby the present plant in operation will be remodeled so as to use the Snow Mountain current and to be used as a distributing station for the power, which will be sold to farmers throughout the entire valley.

The work of completing the tracks of the Central California Traction Company into Lodi, Cal., has been pushed to completion.

Acting on a favorable opinion from the city attorney, the Los Angeles City Council has voted to advertise for the sale of a third-rail franchise along Hill and West Sixteenth streets.

C. H. Weed, engineer and electrician, of Los Angeles, has been in Turlock, Cal., trying to promote electric-light and water plants. Mr. Weed desires to buy a block of land in a desirable location and erect an electric-light plant. Provisions are also made for a water system to be used for domestic purposes and fire protection. A company has been incorporated to be known as the Turlock Electric and Water Company.

Stone & Webster of Boston, under the name of the Puget Sound International Railway Company, have purchased the street-railway lines of Everett, including a line from that city to Snohomish. With the purchase of the line the company intends to supply Everett with power generated from the plant at Nooksack Falls, now in process of construction. Coupled with the Snoqualmie plant, said to be owned by them, the big power establishment at Electron and a new plant to be built on upper White River, the company will have four large plants, generating enough electricity to operate the network of railways owned by them.

The Wenatchee Electric Company, which increased its capital stock to $150,000 a few weeks ago, has filed a mortgage with the Scandinavian Bank of Seattle as trustee for $300,000, funds to be used in the development of a large electric plant in Wenatchee. Arthur Gunn is president of the company. The building of a gas plant is only the beginning of work in view by the company.

William Piggott, president of the Seattle Car Manufacturing Company, stated to the board of county commissioners recently that his corporation intended to build at once a $250,000 plant at Tenton to take the place of the one which burned at Youngstown.

A report from Vancouver, B. C., is to the effect that James A. Moore of Seattle will be in Vancouver next week to select a site for a large electric smelter, steel structural works and iron foundry for handling ore from Texado and Vancouver islands.

The City Council of Dayton, Ore., is investigating the matter of securing a waterwheel and dynamo, with a view to establishing an electric-light plant for Dayton.

In order to install the 33 fire-alarm boxes recently purchased by the Fire Commission of Portland, Ore., the ways and means committee has appropriated $35,433 to cover the expense of running wires and placing boxes in the different districts of the city. Wherever the Home Telephone Company lines run, its poles will be utilized.

Contracts will soon be let for the construction of an electric plant at Katolla, Alaska, to generate 1,500 horsepower for use in connection with railroad construction work. The Guggenheim interests are behind the new railroad project. The present plans include the construction of 10 to 20 miles of trestle work and the erection of general office buildings, hospital and 20 bunk houses and mess houses. A.

PERSONAL.

Mr. Samuel Insull, president of the Chicago Edison Company, returned last week from a short visit to England. It was his fifty-third transatlantic passage.

C. F. Hambfhy has been appointed general superintendent of transportation of the Illinois Traction System. The office is a new one, and Mr. Hambfhy will have charge of all the transportation of the large electric-railway system, with offices in Springfield, Ill.

The place left vacant by the decease of Henri Moissan, the noted French scientist, in the Council of the Astro-physical Observatory of Meudon, near Paris, has now been filled by Prof. Henri Poincaré, the well-known physicist and professor at the University of Paris.

James W. King, manager of the Citizens' Telephone Company of Columbus, Ind., has resigned to enter business on the Pacific Coast. The company is at present making extensive improvements in the plant and is gaining patrons. John Hosea of the New Long-distance Telephone Company, Indianapolis, has been appointed to succeed Mr. King as manager.

Charles Ross Thurman, who is connected with the General Electric Company at Lynn, Mass., and Miss Eliza Carter Thornton were married at the University of Virginia on August 28th. The bride is a daughter of Prof. William M. Thornton, dean of the engineering department at the university. Mr. Thurman graduated from the university with the degrees of electrical and mechanical engineer, and he has been with the General Electric Company for several years.

ELECTRIC LIGHTING.

The Eldorado Springs (Mo.) Electric Company's power house, valued at $15,000, has been destroyed by fire.

L. W. Nelson of Mescalero, N. M., has made application for an electric-light franchise in Higgins, Tex.

Gibbon, Neb., is considering the establishment of an electric-light plant. A committee has been appointed to investigate the cost.

The Baton Rouge Electric Company has been incorporated with a capital of $750,000 to operate a light plant and street-car system in Baton Rouge, La.

A lighting contract was recently closed between the city of Duluth, Minn., and the Water, Light and Power Company. It calls for 203 arc lights at $65 per lamp and additional ones at $58 each.

The White City Amusement Company of Hot Springs, Ark., recently incorporated with a capital of $500,000, of which $50,000 is paid, will put in an amusement park. The charter allows the operation of electric plants and waterworks.

The Americus Railway and Power Company has been incorporated with a capital of $250,000 to do an electric-railway, lighting and power business in and about Americus, Ga. Among the incorporators are W. A. Dodson and A. W. Smith of Americus, J. F. Lewis of Valdosta and Congressman E. B. Lewis of Montezuma, Ga.

City Electrician Pfiester of Cincinnati, Ohio, has made a detailed report on the proposed illumination of the Eden Park water tower. He recommends that 1,000 electric lights be placed on the tower in the form of a circle around the top of the dome and a vertical row from bottom to top. He estimates the cost of installation at $1,500 and the annual cost at $2,000.

Bids for the installation of a conduit system of lighting for artistic cluster lights will be opened by the Board of Public Works of Seattle, Wash., September 21st. Lights will consist of clusters of five each, four to be placed on each side of the street in each block. Cost of installation is estimated at $150,000 and will be borne by the abutting property. It is expected that installation will require one year.

ELECTRIC RAILWAYS.

The Milwaukee and Northern Railway Company has reported to the police of Milwaukee, Wis., that thieves had cut down and carried off about 25,000 feet of trolley wire between Milwaukee and Cedarburg.

A plan is being considered for an electric road from Minneapolis to La Crosse, Wis. This is being backed by the owners of the La Crosse Water Power Company, which has nearly completed its plant at Hatfield, Wis.

Work on the extension of the Northwestern Elevated Railroad from Chicago to Evanston, Ill., is to be rushed so as to be completed by the first of next year. Arrangements are being made to secure new cars and equipment for this branch; 40 cars are to be delivered before November 1st, and more are to follow.

To prevent accidents similar to that on the Mattoon-Charleston line, the Illinois Traction Company, which controls probably the most extensive interurban system in the state, is installing a block signal system on all its lines.

The Hattiesburg (Miss.) Traction Company has lately increased its capital to $500,000. It has secured the franchises of the electric light and power, gas and street-railway companies and will construct a large central power house for all these allied interests.

Rumors are current that the Chicago and Oak Park Elevated Railway is contemplating an extension to Elgin, Ill. Color was given to these accounts by an investigation made by Mr. Lloyd Jones, civil engineer for the road, into the probable difficulties to be encountered on the line.

PUBLICATIONS.

The Engineering Specialty Company, 143 Liberty Street, New York city, has just issued Bulletin 106, a descriptive booklet illustrating but one of its departments, viz., direct-current motors, dynamos and their various combinations. The company has a fully equipped modern factory with every facility for rapid and accurate production, and a competent engineering staff. This bulletin or any of those covering the four other departments will be sent on request.

"On the Art of Cutting Metals," by Frederick W. Taylor, M. E., Sc. D., which was the presidential address presented at the last annual meeting of the American Society of Mechanical Engineers, has been reprinted and bound in cloth by the society; price, $3. This or any other publication of the society may be had by addressing the secretary, 29 West Thirty-ninth Street, New York. It is not necessary to send orders through members. None of the publications of the American Society of Mechanical Engineers is copyrighted.

The New Idea Catalogue of electric-light and power supplies and net price list has just been issued by the Commercial Electrical Supply Company of St. Louis, Mo. It contains the 1907 Fire Prevention Bureau rules. The price list is made up with light-faced type for factory shipment material and heavy-faced type for stock shipment material. On the front cover of the price list are two columns to indicate change in prices during the current month, one indicating goods advanced and the other goods declined. It also contains complete information pertaining to conduit construction. The book will be sent upon request.

SOCIETIES AND SCHOOLS.

The electric-lighting plant of the University of Mississippi was burned a few days ago, entailing a loss of $10,000. Spontaneous combustion of the coal is supposed to have been the origin of the fire.

The Chicago Association of Commerce has published its constitution and by-laws as revised August 1, 1907. The purpose of this organization is toward a united non-partisan effort for the advancement of the commerce, industry and public interests of Chicago, and the officers and members are doing commendable work in this direction. Mr. David R. Forgan is president and Mr. Harry A. Wheeler is general secretary.

TRADE NEWS.

The Amateurs' Electric Supply Company, Peoria, Ill., has been organized as an electric mail order house, catering to the trade of youths and young men interested in experimental supplies. The company solicits catalogues and estimates from firms manufacturing goods in its line.

Announcement is made that the new building of the Westinghouse Electric and Manufacturing Company at its works at East Pittsburg, Pa., will be ready about September 15th. It is 400 by 70 feet in ground dimensions, eight stories high and cost about $500,000. It will be used for the detail and supply department.

The Bossert Electric Construction Company, Utica, N. Y., has disposed of the switchboard and panel-board department of its business to the Nyelee Switchboard Company, Twenty-eighth Street and First Avenue, New York city, which company has the sole right to manufacture Bossert type switches and panel boards. The former superintendent of this department at the Bossert factory will be in charge of the new factory, which will be represented by the R. B. Corey Company, 39-41 Cortlandt Street, New York city, as sales agent. That the business of its former customers in this department will be given to the new concern is the wish of the Bossert company.

Having been obliged for the last year to maintain Pacific Coast headquarters in Oakland instead of San Francisco, the Standard Underground Cable Company of Pittsburg has now permanently relocated at Nos. 511 to 514 Shreve Building, San Francisco, Cal. A. B. Saurman continues as Pacific Coast manager. The company's new Oakland factory is four times as large as the old factory which was destroyed by fire shortly after the earthquake last year. It is as nearly fireproof as possible, equipped with new up-to-date machinery for the manufacture on short notice of insulated wires and cables for practically any service. It is also equipped with complete warehouse facilities for handling the products of the company's eastern factories carried in stock for Coast delivery.

BUSINESS.

Following the tests recently made on the 1,000-kilowatt Allis-Chalmers turbo-alternator now in operation for some months past at the power house of the Kokomo, Marion and Western Traction Company, Kokomo, Ind., this company placed an order with the Allis-Chalmers Company for a duplicate of the turbine unit installed, comprising a 1,000-kilowatt turbine driving a 1,000-kilowatt alternator, with turbo jet condensing system complete. The second unit just ordered will be placed beside the first one in the power house at Kokomo and will furnish power for lighting and railway service.

A large order for railway equipment has just been contracted for with the General Electric Company by the Utah Light and Railway Company of Salt Lake City. The Utah company is planning large extensions to its present 90 miles of track and will install 50 new cars. The contract calls for 50 complete quadruple equipments, consisting of 200 GE-80 40-horsepower motors with K-28 controllers. In addition, the company has ordered 74 GE-80 motors, with extra controllers, circuit-breakers, rheostats, etc., for the re-equipment of old cars.

ILLUSTRATED ELECTRICAL PATENT RECORD.

Issued (United States Patent Office) September 3, 1907.

864,781. Universal Outlet or Junction Box. John L. Gleason, Boston, Mass. Application filed May 31, 1906.

Strip springs are provided on outside of opening with one end fastened to wall of box and other end extending slightly over edge of opening so as to permit a flexible conduit to be passed outwardly, but not inwardly.

864,782. Tumbling Barrel. Harry J. Guttman, Chicago, Ill., assignor of one-third to Alexander E. Keith and one-third to Samuel Cole, Chicago, Ill. Application filed August 7, 1905.

An electro-plating machine comprises a rotatable tumbling barrel, means for changing the angle or inclination of the barrel while the same is in motion. The barrel has cathode terminals on its inner walls and an axial anode.

864,798. Portable Hoist. James L. Pilling, Chicago, Ill. Application filed October 3, 1906.

A compact electric hoist; armature and fields both revolve, being geared together so that fields become winding drum.

864,840. Apparatus for Electrically Removing and Severing Metal. Royal E. Frickey, Berkeley, Cal. Application filed June 29, 1906.

An electrode and holder for same, surrounded by a refractory sleeve, having a detachable refractory thimble at its outer end.

864,842. Electric Drive for Paper-making and Like Machines. James R. Happer, Linwood, Scotland, assignor of one-half to James Bertram & Son, Limited, Edinburgh, Scotland. Application filed January 4, 1907.

A system of electrically driving machines composed of sections driven at variable speed, comprising supply mains, a motor generator for generating a current of variable voltage which may be opposed or added to that from the mains and a separate motor provided for each section having its own regulating device and driven by the current from the mains and the generator.

864,846. Power-transmission Device. Charles D. Jenney, Indianapolis, Ind. Application filed June 23, 1904.

A high speed motor is provided with brackets carrying a counter-shaft, a large pulley on which is connected to a small pulley on the armature shaft by a short belt tightened by means of an idler pulley.

864,858. Automatic Circuit-closer. Hermann G. Pape, New York, N. Y. Original application filed June 16, 1904. Divided and this application filed September 23, 1905.

An operator's receiver contains a switch, which closes when the operator puts the head band over her head.

864,887. Supervisory System for Telephone Lines. William W. Dean, Chicago, Ill., assignor to the Kellogg Switchboard and Supply Company, Chicago, Ill. Application filed January 25, 1904.

A supervisory signal is connected with a cord circuit through relays, so as to operate when the cord circuit is used.

864,888. Trolley-wire Crossover. David H. Doak, Morgan Park, Ill., assignor of one-third to Charles Oldenburg, Chicago, Ill., and one-third to W. H. Conrad, Blue Island, Ill. Application filed October 11, 1905.

One trolley wire runs straight through on an insulated rough-shaped block; the other has two swinging runaways that are actuated by the passage of the trolley to span the gap occupied by the continuous wire.

864,899. Step Switch. Christian Krämer, Frankfort-on-the-Main, Germany, assignor to Felten & Guilleaume-Lahmeyerwerke Actien-Gesellschaft, Frankfort-on-the-Main, Germany. Application filed January 16, 1907.

A switch having an operating and a contact lever eccentrically mounted with regard to each other, so arranged that the operating lever moves the other only step by step in one direction, but freely in the other direction.

864,909. Sound-producing Device. John P. Northey, Toronto, Ontario, Canada. Application filed July 9, 1906.

A cylinder with annular orifices contains a hollow piston open at one end and having similar orifices; to the head of the piston is attached a piston rod having a direct current coil about it, making it a permanent magnet, beyond which is an iron core surrounded by an alternating current coil, which gives reciprocating motion to piston and produces sound.

864,912. Jointed Trolley Pole. Harry Padley, Elyria, Ohio. Application filed June 1, 1906.

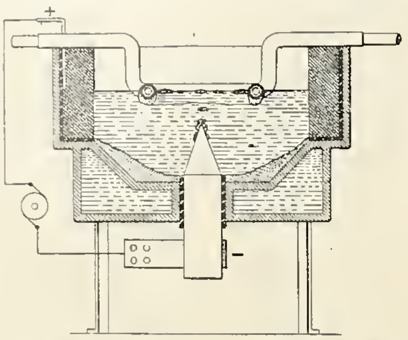
A two part trolley pole, hinged at center to permit swinging of the upper part inward and downward upon the lower part, and a spring fixed on lower part to catch and hold the upper part when the pole collapses.

864,915. Elevator Signaling Apparatus. Charles A. Reiners, Hoboken, N. J., assignor to the Elevator Supply and Repair Company, Chicago, Ill. Application filed April 9, 1907.

An electric signaling system adapted to two cars, has a light in each car controlled by passengers wishing to signal operator; this lights when car approaches floor and there also lights a signal lamp on floor; both these are extinguished when car passes the floor.

864,928. Electrolytic Production of Earth-Alkali Metals. George O. Seward and Franz von Kügelgen, Holcombs Rock, Va., assignors to the Virginia Laboratory Company, New York, N. Y. Application filed April 25, 1906.

The current density at a submerged cathode is maintained so high that the metal is formed there in a fused state and then passes through a cooler portion of the electrolyte to a suitable collector. (See cut.)



NO. 864,928.—ELECTROLYTIC PRODUCTION OF METALS.

864,930. Receptacle for Electrical and Other Devices. Robert Siegfried, Pittsburg, Pa., assignor to the Westinghouse Electric and Manufacturing Company, Pittsburg, Pa. Application filed October 3, 1905.

A tank for transformers or other apparatus has a separate base with an annular recess outside of tank, a cover with an annular channel to fit top edge of tank and bolts to clamp the tank between the base and the cover.

864,947. Clamp for Electric Wires. Elisha W. Buffinton, Fall River, Mass., assignor of one-half to Marietta M. Huggett, Fall River, Mass. Application filed May 1, 1907.

A knob or cleat consisting of base and cap, having two grooves for wires and a short groove and tongue between these to interlock the base and cap.

864,950. Telegraph Transmitter. Josiah A. Carter, Jr., Atlanta, Ga. Application filed March 4, 1907.

A combination of a vibrator, key lever, adjusting screw weights, an auxiliary lever contacting with the vibrator and with the key lever, and a movable stop; the key lever controlling the action of the vibrator, stop and bar. (See cut.)

864,957. Portable Search Light. John Dickens, Passaic, N. J., assignor to the Standard Sheet Metal Company. Application filed October 8, 1904.

A flash light set in a tube with some dry cells has an adjustably focussing lens and a special contact button.

864,959. Tank Alarm. Glen F. Elliott, Delmar, Del. Application filed April 20, 1907.

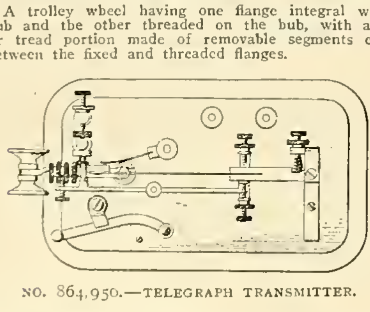
A weight controlled by the rise and fall of a float in the tank closes an alarm circuit at adjustable points.

864,961. Automatic Electric Gong-ringing Device for Street Cars. Nathan Fallek and George F. Wolfe, Denver, Colo., assignors to the Standard Electro-automatic Signal Device Company, Denver, Colo. Application filed April 22, 1907.

The top of the controller has a ring containing contacts; a contact arm extends from the controller shaft and engages these contacts, thus ringing the gong, when the controller handle is turned.

864,965. Trolley Head. James D. Gibbs, Louisville, Ky. Application filed January 15, 1906.

A trolley wheel having one flange integral with the hub and the other threaded on the hub, with a collar or tread portion made of removable segments clamped between the fixed and threaded flanges.



NO. 864,950.—TELEGRAPH TRANSMITTER.

864,968. Multiple Needle Holder for Electrolysis. Edward W. Johnson, Chicago, Ill. Application filed June 28, 1907.

A support having a number of arms ending in needle holders and means whereby these holders may be held in any desired position, the needle holders being in electrical connection with a socket on the support.

864,971. Electric Signaling Device. Alfred Larsson, Buffalo, N. Y. Application filed June 9, 1906.

An electromagnet has an armature to which is fastened a spiral spring and a hammer.

864,995. Junction-box-cover Rosette. Frank J. Russell, New York, N. Y. Application filed October 20, 1906.

A drop cord rosette has a base, with terminal plates and coupling sleeves, and a cap with service terminals and assembling screws.

865,011. Connection System for Direct-current Electric Motors. Raoul Brun, Havre, France. Application filed February 28, 1906.

The combination of a compound-wound motor and an auxiliary dynamo-electric machine mechanically coupled to the motor, the armature of the auxiliary machine being connected in series with the shunt-field winding of the motor so that the voltage of the said machine is opposed to that of the source of supply, and the field winding of the auxiliary machine being connected with the series winding of the motor.

865,013. Railway Block-signal System. Winthrop M. Chapman, Needham, Mass. Application filed January 24, 1906.

Every block has a signal at each end actuated by two magnets. When one is energized, signal moves to safety position; when other is energized signal moves to danger position; entry of a car into the block closes the circuits of the nearer safety moving magnet and of the remote danger moving magnet.

865,016. Electric Furnace. Walter G. Clark, New York, N. Y., assignor to the Electric Furnace Company, Portland, Maine. Application filed December 17, 1906.

The walls are of low resistance conducting material and an internal electrode is of relatively higher resistance except at its foot, which is at first in contact with bottom of furnace and is raised as soon as arc is formed.

865,038. Watertight Electric Bell. Walter C. Hill, London, England. Application filed May 19, 1906.

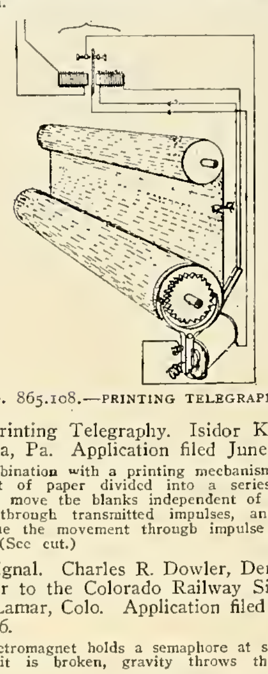
The mechanism is inclosed in the bell, which is in the form of a hollow flat cylinder.

865,068. Electric Generator. Klas Weman and Alfred Larsson, Buffalo, N. Y. Application filed May 21, 1906.

A magneto generator has two curved sheet metal pole pieces.

865,093. Current Transformer. Oswaldo de Faria, Paris, France. Application filed February 4, 1905.

An electrolytic transformer has a hollow carbon electrode, having horizontal perforations at its top and bottom, and a metallic electrode within this hollow one; the circulation of the electrolyte is like that in a thermo-siphon.



NO. 865,108.—PRINTING TELEGRAPHY.

865,108. Printing Telegraphy. Isidor Kitsee, Philadelphia, Pa. Application filed June 29, 1907.

In combination with a printing mechanism, a continuous sheet of paper divided into a series of blanks, means to move the blanks independent of the received message through transmitted impulses, and means to discontinue the movement through impulse locally generated. (See cut.)

865,169. Signal. Charles R. Dowler, Denver, Colo., assignor to the Colorado Railway Signal Company, Lamar, Colo. Application filed September 12, 1906.

An electromagnet holds a semaphore at safety; when the circuit is broken, gravity throws the signal to danger.

865,211. Binding Post. Earl H. Rollinson, Albany, N. Y. Application filed November 12, 1906.

Has a washer with projecting ears on its periphery to hold the wire.

865,212. Spark Plug. George W. Sage, Eureka, Cal. Application filed May 25, 1906.

A contact and release igniter that has a rotating electrode and two rocking electrodes mounted in and insulated from the body and adapted to be successively engaged by the rotating electrode.

865,215. Art of Telephony. Daniel M. Therrell, Charleston, S. C. Application filed July 23, 1904.

Covers various methods of increasing the currents in transmitter and line circuits, as by producing resonance and attuning to the essential frequencies of the sound to be transmitted.

865,219. End Connection for Conductors on Field Magnets of Alternate-current Generators. Miles Walker, Hale, Altrincham, England, assignor to the Westinghouse Electric and Manufacturing Company, Pittsburg, Pa. Application filed July 13, 1907.

Conductors project from the core slots; a number of ring conductors are mounted concentrically with the core having outwardly and laterally projecting lugs, the ring conductors being arranged in two spaced groups with the lugs of the two groups projecting toward each other, and longitudinally extending conducting bars are connected, respectively, to the said lugs and provided with outwardly projecting radial portions that connect to the ends of the core conductors. (See cut.)

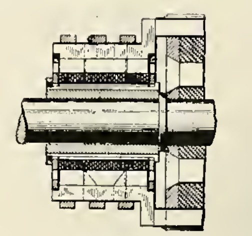
865,271. Long-burning Arc Lamp. Josef Rosemeyer, Lindenthal, Germany, and Gustave Dive, Bressoux, Belgium. Application filed March 7, 1905.

Provides a special construction whereby the globe is hermetically held to the casing.

865,285. Electric Smelting Apparatus. James C. Young, Jersey City, N. J. Application filed January 16, 1907.

Has a carbon forming one pole and a series of spaced receptacles mounted for rotation in a vertical plane forming the other pole, whereby an arc can be established or interrupted between said receptacles, one at a time, and the carbon.

865,291. Lightning Arrester. William J. Bell, Deerfield, Wis., assignor of one-third to Howell B. Fargo, Deerfield, Wis. Application filed September 25, 1906.



NO. 865,219.—END-CONNECTION FOR FIELD-MAGNET CONDUCTORS.

A non-conducting base has a socket into which fits a removable vertical carbon rod; a metallic cover fits over this rod, but is separated from it by a small air space; the line wire connects to the cover and the ground wire to the carbon rod.

865,305. Locking Device for Cross-wires. Adam Heim, Brownsville, Ind., assignor of one-half to Charles A. Rieman, Connersville, Ind. Application filed July 11, 1906.

A temporary wire clamp made of a single piece of resilient wire bent in the middle to fit over one of the cross wires and having its ends bent so as to lie along side of, and hook over, the other cross wire.

865,323. Trolley. Leslie S. Wilder, Northampton, Mass., assignor of one-half to Henry S. Wilder, Easthampton, Mass. Application filed January 10, 1906.

A trolley guard and finder has a stirrup pivoted at its ends near the trolley wheel axle and carrying divergent arms, the stirrup and arms being held out of contact with the trolley wire as long as the trolley wheel touches the latter.

865,330. Battery. Reuben S. Clymer and Thomas M. Woodhouse, Allentown, Pa.; said Woodhouse assignor to said Clymer. Application filed November 7, 1906.

Therapeutic battery has electrodes made of plates faced with absorbent material, the positive plate having a central projecting pin and the negative having a heating coil embedded in the absorbent material, both electrodes being connected to a source of current.

REISSUE.

12,691. Magnetic Composition and Method of Making the Same. Robert A. Hadfield, Sheffield, England. Application filed July 31, 1907. Original No. 745,829, dated December 1, 1903.

A magnetic material containing iron with an admixture of from one to five per cent of silicon, and treated by heat to at least between 700 degrees and 850 degrees C.; the treated material having magnetic permeability and electrical resistance increased and the hysteresis quality decreased to figures above and below respectively those which obtain with the purest iron commercially obtainable.

PATENTS THAT HAVE EXPIRED.

Following is a list of electrical patents (issued by the United States Patent Office) that expired September 9, 1907:

435,958. Method of Regulating Electrically Operated Mechanism. M. J. Wightman, Lynn, Mass.
435,967. Electric Lamp. Wm. D. Graves, Cleveland, Ohio.
435,982. Regulator for Dynamo-electric Machines. W. Stanley, Jr., Great Barrington, Mass.
435,983. Electrical Traction Apparatus. W. Stephens, Santa Rosa, Cal.
435,985. Rheostat. F. Thone, Oskaloosa, Iowa.
436,001. Electrolyte for Galvanic Batteries. F. K. Irving and F. M. Hill, Brooklyn, N. Y.
436,023. Electric Detonator or Primer. H. J. Smith, Pompton, N. J.
436,025. Electric Signal for Railways. G. A. Tower, Richmond, Va.
436,030. Electric Burglar or Automatic Fire Alarm. E. R. Wilder, Kansas City, Mo.
436,050. Secondary Battery Plate. T. P. Whittier, Saginaw, Mich.
436,087. Cut-out for Electrical Translating Devices. C. G. Perkins, Hartford, Conn.
436,107. Electric Switch. C. G. Perkins, Hartford, Conn.
436,113. Magneto Electric Machine. La Motte C. Atwood, St. Louis, Mo.
436,119. Electric Soldering Iron. C. E. Carpenter, Minneapolis, Minn.
436,125. Electric Lighting and Heating Apparatus for Electric Railways. M. W. Dewey, Syracuse, N. Y.
436,127. Electric Motor. T. A. Edison, Llewellyn Park, N. J.
436,154. Electric Signal for Railroads. F. C. Schroen, Baltimore, Md.
436,168. Electric Danger and Safety Signal for Railroads. E. M. Burt, Paris, Ill.
436,200. Electric Converter. G. Westinghouse, Jr., Pittsburg, Pa.
436,219. Electric Valve Controller. H. W. Deeds, Indianapolis, Ind.
436,275. Pulsating Current Battery System. C. J. Van Depoele, Lynn, Mass.
436,276. Adjustable Current Reciprocating Engine System. C. J. Van Depoele, Lynn, Mass.
436,277. Electric Power Hammer. C. J. Van Depoele, Lynn, Mass.
436,281. Portelectric. J. T. Williams, Mount Vernon, N. Y.
436,316. Electric Incandescent Lamp. J. S. Potter, Newton; D. J. Cartwright, Boston and B. B. Keyes, Chelsea, Mass.

WESTERN ELECTRICIAN

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Power Plant of the Antwerp Railway.

By F. C. Perkins.

A modern power plant for electric-railway operation has recently been installed at Antwerp by the Compagnie Mutuelle des Tramways de Bruxelles, under the name of the Compagnie Generale des Tramways d'Anvers, with sub-stations, track equipment and rolling stock complete. The power station is located at Merxem, the engine and boiler rooms being located at the rear of the building and the offices in front.

The accompanying illustrations show the interior of the power house, with views of the switchboard, generators and engines, as well as the motor-generators and mechanical equipment. The sub-station and high-tension equipment are also shown, and there is a view of a car on one of the business streets of Antwerp.

In the boiler room a motor-driven coal-conveying apparatus has been provided for feeding the coal to the boilers, a large coal bunker being placed laterally to the boiler plant, permitting an easy storage of the fuel. There is a battery of six boilers, each having two fire boxes with a heating surface of 70 square meters, supplying steam from the boiler room to the engine at a pressure of 10.5 atmospheres. Provision has also been made for installing four boilers when desired. The boilers are provided with superheaters of the Büttner system, having a heating surface of 40 square meters, the superheat being from 350 to 360 degrees. A Green economizer installed has two sets of 198 tubes each, with scrapers operated by electric motors of three-horsepower capacity.

The boilers are supplied with water by triplex pumps having an output of 10 cubic meters per hour, driven by motors having a capacity of 5.5 horsepower. A duplex steam pump of the same output is also provided. These pumps are installed below the reservoir from which the water is fed. The chimney at this station is 50 meters high, with a diameter of 2.5 meters at the top. It stands on a cement foundation.

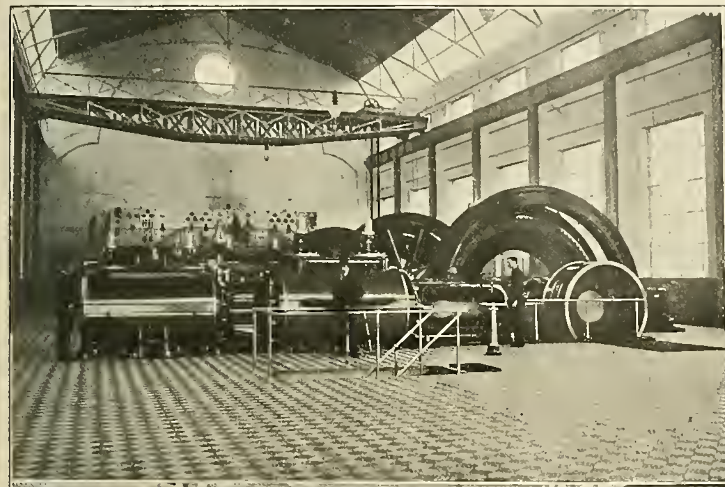
The engine and generator room is equipped with three units of 700 kilowatts each. The room measures 50 meters in length and 20 meters in width, space being provided for an additional unit of the same capacity. The engines installed at this station are of the Sulzer horizontal compound tandem condensing type having an output of 1,000 horsepower, but with an admission of 48 per cent. at the high-pressure cylinder, a maximum output of 1,650 horsepower may be obtained. The high-pressure cylinder has a diameter of 675 millimeters, and that of the low-pressure 1,100 millimeters, while the stroke of the piston is 1,150 millimeters. The speed of these engines, it is said, does not vary more than 1¼ per cent. with a change of load of 25 per cent., nor more than two per cent. with a variation of load of 50 per cent. The flywheel effect of the rotor of the alternator, which weighs 16.5 tons, is supplemented by a flywheel weighing 30 tons.

Three alternators of the three-phase type are in operation, each having a capacity of 700 kilowatts, and supplying current at 6,300 volts pressure with a frequency of 25 periods per second. The external diameter of the alternators is 4,320 millimeters, the width being 320 millimeters. The revolving field is of cast-steel, constructed in two parts, and weighs complete 16,500 kilograms, carrying 32 poles. It has an external diameter of 3,380 millimeters, the air-gap being 10 millimeters. The coils are wound with wire 69 square millimeters in section and are connected in series. The armature winding consists of 32 coils per phase, each occupying two grooves, there being 192 holes, or six per pole.

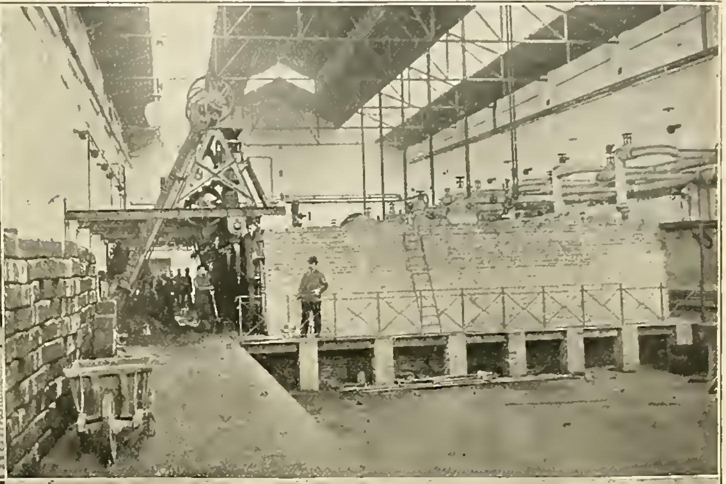
Excitation of the field coils is accomplished by a Tudor storage battery of 60 cells, having a capacity of 360 ampere-hours at a three-hour discharge rate. The battery is charged by means of a motor-generator set consisting of an induction motor operating at a pressure of 6,300 volts from the high-tension line and having a capacity of 112 horsepower, this motor being directly coupled to a direct-current generator supplying current at 120 volts. There is also installed in this power station a steam-driven exciter set consisting of a high-speed Carels engine directly coupled to a direct-current generator driven at a speed of 420 revolutions per minute, and supplying a current for field excitation at 120 volts. The extra 30 kilowatts provided is utilized for lighting the station as well as for operating auxiliary motors.

As shown in the accompanying illustrations, the switchboard is mounted on a gallery in the engine and generator room, the high-tension switching devices being installed underground. The switchboard is of white marble, having 14 stationary panels and a movable one. Three of the panels are equipped with measuring instruments, switches and controlling apparatus for the alternators; four panels are similarly equipped for the feeders, and two for the exciters and induction motors. There are also panels for the storage-battery and lighting circuits. The movable panel carries the synchronizing apparatus and is mounted at the extreme end of the switchboard gallery. The transformers and automatic oil switches are enclosed in a separate chamber to avoid danger to attendants.

The central power station is connected to the sub-stations by four feeder cables consisting of three conductors of 50 square millimeters each.

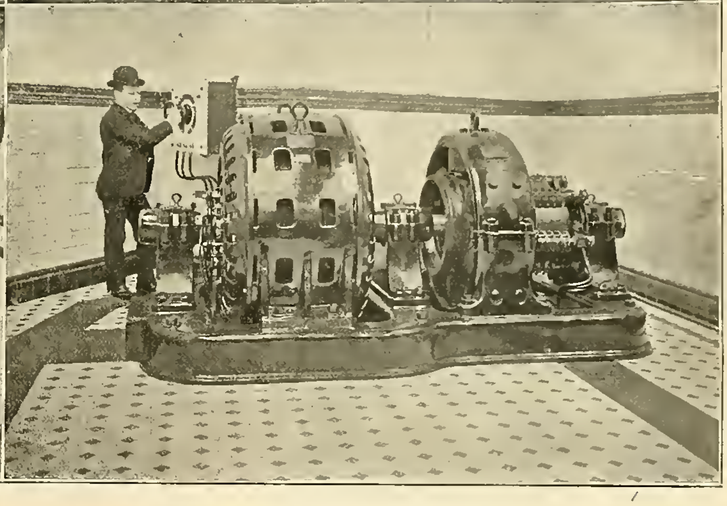


Engine and Generator Room in the Main Station.



A View in the Boiler Room.

Sub-station, showing Transformers and Rotary Converters.



One of the Motor-generator Sets.

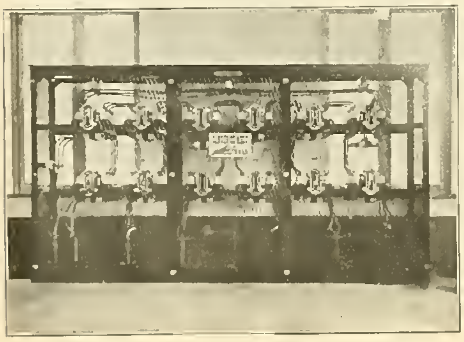
POWER PLANT OF THE ANTWERP ELECTRIC RAILWAY, IN BELGIUM.

The sub-stations are located at l'Avenue du Commerce and Rue Baudewyns, and are equipped with step-down transformers, reducing the three-phase current from 6,000 volts to 340 volts. Two Westinghouse rotary converters are also installed, each having a capacity of 550 kilowatts, and there is a storage battery having a capacity of 160 ampere-hours at a discharge rate of three hours, this accumulator installation consisting of 265 Tudor elements. For charging the storage battery a motor-generator group is used, consisting of an induction motor, operating from the step-down transformer circuit at a pressure of 340 volts, directly

STREET SCENE IN ANTWERP, BELGIUM.

coupled to a direct-current generator having a capacity of 85 kilowatts.

Each of the three monophase step-down transformers forming a group supplying current to the rotary converters has a capacity of 220 kilowatts. The primary winding of these transformers is designed for a pressure of 6,000 volts, receiving the current direct from the power-transmission line, while the secondary winding supplies a current to the rotary converters and asynchronous motors at a pressure of from 336 to 380 volts. The 550-kilowatt Westinghouse rotary converters are of the six-pole type, operating at a speed of 500 revolutions per minute and delivering direct current of 1,000 amperes at a pressure of 330 volts. The current from these rotary converters is utilized for



HIGH-TENSION APPARATUS OF ANTWERP RAILWAY EQUIPMENT.

operating the street railways of Antwerp, the storage-battery installations being provided as a reserve and for regulation.

The mechanical equipment of the Antwerp Railway power house was undertaken by the Ste. Carels de Gand and the electrical installation by the Ste. Electricite et Hydraulique of Charleroi, Belgium.

Great Western Power Extension.

Officials of the Great Western Power Company admit that the rights-of-way now being secured in Contra Costa County from Antioch to Richmond, Cal., by the way of Concord, are for their company and that the stringing of wires will not long be delayed. At Antioch the high-tension wires will cross the river on two high steel towers and will continue over a right-of-way more than 100 feet wide. This has given many the impression that the Gould interests, which are to a certain extent behind the power project, are planning to build an electric-railway feeder through Contra Costa County from Antioch to Richmond.

Transmission Plant of the Niagara, Lockport and Ontario Power Company.

From time to time the Western Electrician has kept its readers informed of the operations at Niagara Falls by the various power-generating and transmitting companies. Conspicuous among these companies is the Niagara, Lockport and Ontario Power Company, which on July 7, 1906, put in operation its first transmission lines, marking the inauguration of the first undertakings in the matter of distributing Niagara power over a large section of the country, and the beginning of an enterprise which is one of the most important of its kind in the world.

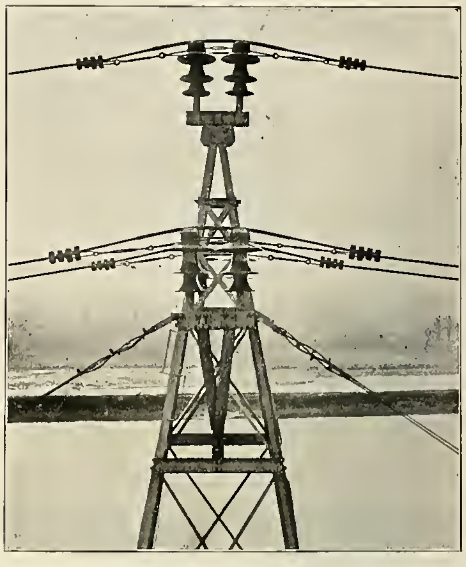
Several accounts of this company's plans and operations have appeared in the Western Electrician, the principal one being in the issue of February 24, 1906. Now that the plant is well in operation, a further account of the equipment and methods of operation will be of interest. The following details and illustrations are taken from the paper of Mr. Ralph D. Mershon, chief engineer of the company, read at the Niagara Falls convention of the American Institute of Electrical Engineers on July 26, 1907:

The plans realized at present and contemplated for the immediate future involve a maximum transmission distance of 160 miles. This distance puts the plant among the longest transmissions of the world. The prospective system is a comprehensive one for the delivery of power in the United States within an economic transmission radius of Niagara Falls, and especially for its delivery in the northern and western portions of the state of New York. The company expects within the next two years to be transmitting 60,000 horsepower, and its present right-of-way purchases are with reference to an ultimate transmission of 180,000 horsepower. The plans of the company as at present laid out contemplate the transmission of this power by means of main lines and branch lines therefrom; the contracts for power being, wherever possible, made for delivery of the power at the main-line voltage of 60,000 less line drop. Where, however, the business of a given territory will justify it, the company will install step-down transformer stations for the delivery of power at a lower voltage. Each of the main transmission circuits will be capable of receiving and transmitting 30,000 horsepower at 60,000 volts, and it is intended always to provide a sufficient number of spare main transmission lines to insure continuity of service on the main line.

The Niagara, Lockport and Ontario Power Company is a transmission company only; that is, it buys the power to be transmitted and has, therefore, no generating plant of its own. The power for the transmission is generated in the hydraulic power station of the Ontario Power Company, situated on the Canadian side of Niagara Falls. This plant has been described in the Western Electrician. The transmission lines of the Ontario Power Company extend from their transforming station to a point some six miles farther down the Niagara River, at which point the lines connect to circuits spanning the Niagara River. The Niagara, Lockport and Ontario Power Company takes delivery of the electric power at the international boundary line in the middle of the Niagara River.

The installation which the company has now in operation is for receiving 30,000 horsepower and delivering this amount, less the line loss. The main transmission consists of two lines in duplicate. From the Niagara River to Lockport, a distance of 16 miles, there are two lines on the company's private right-of-way, each capable of transmitting 30,000 horsepower. From Lockport to Mortimer, a distance of 57 miles, there is a line on the company's private right-of-way having a capacity of 20,000 horsepower. From Mortimer east to Syracuse, a distance of 81 miles, there is a line on the company's right-of-way having a capacity of 10,000 horsepower. From Lockport to a point about 11 miles east and thence south on the company's private right-of-way to the West Shore, thence on the West Shore to Pittsford, is a line having a capacity of 20,000 horsepower. From Pittsford on the West Shore right-of-way east to Syracuse is a line having a capacity of 10,000 horsepower. From Lockport south to a point south of Buffalo there are two transmission lines on the private right-of-way of the company, each having a capacity of 30,000 horsepower. These two lines south are tapped into the two lines coming from the Niagara River to Lockport, and constitute, therefore, at present, a branch line; but they will be eventually extended clear through to the Niagara River, and it is in anticipation of this extension that they are constructed with the full capacity of 30,000 horsepower. As will be seen from the above, the distance from the Niagara River to Syracuse is 154 miles. In addition to this the transmission from the transforming station of the Ontario Power Company to the Niagara River has a length of about six miles, making, as previously mentioned, a maximum transmission of 160 miles.

The power is brought across the Niagara River by means of aerial cables spanning the river, and delivery of the power is taken by the transmission company at the international boundary line. The cables are brought across the river in three spans, one span from steel cantilevers at the top of the cliff on the Canadian side to steel towers at the water's edge on the Canadian side, another span from the water-edge towers on the Canadian side to the corresponding towers on the American side,

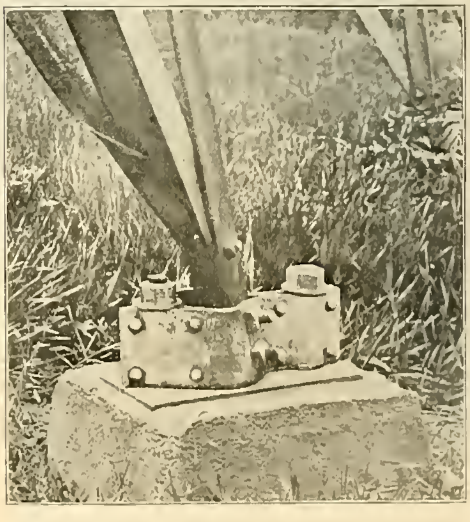


TOP OF DOUBLE-GUYED STEEL TOWER.

and a third span from the steel water-edge towers on the American side to the steel cantilevers at the top of the cliff on the American side. The use of cantilevers is necessitated mainly by reason of the steep angle at which the cable descends from the top of the cliff. Their use also makes possible the required clearance between the cable and the slope of the gorge, a point of special importance on the American side in view of the fact that one of the branch lines of the New York Central Railroad is on the American slope of the gorge. The steep slope of the cable at the cantilevers would make it bear upon the upper petticoat of the insulator supporting it, if the cable were attached to the top of the insulator in the usual way.

The steel cantilevers and the river-edge towers are all designed to withstand the most extreme conditions of sleet and wind that will probably ever exist. The requisite mechanical strength of the insulation at the points where the cables are attached to the steel structures is obtained by using a sufficient number of line insulators, and the proper distribution among these insulators of the forces which will come upon them is effected by means of malleable cast-iron caps cemented to the tops of the insulators, and to which the cables are fastened.

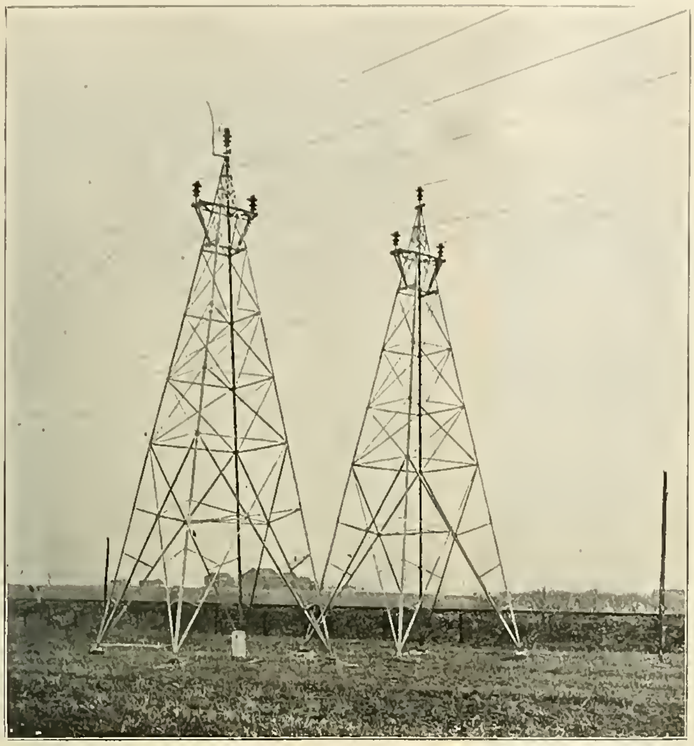
With the exception of that portion of the main line on the West Shore between Churchville and Syracuse, the main-line structures are all steel towers and the standard line-span is 550 feet. On some portions of the transmission line, however, much longer spans are used, the longest at present installed being 1,253 feet. In some cases these long spans had to be provided with towers heavier than



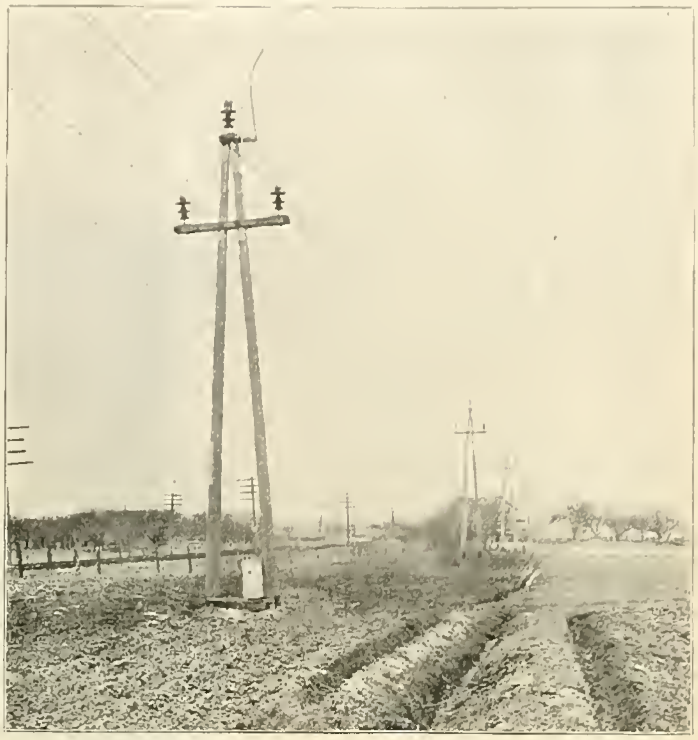
METHOD OF FASTENING TOWER TO FOUNDATION.

the standard, but in some cases it was possible to put them up with little, if any, modification of the standard tower construction. For a number of reasons, the principal one being lack of the requisite space, it was necessary to use on the West Shore right-of-way between Churchville and Syracuse wooden construction of special design, the standard span being 220 feet. In every case on the 60,000-volt lines, each line of towers or wooden structures carries only one three-phase circuit. The main-line conductors installed so far are all of aluminum cable, except on a portion of the line between Mortimer and Syracuse, where, because of the long spans employed, it is preferable to use copper.

The first of the steel towers installed were of the tripod type, made of lap-welded pipe; but the later towers, and those which in the near future will be installed, are of structural shapes and galvanized. The later towers are interchangeable; that is, the guyed and unguyed towers are exactly similar except for the guys and double insulators of the former. Contrary to the practice which has heretofore been followed in the matter of steel line towers, the towers of this transmission line are mounted on foundations of reinforced concrete. These foundations are designed to utilize the weight of the earth around them in resisting uplift. The towers and their foundations are capable of withstanding transverse forces which will be brought upon them when the line cables are covered with 0.5 inch of ice all around them and the wind blowing transverse to the line at a velocity of 75 miles an hour. The towers have the same strength in all directions; that is, they are capable of withstanding the same forces in the direction of the line that they are capable of withstanding transverse to the line; but to meet the contingency, not likely to occur, of all three cables breaking at once, in which case the full tension of all the cables might be brought upon the towers, there are at intervals along the line certain towers guyed both ways in the direction of the transmission line and having double fixtures.



Line-structure Lightning Arrester on Steel Tower.



A-frame Construction, showing Line-structure Lightning Arrester.

NIAGARA, LOCKPORT AND ONTARIO POWER COMPANY.

LOCKPORT SUB-STATION, SHOWING 11,000-VOLT OUTDOOR LIGHTNING ARRESTER.

As stated above, on the West Shore right-of-way it was necessary to use wooden line structures. The type of construction employed is that which has been designated by the company as "A-frame construction." By adopting this type of construction, in which each structure consists of two poles instead of one, it is possible to use twice the length of span that would be used in ordinary wooden pole construction, and employ therefore one-half the number of insulators. On some portions of the West Shore right-of-way it was necessary to use steel construction, and in such places there were installed galvanized lattice steel poles.

In a number of places on the main line, both on the West Shore and on the private right-of-way, it is necessary to cross the Montezuma marsh. Where this marsh was crossed with steel tower construction, the concrete foundations for the steel towers were built by first excavating the swamp through the soft mud until the soft marl, forming the substratum of the swamp, was reached. On the marl was laid a platform of two layers of corduroy, and on this platform was built the concrete foundations, the weight of which was made sufficient to take care of any uplift which will come upon the towers.

In some of the towers and A-frames there is a horn attached to a cap on the top of the insulator and another horn alongside of it fastened to the structure and extending some distance above the insulator. This comprises a combined line-structure lightning arrester, or spark-gap, and lightning rod. It has been decided to make a careful trial of this method of protection of the line before resorting to a grounded cable, partly because of the great expense of the grounded cable and partly because there is no reason to think, so far, that it will necessarily afford complete protection in every case. For the present these line-structure lightning arresters will be installed only on the top cable in view of the fact that during the last lightning season, in the course of which a number of insulators were broken by lightning, more than three-fourths of the insulators so broken were top insulators.

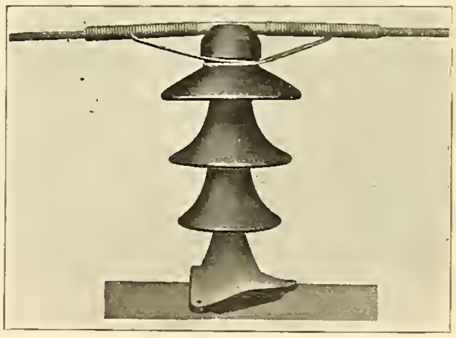
The insulator used on all the main-line construction is one especially designed by Mr. Mershon for this plant. It has probably the greatest factor of safety as regards flashing, etc., of any insulator in practical use today, and is considerably larger and heavier than any insulator of which corresponding use has heretofore been made. It consists of three shells nesting in each other and cemeted together by means of neat Portland cement, the whole insulator being cemented in a similar manner to a steel pin before attachment to the tower. The total height of it from the edge of the lower petticoat to the top of the head is 19 inches. The diameter of the upper petticoat is 14.5 inches. The insulator used on some of the branch lines is smaller and less expensive than that for the main line, partly because the branch lines receive in general a somewhat lower voltage than the main line and partly because the lines, carrying the small amounts of power they do, are not considered to be entitled to the same insurance as the main line.

Each branch line has in series with it, at the point where it is tapped off the main line, 60,000-volt outdoor fuses to cut out the line in case of trouble upon it. The fuses consist of lengths of thin copper wire 16 feet long, run through an ordinary small rubber bathroom hose and laid in clips on top of a wooden bar, supported at each end and the center by line insulators mounted on poles. The fuses are parallel to each other, in the same horizontal plane, and the distance from center to center is about 25 feet. These fuses have so far proved very satisfactory, but will probably in time be replaced with fuses of the expulsion type.

There are only three sizes of cables used on the main transmission line, designated by the company as 3/3, 2/3 and 1/3, respectively. The 3/3 cable is aluminum cable, consisting of 19 strands, and having a total area of 642,800 circular mils, being equivalent to 400,000 circular mils copper. The areas of cross-section of the other cables are, respectively, 2/3 and 1/3 that of the large one.

In ordinary straightaway work the cables lie in the top groove of the insulator, and the pull of the cable is taken care of by means of two aluminum wire ties around the neck of the insulator. One of these ties extends each way along the cable. The tie itself consists of a single loop around the neck of the insulator, the two ends of the loop being twisted around the line cable. The result is that the cable is not really fastened to the insulator at all, but simply lies in the top groove. The ties do not, therefore, perform any function, except when there is a pull on the cable tending to slide it in the direction of its length. The advantage of such a tie is twofold. First, the full strength of the tie wire is developed, which is not the case if a tie is twisted or "pig-tailed," since, in such case, the tendency is for the tie to cut itself in two at the twist; second, the tie does not damage the soft aluminum cable, as would be the case with most of the other ties usually employed.

In other than straightaway work, and where it is desirable that the method of fastening to the insulator shall be such as will withstand a pull equal to the full strength of the cable, in case the cable should break, the tie mentioned above is not used, but instead there is employed a cable-clamp and a yoke extending each way on the cable.



60,000-VOLT MAIN-LINE INSULATOR WITH TIE AND CABLE PROTECTION.

In every case the cable near the insulator is protected from possible arcs, so that in the event of an arc there will be a chance for the circuit-breaker at the generating station to open before the cable shall have been burned off. This protection is accomplished in the top groove of the insulator by means of sheet aluminum wrapped around the cable at this point to a thickness of one-eighth inch, and is accomplished on each side of the head of the insulator to a distance of 12 inches from the head partly by the turns of the tie-wire mentioned above and partly by an additional serving of tie-wire. Where, in the case of the use of cable clamps, no tie-wire is used, its absence is made up for by additional serving.

At intervals along the line there are provided disconnecting switches for sectioning the line to facilitate testing out in case of trouble or cutting out any portion of the line which is damaged. There are also provided at certain points in connection with these disconnecting switches cross-connecting switches, enabling the interconnection of different portions of the two lines.

On a considerable portion of the company's right-of-way is a wagon road for use in patrolling the line and delivering materials for construction or repair. At certain points along the line there are patrol houses for the storage of material, for taking care of teams and for the comfortable housing of the patrolmen. Each house has in it sleeping room, kitchen and sitting room. On all of the transmission lines also the company has a private telephone line on a separate set of wooden poles. Taps from this line are brought into each of the transmission houses, and in addition to this the line patrolmen have portable telephones which can be connected to the telephone line at any point.

Most of the contracts which the company has for the supply of power cover the delivery of the same at the main-line voltage, so that, so far, the company has installed only three sub-stations, two of them of considerable size at Lockport and Gardenville, respectively, and one at Baldwinsville, a very small and comparatively inexpensive one. The stations at Lockport and Gardenville have each a normal capacity of 3,000 kilowatts, not including the spare apparatus. They are so designed that their capacity can be indefinitely increased. The Baldwinsville station has a capacity of 750 kilowatts.

The 60,000-volt bus-bars at the Lockport and Gardenville sub-stations are outdoors; in other words, these bus-bars have been treated exactly as if they were part of the transmission line and located out of doors in a manner, so far as insulation is concerned, similar to the transmission-line cables. In connection with them are disconnecting switches for making various combinations of the apparatus connected to them. Of course the disconnecting switches are not intended to break the working current. When it is necessary to break the circuit under load, it will be accomplished by means of the 60,000-volt electrically operated oil switches installed in the station which, in the case of the Lockport sub-station, serve also for the control of the two lines to the Buffalo district.

Another feature out of the ordinary in connection with this station is the lightning-arrester equipment. This equipment is also out of doors and consists of a number of horn-type lightning arresters mounted on wooden poles in much the same manner as such arresters are ordinarily mounted. The installation differs, however, from the ordinary lightning-arrester installation of this kind in that, instead of there being only one pair of horns for each line conductor there are three such pairs. One pair is set for a comparatively low-striking electromotive force and has in series with it a high resistance; the next pair is set for a higher striking electromotive force and has in series with it a lower resistance; a third pair is set for very high-striking electromotive force and has in series with it a fuse.

The theory on which these arresters are installed is that for ordinary slight static disturbances in the line the arrester having the lower striking electromotive force will discharge, and since it has in series with it a comparatively high resistance the resultant disturbance to the system due to the generated current which follows the discharge will be comparatively slight. A more severe static disturbance (whether due to lightning or to any other source) will cause both the arrester having the lowest gap and the arrester having the next higher gap to discharge simultaneously, thus affording two discharge paths to earth, the combined resistance and inductance of which is considerably lower than that of the first path. This will mean a somewhat more severe disturbing effect on the system due to the generated current which follows.

There will be installed shortly on the company's system two switching stations, one at Mortimer and one at Syracuse. The one at Syracuse will be for taking care of the two incoming 10,000-horsepower lines and the outgoing lines to the consumers in Syracuse. The one at Mortimer will be for taking care of the two incoming 20,000-horsepower lines and five outgoing lines, two of them being a line in duplicate to Rochester; two of them the line in duplicate to Syracuse, and one the Avon branch line, supplying several installations, among them the station of the Erie Railroad Company, operating its trolley line between Rochester and Avon. Both these switching stations will be equipped with the 60,000-volt electrically operated oil switches, reverse relays and other apparatus necessary for properly manipulating the circuits which they control.

The transmission plant has been built in accordance with the design of Mr. Mershon, acting as chief engineer of the Niagara, Lockport and Ontario Power Company, and has been constructed under his supervision and that of his assistant in the work, Mr. H. L. St. George. The construction work has been done by the Iroquois Construction Company of Buffalo, headed by General Francis V. Greene, president, the construction work itself being directed by Mr. F. B. H. Paine, vice-president and chief engineer of the construction company, assisted by Mr. Walter S. Skinner and Mr. S. Piek.

Battery-propelled Cars on Standard-gauge Railways.

By Dr. Alfred Gradenwitz.

An interesting departure in the use of electricity for the operation of standard-gauge railways has been made recently on three suburban lines starting from Mayence, Germany, by running individual battery-propelled motor cars in the intervals between the ordinary trains. These cars are intended

MOTORMAN'S CABIN IN BATTERY-PROPELLED CAR.

mainly for dealing with the traffic of business men, factory employes, workmen and school children from the suburbs of Mayence to the city itself and vice versa, as well as for effecting connections to the stations served by express trains. The three suburban roads using these cars are the Mayence-Oppenheim, 20.41 kilometers; the Mayence-Ingelheim, 18.08 kilometers, and the Mayence-Rüsselsheim, 12.22 kilometers.

The carriages in question have been converted from old three-axle third-class cars of the Berlin Metropolitan Railway, the side corridors being done away with, making the seats continuous throughout the width of the car. The braking cabins have been extended to form the driver's cabin, comprising the controllers, measuring instruments and brake. An end compartment of the car can be used if desired as a second-class compartment. The cars are designed for briquette heating and electric lighting. Each compartment has an electric alarm for signaling the driver which is actuated in the usual manner by the emergency brake line from the interior of the car.

The accumulator battery, supplied by the Akkumulatoren-Fabrik, Ltd., comprises 180 cells installed below the hinged seats in boxes of seven to eight cells each. One of the accompanying illustrations is a view of the car with the doors open, showing the hinged seats which contain the batteries.

Each motor car is equipped with two 25-horsepower series motors driving the two end axles through simple toothed wheel gearing. These motors are designed for giving the car a maximum speed of 50 kilometers an hour on level track. In starting they are connected up in series and are changed to parallel after reaching a running speed of about 25 kilometers an hour. The working weight of each car is about 33 tons, of which about 10 tons represents the battery and six tons the motor equipment.

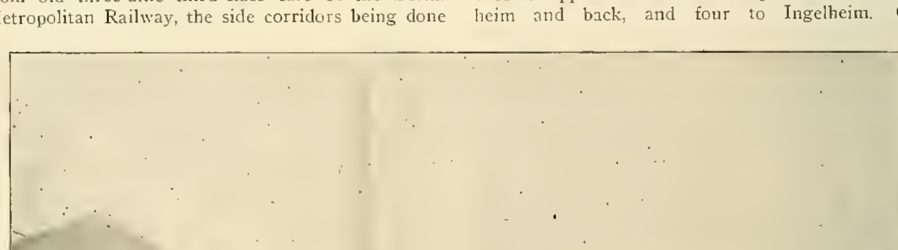
The charging station for the batteries has been installed at the Mayence railway station, the motor-car service comprising for the time being the three suburban lines mentioned. The permanent generating plant for charging, to be operated by a 100-horsepower Diesel engine, is being built. In the meantime the charging current is derived from the cables of the municipal electricity works of the city of Mayence, and as this supplies only alternating current, a special converter had to be provided. This is designed for an output of only 70 horsepower, an existing machine set having to be used owing to the hastened conversion of the cars.

The current derived from the municipal electric works is paid for at the rate of 15 pfennige per kilowatt-hour, while the Diesel engine plant is expected to produce the current at about six pfennige. It may be said that the city of Mayence, on account of the contemplated erection of a private charging plant, could not be induced to grant special rates, as the converter plant will have to be kept in the future only as reserve.

The recharging of the batteries is effected after completing a trip, the time table being arranged with a view to leaving sufficient time for recharging between each two runs. In the case of the Mayence-Oppenheim-Mayence and Mayence-Ingelheim-Mayence trips, 40 to 50 minutes are required, and on the Mayence-Rüsselsheim-Mayence run, 30 to 35 minutes. In charging the doors are opened and the seats turned up as shown.

The cost of conversion was about 30,000 marks for each car, of which the battery cost 10,000 marks and the motor equipment 14,000.

These cars, since their inauguration on February 18th, have been making four runs daily from Mayence to Oppenheim and back; eight runs to Rüsselsheim and back, and four to Ingelheim. Only three cars are used in ordinary operation, the fourth car being kept as reserve in permanent working order, while the fifth is used only as a repair car.



BATTERY-PROPELLED CAR WITH DOORS OPEN SHOWING BATTERY COMPARTMENTS UNDER THE SEATS.

The consumption of energy of each car is about 18 to 20 watt-hours per ton-kilometer. The time table has been included in the official railway guide, the time on the Mayence-Oppenheim line having been recently reduced by seven minutes.

Manufacture of Electrolytic Disinfectant at Poplar, London.

[From the London correspondent of the Western Electrician.]

The plant installed by the Poplar Borough Council, in which the Hermite process has been adopted for the manufacture and supply of electrolytic disinfectant for all purposes throughout the borough, has now been working 12 months and is reported by Dr. Alexander, the medical officer of health to the council, who introduced the idea, to be a complete success. This officer is to be congratulated for his persistence in face of great opposition to

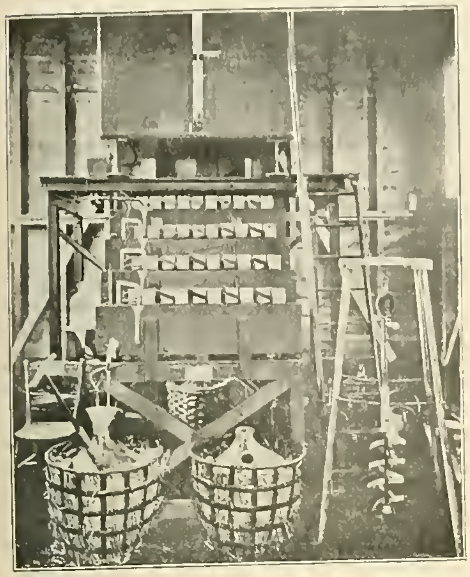


FIG. 1. ELECTROLYZER USED IN MANUFACTURE OF ELECTROLYTIC DISINFECTANT.

the scheme. He expresses himself as conscious that the step initiated has proved itself overwhelmingly satisfactory from every point of view, particularly that of the public health of the district.

A similar plant is in operation at Rolleville, near Havre, France, and a deputation from Poplar visited this installation. What it saw there assured the members of the ultimate success of the scheme in Poplar. It had been suggested that the health of the borough would suffer if such a disinfectant were introduced, but this, happily, has not proved true, for the annual notification rate per thousand living in the borough was 6.2 against the figure of 7.5 for London for the year 1906.

The system adopted at Poplar is to mix a certain quantity of fluid in an elevated tank, and then to allow this fluid to flow through four double troughs, or cells, placed one above the other, so that the liquid descends continuously by gravity. Each trough is divided laterally by a partition, and in each of the two divisions five distinct "elements" (consisting of one positive and two negative plates) are suspended. (See Fig. 1.) The positive plates are of thin platinum wire wound upon slate slabs, and the negative plates are of zinc. There are thus four troughs, each containing 10 "elements," or 40 cells in all.

The liquid enters through the funnel, visible toward the top left-hand side of Fig. 1, passes along the front division of the top trough, back through the division behind, over a weir, and into a subdivision, from which it is drawn off by the bent glass tube discharging into the second funnel; it passes along the front division, back through the division behind, over the weir, into the pocket of the second trough, and so on, to the final bent tube, which discharges it into a carboy.

A bottle arranged at the side of the tier of cells (as shown) supplies the sodium-hydroxide used as a preservative, which flows, drop by drop, into the carboy as it is filling, and serves to neutralize free hypochlorous acid. As the liquid passes through the troughs it is subjected to the action of a regulated current of 15 to 17 amperes at 230 to 250 volts, being 5.7 to 6.2 volts per cell. During the run the liquid in the carboy is thoroughly stirred by means of an ebonite rod, shown in the illustration, and provided with rubber flaps.

The objects aimed at to make the working of the apparatus and the manufacture of the fluid become simple and automatic were as follows:

(1) To see at a glance whether the apparatus is working properly. This is accomplished by a gauge glass in front of the large tank and another gauge glass on the little supply tank (Fig. 1), the first to show the quantity of salt liquid capable of being acted upon, and the second to show if the liquid is running properly into and out of the small supply tank, as the chloride of magnesium contains impurities which are likely to block up the valve of the small cistern and the taps leading to and from the same. A thermometer is kept in the small supply tank to note the temperature of the salt liquid, and another thermometer is placed at the outgo of the last electrolyzer; the difference of the temperature gives the rise in temperature due to the electrolysis, and which is found, when the apparatus is working satisfactorily, to be under 30° F. The small tank is necessary to keep a constant flow of the fluid into the electrolyzers. When first the apparatus was erected the fluid used to become unduly hot on account of the flow slowing down through diminution of the head of water in the large tank. The tank had ultimately to be raised onto girders and a small supply tank fixed at a lower level.

(2) The liquid to be electrolyzed in the large tank had to be stirred from time to time to keep the mixture of an equal gravity throughout, more especially as for obvious reasons a certain quantity of a solution of sodium hydroxide is added. To keep the liquid stirred a large, broad drilled plate of galvanized iron is used, one end of which acts as the fulcrum when the other is lifted up by means of a chain leading over pulleys to the ground, so that the attendant has only now and then to pull the chain to lift the plate up and down instead of running up and down the ladder and stirring the liquid with a rod.

(3) It is necessary to govern the electric current, which is taken direct from the mains, on account of the density of the salt mixture to be acted upon varying from time to time, owing to the temperature changes and consequent changes in conductivity. This difficulty is overcome by the current regulator, Fig. 2.

(4) To prevent shocks and waste of fluid while changing the carboys, a special glass tap has been made. (Fig. 1.)

(5) To prevent loss of available chlorine the solution of sodium hydroxide drips into a specially blown carboy at the same time as the fluid is running into it, and the two fluids are mixed with a stirrer inserted through an aperture in the neck of the carboy, and when the carboy is full a final mixing for about two minutes is given by means of a stirrer fixed to gear wheels. This apparatus is shown at the right in Fig. 1. Before the ebonite stirrers with rubber flaps were made, full carboys and half carboys had to be shaken rapidly for about 10 minutes, and this not always with the best results as to bringing about the desired stability, for when sodium hydroxide is added the precipitate falls to the bottom, and it is necessary to render the solution milky throughout.

(6) So far as oxychlorides are concerned, the apparatus in 10 months had only been taken to pieces and cleaned twice. Every day, after working, the electrolyzers are emptied by means of the mud holes by removing the rubber plugs, and the fluid which is run out is kept to recharge the electrolyzers. These latter, after being emptied, are washed out by means of a hose, and then, until the next working, are kept filled with water, which softens any deposit formed upon the electrodes, and before starting work the electrolyzers are emptied and washed out again, a matter which takes up a few minutes every day before and after each working.

During the 12 months of operation (the apparatus was installed at the beginning of February, 1906) some 17,000 gallons of fluid have been manufactured of a strength between 4.0 and 4.5 grammes of available chlorine per liter — 1,000. The fluid has been issued to the public in pint bottles, while for watering the roads, etc., has been furnished with nearly 10,000 gallons at one penny per gallon. There have been required 2,543 units of electrical energy, supplied by the municipal power station at 1½d. per unit; four tons of salt have been used at 24s. per ton; two tons of chloride of magnesium at £3 17s. 6d. per ton; caustic soda costing £4 8d.; water, together with that used for washing out the electrolyzers and for other purposes, £2 15s. 8d., including meter rent.

The cost of the plant, which is indestructible with the exception of the 40 zinc electrodes, which may occasionally have to be replaced at a cost of 7s. 6d. each after some years of wear, was £583 9s. 2d. The operating expenses and cost of manufacturing from February, 1906, to February, 1907, was £635 13s. 11d. Deducting receipts from the works department amounting to £37 19s. 8d., left the total expense for the year at £597 14s. 3d. This figure compares with £664 2s. 9d.; £771 6s. 11d. and £862 5s. 7d., respectively, for the years 1903, 1904 and 1905, when the ordinary carbolic disinfectants were supplied.

Bearing upon the stability of the fluid, it is stated that experiments carried out have shown that samples of fluid prepared a year ago showed a fall of chlorine not exceeding 0.5 gramme per liter (about 10 per cent.) in the first few months, since which time the chlorine has remained quite constant. Fluids prepared in October, 1906, by the improved method remained absolutely constant up to March, 1907.

On the evening of October 1st the Street Railway Association of the State of New York and the Empire State Gas and Electric Association will hold a joint meeting at Madison Square Garden, New York. The annual meeting of the Gas and Electric Association will be held at the same place on October 2d.

Three-wire Dynamos versus Motor Balancers for Three-wire Circuits.

A paper by B. Frankenfield, engineer of the Allis-Chalmers Company at the Cincinnati works, read before the recent convention of the National Electric Light Association at Washington, summed up in a concise statement the many advantages claimed for the motor balancer over the three-wire generator. The balancer system was devised for supplying a three-wire load from a station using two-wire dynamos. It is said that a station designed on this plan has the advantage in cost and simplicity over a station using three-wire dynamos. The inherent regulation can be made extremely good in shunt wound balancers and practically perfect in compound balancers, while perfect hand regulation can always be obtained with any balancer of the motor-generator type.

A comparison of the three-wire dynamo with the two-wire dynamo and balancer may be summarized as follows:

The three-wire dynamo cannot be regulated for equal voltage; the balancer can. The balancer can also be made to regulate inherently for equal voltage, which is not true of the three-wire dynamo. The balancer is capable of carrying a neutral overload with good regulation, while the three-wire dynamo can carry it, but only with poor regulation.

The three-wire dynamo represents extreme specialization in design. This means long delivery and also delay when it becomes necessary to make repairs. The two-wire plant with a balancer consists of standard apparatus throughout. This means quick delivery and quick repairs. The three-wire dynamo has complicated connections repeated for each unit in the plant, making it difficult to locate trouble, while the connections of a two-wire plant using a balancer are simple and easy to understand, and any trouble is easily located. The three-wire dynamo requires expensive switchboard connections and heavy cables. The two-wire plant with balancer does not.

A plant using three-wire dynamos occupies more floor space than a two-wire plant with a balancer. A two-wire dynamo will now operate successfully in parallel with a three-wire dynamo without remodeling. Any number of two-wire dynamos can be added to a two-wire plant with balancer without making a single change in their construction.

There is danger of a violent short-circuit when a three-wire dynamo is brought up to speed and paralleled. This same danger does not exist in equalizing a two-wire dynamo or in equalizing a balancer. Two double-pole circuit-breakers are required by a three-wire dynamo, while the two-wire

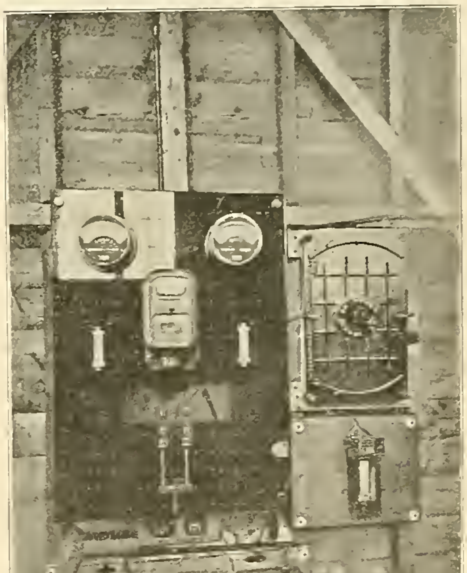


FIG. 2. SWITCHBOARD AND CURRENT REGULATOR IN POPLAR DISINFECTANT PLANT.

dynamo requires but one, and the balancer requires but one. The three-wire dynamo plant requires two equalizers. The two-wire plant requires one, and, where compound balancers are operated in multiple, the equalizer outlay for this portion of the plant is insignificant.

The three-wire dynamo plant requires two ammeters for each machine. The two-wire plant with balancer requires but one ammeter for each machine and one for the balancer. The balancer can be located at a distance from the station. The three-wire dynamo must reach out from the station to the distant point. Lastly, it should be emphasized that the balancer is not limited to small isolated-plant service, but is capable of heavier duty.

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DEPARTMENTS.

DATES AHEAD.

Colorado Light, Power and Railway Association (annual meeting), Savoy Hotel, Denver, Colo., September 18th, 19th and 20th.

Central Electric Railway Association (regular meeting), Columbus, Ohio, September 26th.

New York Electrical Show, Madison Square Garden, September 30th to October 9th.

American Street and Interurban Railway Association and affiliated societies (annual convention), Atlantic City, N. J., October 14th to 18th.

AFTER A LIFE of twenty years, for it was born in the same year as the Western Electrician, 1887, the Chicago Edison Company has passed out of existence, having been combined with the Commonwealth Electric Company on September 16, 1907, to form the Commonwealth Edison Company, which is now conducting the central-station business of Chicago, and will undoubtedly sustain this relation to the community for many years to come. While the change is one of name rather than of policy or administration, for the two companies have been owned by the same interests and closely connected for several years, yet the event is of much interest, for the Chicago Edison Company has veritably passed away, and during its span of life, a score of years merely, the central-station business of supplying electric light and power has developed to an amazing extent, and the Chicago Edison Company has been widely recognized as second to none for progressiveness in adopting new ideas, for enterprise in securing new business and for extending the sphere of central-station influence, for the excellence of its administrative methods, for broad-minded liberality in dealing with consumer and the public and for practical success as a business proposition. Mr. Samuel Insull has been president of the Chicago Edison Company for fourteen years and of the Commonwealth Electric Company for a somewhat shorter period, and it is but just to say that to him and to the staff of able assistants by which he is surrounded the conspicuous success of these companies is due.

Organized in 1887 to supply electric light and power, the Chicago Edison Company supplied the central portion of the city. It was a licensee company of the Edison Electric Light Company, and its first power house, abandoned a number of years ago as a generating station, was at 139 Adams Street, now the site of the Edison office building, which, although comparatively new, is already too small for the many departments of a great central-station service, several of which are sheltered elsewhere. In 1893 the company absorbed its principal competitor, the Chicago Arc Light and Power Company, and soon thereafter built the Harrison Street plant, famous at the time, but now completely overshadowed by the gigantic Fisk Street station of the Commonwealth company. On March 31, 1907, the company operated three generating stations and 22 sub-stations, and its connected load was equivalent to 1,924,886 16-candlepower lamps. Its outstanding capital stock was $13,614,115 and its bond issue $5,500,000. For 18 years the company had paid eight per cent. dividends.

In 1897 and 1898 various electric-lighting concerns doing business outside of the central district of the city were purchased by interests friendly to the Chicago Edison Company, and in May, 1898, these properties were consolidated in the Commonwealth Electric Company, thereby placing practically the entire central-station business of Chicago under one management. This company's franchise, granted by the City Council, runs for 50 years and covers every part of the city of Chicago. The company operated two generating stations and 10 sub-stations. One of the former is the great Fisk Street plant, the first central station in this country and probably in the world to install steam turbines and having a present maximum capacity of 110,000 horsepower and planned for twice that capacity ultimately. On March 31, 1907, this company's connected load (exclusive of the large amount of power supplied to street railways) was the equivalent of 1,313,852 16-candlepower lamps. The capital stock of the company was $10,000,000 and its bond issue $8,500,000.

Thus the consolidated company will possess five generating stations and 32 sub-stations. Its connected load (exclusive of railway power business) is more than the equivalent of 3,238,738 16-candlepower lamps. Its capital stock is $30,000,000. It is this great electric-light and power business, created within twenty years, which the new Commonwealth Edison Company is called upon to administer. We wish it all success, not merely because it is an important electrical enterprise, but because, in a wider outlook, its management, broad-minded and public-spirited as past experience leads one to expect, means so much, in this day and age, in the development and improvement of the great city with which its fortunes are bound up.

WHILE the electrical industry in this country is in a fairly satisfactory condition, barring some uncertainty owing to the price of copper, the state of affairs in England is not reassuring. The London correspondent of the Western Electrician takes a rather gloomy view of the situation, as will be seen by the following, written on September 6th:

"The close of the parliamentary session of 1907 causes one to reflect upon the very unsatisfactory result, from the point of view of the electrical industry over here. No new bills have been passed which will result in any considerable works being constructed, so that the manufacturing industry will not benefit to any extent worth mentioning. The rejection of the London County Council electric power bill has been a direct loss of several million pounds in orders for electrical machinery, and what this would mean at the present juncture in reviving the industry does not need much thought. None of the other private bills has anything more than a local interest, and all around it is generally conceded that the session of 1907 has been the dullest on record.

"No crumb of comfort has been offered, even, in an attempt at revising the general legislation relating to the electrical industry. As I have previously pointed out, we are now working under electric-lighting acts 25 years old and tramway acts still more ancient. In fact, the latter were passed before the days of mechanical tramways in any form. Year after year passes, and although the government is urged to make revisions to bring this class of legislation up to date, no movement is made. Meanwhile the stagnation in the industry becomes more acute; yet it seems hopeless to expect any reform."

This is rather depressing. But may it not be that the electrical men of England rely rather too much on government and not enough on their own initiative? Perhaps a Co-operative Electrical Development Association for Great Britain would be a good thing. Legislative reforms are undoubtedly badly needed; but it would be a pretty shrewd guess that even under existing powers a great deal of additional electrical apparatus could be put out by an intelligent, persistent campaign of solicitation, advertising and education addressed to the general public. In this country it is felt that only a beginning has been made in the matter of supplying the nation's electrical needs, and probably this is the case in the United Kingdom also.

TELEGRAPH POLES, or poles supporting electric wires of any sort, have usually been looked upon as necessary evils—something to be tolerated because very useful but nevertheless to be candidly regarded as adding nothing to the beauty of the landscape. But there is, it appears, another side to the question. A writer in the London Daily Telegraph, quoted in the English Electrical Review, defends the poles in what is described as an eloquent essay on the artistic effect of a telegraph line in a rural landscape. He notes the romance of the thrumming wires and the utility of the line as a guide in a strange land, and continues: "A man who cannot see the nobility of the long line of tall giants crossing the bare shoulder of a distant hill has little of the artist and nothing of the poet in his constitution. Silhouetted against a sunset, they have their own especial value, and modern artists have not failed to see their beauty in less obtrusive places. They form a black thread in the embroidery of Nature, and only those who have studied embroidery know of what infinite use that black line is in art. It must be used sparingly, as sparingly as gold, but its effect is as noble, and far more refined. . . . No artist, except your early Victorian dilettante, would dare to leave the poles out. I have known men wilfully and with vast wisdom aforethought put them in where they never were."

This is in refreshing and welcome if rather unexpected contrast to the contumely which has been heaped upon the humble telegraph pole. Unless this man is poking fun at us electrical folks, we shall quote him in triumph when overhead construction is next assailed as unsightly.

CANADIAN ELECTRICAL ASSOCIATION.

As previously announced, the seventeenth annual convention of the Canadian Electrical Association took place in Montreal, Wednesday, Thursday and Friday, September 11th, 12th and 13th. At the beginning it gave evidence of being a pronounced success, and when the proceedings were fully under way there was no room whatever for doubt. The total number registered was 261 in addition to a large number of ladies.

The week attracted to Montreal electricians from all parts of Canada and many from the United States, as conventions were held by the Canadian Electrical Association, Canadian Street Railway Association and the Maritime Electrical Association. The electrical exhibition was also a great attraction, being pronounced by visitors from the United States to be the equal for its size of anything ever attempted in that country. For the success of this exhibition too much credit cannot be given Mr. R. S. Kelsch, the vice-president and managing director, who gave his personal attention to the undertaking in a manner to insure the best possible results.

To revert to the Electrical Association convention, the chair was taken promptly at 10:30 on Wednesday by the president, Mr. R. G. Black. Unnecessary preliminaries were dispensed with, and, after a few brief remarks and the reading of the minutes of the last convention, the president delivered his address, which contained much food for thought. He emphasized the fact that at certain hours of each day every plant was taxed to its utmost capacity—the point known as the peak. The difficulty was that every plant had to be equipped to supply peak business, while during the rest of the day a large proportion of the plant was practically idle. With this factor considered, and the continually rising price of labor and almost every other element that entered into the commercial use of electrical energy, Mr. Black pointed out that the problem of earning dividends was ever growing harder instead of easier. As a way out of the difficulty he suggested the extension of the use of electric energy for electric heating and cooking and other household purposes. The result of the address was to impress the members with the fact, that, far from any general reduction in prices of electric power or light being within sight, the producers of electric energy must seek to extend their markets in order to make a reasonable profit at present rates.

The president then submitted the constitution of the association as revised by the managing committee, which was approved by the convention. The important feature in the new constitution is the formation of what might be termed a lighting section, following somewhat the plans of the National Electric Light Association. The new clauses covering membership are as follows:

Membership.—(a) The association shall consist of Honorary and Active members.

(b) Honorary members shall be any gentlemen who shall be elected as such by a two-thirds vote of Active members present at any sitting of any annual convention.

(c) Active members shall be owners, part owners, or directors, managers, superintendents, engineers or other employes of electrical undertakings, electrical engineers, students in electrical engineering, gentlemen engaged in electrical education or in the manufacture or sale of electrical apparatus or supplies, electrical contractors, and all other gentlemen whom the managing committee shall consider eligible as members.

(d) All Active members who are owners, part owners, managers, superintendents, engineers or other employes of electrical undertakings for the sale of electric light or power, owned by individuals or joint stock companies, who shall produce certificates from the owners or managers thereof that said persons are authorized to represent them, shall constitute the executive section of the association.

(e) Active members who do not form part of the executive section shall not be eligible to office in this association, and shall not be permitted to attend meetings of the executive session. This section does not apply to the offices of secretary and treasurer.

The report of the secretary-treasurer, Mr. T. S. Young, showed a balance in the treasury on May 31st last, the close of the association year, of $1,120. The membership at that date was 302. This, the report states, would appear to be a decrease as compared with the previous year, and a few words of explanation may be permitted. Until last year no steps were taken by the executive to remove from the membership roll the names of persons, who, although neglecting to send in their written resignations as required by the constitution, evidently did not consider themselves bona fide members of the association. The adoption of a less generous policy by the executive resulted in the removal of a large number of names from the register. That the association has made substantial progress, however, is shown by the fact that 62 new members joined during the year, and 28 members from May 31st to August 30th, or a total of 90 new members since the last convention. The present membership is 320. The report pointed out that the use of electric light in Canada has increased over 100 per cent. in five years.

The first of a varied programme of papers was then reached. It was entitled "Electric Heating and Cooking Devices," the author, Mr. A. B. Lambe, of the Canadian General Electric Company, delivering it extempore, in a very acceptable manner and exhibiting numerous devices calculated to increase the revenue of the central station. The advantages to the consumer, he argued, were such that though the cost of operation might be slightly larger than by the old system, the results were such as would insure their use, once the people realized the advantages. The results to the electric companies would be that, during the day hours, when the electric light was little used, the power could be applied to other purposes, and thus the general demand would be much more nearly equalized than at present.

R. S. KELSCH,
President of the Canadian Electrical Association.

At the afternoon session two papers were read, as follows: "Trials of the Operating Man," by Mr. M. A. Sammett of the Montreal Light, Heat and Power Company, and "Three-wire Generators," by Mr. B. T. McCormick, of Allis-Chalmers-Bullock. Mr. Sammett's paper is printed in another part of this issue.

In his paper Mr. McCormick said that three-wire generators can be operated in multiple with one another, or in multiple with two-wire generators, and it is often convenient to operate a 120-volt machine in multiple across one side of 240-volt three-wire systems, to maintain a better balance, in case that side is unloaded. The two-wire generator with rotating direct-current balancers, as a competitor of the three-wire generator, possesses a great many good points, but the cheapness, simplicity and compactness of the three-wire generator are points not to be overlooked in deciding on a three-wire system.

In the evening the members visited the electrical exhibition as the guests of the management.

Thursday's Session.

A paper on "High-tension Insulators from an Engineering and Commercial Standpoint," by Mr. C. E. Delafield of the Ohio Brass Company, Mansfield, Ohio, was the first on the programme for Thursday. As an illustration of the possibilities of delivering power at 150,000 volts, Mr. Delafield said it would be possibile to deliver the power generated at Niagara Falls economically to Boston, New York or Philadelphia, and, apparently, the principal hindrance to this consummation at the present time is in the fact that there is not on the market what might be termed a successful insulator for this enormous voltage, although the merits of a number of different types of insulators are at the present time being advocated for this purpose. An ideal insulator for all conditions of high-voltage stress should be one that would take care of climatic conditions, such as fogs, dust deposits, salt spray, etc., and should have as few still-air spaces as possible.

What might be termed a lamp session was next taken up. A. B. Fleming of the Canadian Westinghouse Company presenting a paper on "The Value of the Nernst Lamp to the Central Station," and J. M. Robertson of the Montreal Light Heat and Power Company one on "Incandescent Lamps." Mr. Robertson presented a short description of several types of lamps which are at present on the market, giving an outline of their characteristics and limitations, and comparing them as comparative new comers in the electrical field with the older and more familiar carbon lamp. The weakness of the carbon-filament lamp, he said, was the fact that its operating temperature must be comparatively low, not more than about 1,800 F. The best commercial efficiency which this lamp has attained is 3.1 watts per candle, but by far the larger part of the lighting business is done with lamps which consume 3.5 watts per candle or more.

The metallized filament lamp was the result of an effort to produce a carbon filament which could be operated at a higher temperature. Mr. Robertson's paper was illustrated, showing curves of resistance of the carbon, metallized, tantalum and tungsten filaments. The metallized filament, on account of its reduced diameter, as well as the increased brittleness of the material, is more fragile than the carbon filament, and consequently metallized lamps require greater care in packing and handling than the carbon type. The best efficiency of the metallized-filament lamp is about 2.5 watts per candle, and the life of the average lamp under good conditions of regulation is about 500 hours.

The process of manufacturing the tantalum lamp is similar to that of the carbon lamp. On account of the great length of filament required to obtain the necessary resistance, it has heretofore been impossible to make lamps of very high voltage or very low candlepower. At present lamps are obtainable in 20 and 40-candlepower units at voltages between 100 and 130 volts. At present the best efficiency of the larger lamps is about two watts per candle, with a life of about 800 to 900 hours. Recently the lamp has been improved to such a point that it may be used on alternating currents at the same efficiency as on direct current, though with a reduced life. Under ordinary conditions and on 60 cycles the life should average about 60 per cent. of the life on direct-current circuits under the same conditions.

The tungsten lamp, one of the latest productions to be placed on the market, follows in form the lines of the familiar carbon lamp. Its usefulness at present seems to be confined entirely to street lighting, where the conditions most nearly suit its peculiar properties. The efficiency of the lamp is $1\frac{1}{3}$ watts per candle, and the life on well-regulated circuits about 1,000 hours.

Curves were shown of comparisons between the results which may be obtained from the perfected carbon lamp and the higher efficiency type. The newer lamps show much better maintenance of initial candlepower than does the carbon lamp. In respect to relative costs of operating, it is shown that at one cent per kilowatt-hour the carbon lamp cannot compete with the metallized filament, which in turn must yield to the tantalum at two cents, and it in turn to the tungsten at four cents.

In conclusion, Mr. Robertson stated that while the position of the high-efficiency lamp is at the present time somewhat indeterminate, there seems no reason to doubt that within a reasonably short time lamps having an efficiency of one to two watts per candle will be obtainable in standard units and voltages, and the introduction of these lamps bids fair to be a somewhat disturbing factor in the electric-lighting business. Although the amount of light required by the ordinary customer is not measured by him in fixed units of illumination, but in dollars per month of cost, and he will usually respond to a reduction in price by an increase in his use until the new cost is about equal to the former bill, it is doubtful if this law will hold over such a wide cost ratio as three to one.

A lively discussion followed the reading of the two papers mentioned. The president referred to the helion lamp as one which was destined, according to the claims of the manufacturers, to work a revolution in the lighting business, but the opinion of the meeting seemed to be that this lamp was yet in the experimental stage. It was also argued that there would be plenty of time for the electrical industry to adjust itself to new conditions, and that in creating a market for these new lamps the general use of electric light would be encouraged and the business expand accordingly.

At the afternoon session a very interesting paper on "Frazil and Anchor Ice" was read by John Murphy, electrical engineer of the Department of Railways and Canals, Ottawa. Mr. Murphy went in detail into the subject of ice as a source of great difficulty to hydraulic plants. His simple, but effective remedies, were listened to with great interest. Further reference to the paper will be made in a future issue.

An illustrated address on "Methods of Illumination" was given by V. R. Lansingh, engineer and general manager of the Holophane Company, New York.

Election of Officers.

The election of officers took place at the executive session at 4:30 p. m. on Thursday, with the following result:

President—R. S. Kelsch, consulting engineer, Montreal.

First Vice-president—W. N. Ryerson, superintendent Ontario Power Company, Niagara Falls, Ont.

Second Vice-president—R. M. Wilson, Montreal Light, Heat and Power Company.

Secretary-treasurer—T. S. Young, Confederation Life Building, Toronto.

Managing Committee—A. A. Dion, superintendent Ottawa Electric Company, Ottawa, Ont.; B. F. Reesor, managing director Georgian Bay Power Company, Lindsay, Ont.; Charles B. Hunt, manager London Electric Company, London, Ont.; J. M. Robertson, Montreal Light, Heat and Power Company, Montreal, Que.; J. J. Wright, manager Toronto Electric Light Company, Toronto; W. Williams, Gas and Electric Light Company, Sarnia, Ont.; H. O. Fisk, Peterboro Electric Light Company, Peterboro; J. W. Purcell, Hiram Walker & Sons, Walkerville; R. G. Black, general superintendent Toronto Electric Light Company; J. G. Glassco, Hamilton Cataract Power Company, Hamilton.

R. S. Kelsch, the new president of the association, is prominent among the electrical men of Canada. He has been engaged in electrical engineering work for the last 20 years, during the first 10 in Chicago, in charge of large electrical properties in that city, and since April, 1897, in Montreal. He erected and operated the plant of the Lachine Rapids Hydraulic and Land Company, remaining in charge of same in the capacity of general superintendent and engineer until the Lachine company was absorbed by the Montreal Light, Heat and Power Company in 1903. He then established an office as consulting electrical engineer and was immediately retained by the Montreal Light, Heat and Power Company to consolidate the two plants, one system being three-phase 60-cycle and the other two-phase 66-cycle. He still acts as consulting engineer for the company in addition to an extensive outside practice. Mr. Kelsch is vice-president and managing director of the Canadian Electrical Exhibition Company.

Closing Session.

A morning session on Friday concluded the business meetings. Mr. G. Percy Cole, of Allis-Chalmers-Bullock, Ltd., read an interesting paper on "Modern Lightning Transformers," which was followed by an equally interesting contribution on "The Responsibility of Electric Company for Accidents," by Mr. George H. Montgomery, solicitor for the Montreal Light, Heat and Power Company. Both of these papers were fully discussed.

The Question Box, edited by Mr. A. A. Dion, was then taken up, but owing to insufficient time, it was necessary to confine the discussion to a limited number of questions.

The question of the next place of meeting was left with the incoming managing committee, the general opinion being, however, that it should be held in the West.

The entertainment programme included a theater party at His Majesty's Theater on Thursday evening, when the "Gingerbread Man" was produced. Owing to the inclement weather, it was necessary to cancel the tea, which was to have been provided for the ladies at the Royal St. Lawrence Yacht Club. On Friday afternoon special cars carried a number of the party to the race track, while the evening was devoted to a visit at Dominion Park.

Standard Symbols for Wiring Plans.

In the Western Electrician of September 29, 1906, was printed the complete set of standard symbols for wiring, which have now been adopted, with revisions here noted, by the National Electrical Contractors' Association of the United States, the American Institute of Architects of the United States, the supervising architect's office of the United States, quartermaster general's office of United States army, several municipal departments, many technical institutions, prominent architects and engineers, and numerous individuals.

Since the first edition was printed there has been a slight change in the symbols for center and bracket outlets, symbols for indicating "gas only" outlets having been added. The second and fourth lines contain the changes made. Otherwise the symbols are the same as the list printed in the issue mentioned. The suggestions in connection with the standard symbols are changed to read as follows:

SUGGESTIONS IN CONNECTION WITH STANDARD SYMBOLS FOR WIRING PLANS.

It is important that ample space be allowed for the installation of mains, feeders, branches and distribution panels.

It is desirable that a key to the symbols used accompany all plans.

If mains, feeders, branches and distribution panels are shown on the plans, it is desirable that they be designated by letters or numbers.

Height of Center of Wall Outlets (unless otherwise specified):

Living rooms .... [illegible] ft. 6 ins.
Chambers .... [illegible] ft. 0 ins.
Offices .... 6 ft. 0 ins.
Corridors .... 6 ft. 3 ins.
Height of Switches (unless otherwise specified) ...... 4 ft. 0 ins.

In presenting the revised symbols the National Electrical Contractors' Association says:

"We are informed that the use of these symbols has become quite universal, and are confident that with the recent endorsement of the American Institute of Architects and the government departments preparing wiring plans, the success of the symbols is assured. However, to make the standardization complete, it is necessary that everybody making wiring plans make use of the symbols. We fully recognize that the adoption of the system will entail some inconvenience at first, and individual systems will have to be sacrificed, but we believe that you will agree with us that the benefit obtained by the standardization is worth the sacrifice and trouble."

Additional copies may be had of the secretary of the National Electrical Contractors' Association, Utica, N. Y., or secretary of the American Institute of Architects, the Octagon, Washington, D. C., at small cost.

Copper Prices Declining.

A New York dispatch to the Chicago Record-Herald, dated September 12th, says:

"A crisis in the copper situation, due to a deadlock between the producer and the consumer, has resulted in a tremendous overproduction of the metal, and the Amalgamated Copper Company, the largest producer of copper in this country, will soon shut down its mines in and about Butte, Mont."

"The Amalgamated company, along with other copper companies, has been piling up a large surplus of metal for several months, and it is authoritatively stated that there is now a surplus of 250,000,000 pounds of refined copper in the United States.

"The present situation has developed from the seeming inability of the producer and consumer to reach a price for the metal that would prove satisfactory. The selling price of copper has been steadily reduced in the copper markets of the world, but the consumer has steadfastly declined to purchase except when needs were pressing. The official price for copper has been lowered from 25 cents to 18 cents a pound by the United Metals Selling Company. Copper producers on the metal exchange, in their efforts to tempt the buyer, have gradually cut the price to 15¾ cents for electrolytic, which figure was reached today. As a consequence of this acute copper situation, copper stocks have accumulated rapidly. The production of refined copper in September, it was stated today, will be 6,000,000 pounds less than last month. There were reports in the financial district this afternoon that certain banks have declined to carry any more copper metal in their loans."

Central Electric Railway Meeting.

The first regular meeting of the Central Electric Railway Association, after the summer vacation, will be held in Columbus, Ohio, September 26th. In addition to the report of the standardization committee, and discussion thereof, two papers will be read—one on the "Single-phase System of Operating Electric Cars," by George D. Nichol, electrical engineer of the Indianapolis and Cincinnati Traction Company, and the other on "The Twelve-hundred Volt Direct-current System of Operating Electric Cars," author to be announced. A good attendance is anticipated. C. C. Reynolds, superintendent of the Terre Haute, Indianapolis and Eastern Traction Company, will run a through car from Indianapolis to Columbus, leaving the Traction Terminal Station at 10 o'clock a. m., September 25th. Mr. Reynolds has invited a number of traction officials of Kentucky, Illinois and Michigan to go to the Columbus convention with him on the special train.

Distinguished Germans Study American Methods.

The commission composed of distinguished Germans sent by the German government to inspect electric railways and transmission lines in this country is finding much of interest. Last week members of the party were in Indianapolis inspecting the network of interurban electric railways centering in that city. The party was especially interested in the single-phase system of the Indianapolis and Cincinnati Traction Company and the power house at Rushville; also the new 1,200-volt direct-current railway and power house of the Indianapolis and Louisville Traction Company.

Arriving in New York from Europe the commission studied the power houses and electrical equipments of the New York Central, the Long Island and the New Haven roads and the plants of the Interborough Rapid Transit Company. Officials of these companies and of the General Electric Company entertained the party. At Boston the visitors were entertained by C. B. Davis of the General Electric Company, President Bancroft of the Boston Elevated, President Sullivan of the Massachusetts Street Railways, and C. L. Edgar of the Edison Illuminating Company. Albany was visited next.

At Schenectady the party was shown through the various departments of the works and entertained at the Mohawk Club. The reception committee consisted of Vice-president E. W. Rice, Jr., Vice-president J. R. Lovejoy, General Manager G. E. Emmons, General Superintendent E. B. Raymond, William S. Hules, M. A. Oudin, W. B. Potter, D. B. Rushmore, J. E. Noeggerath and Eugene Eichel.

Among those in the German party are Geheimrath Willfeld of the Prussian government, P. Pforr of the railway department of the Allgemeine Electricitaets Gesellschaft, William Shuly of Berlin; Prof. Reichel of the Royal Technical University, Berlin; Director Frischmut of the Siemens-Schukert Works, Director A. Flies of the A. E. G., and Director Jordan of the Lahmeyer Works.

Consolidation of Chicago Edison Company and Commonwealth Electric Company.

As foreshadowed in the Western Electrician of July 20th last, when the details of the plan were set forth, the Chicago Edison Company and the Commonwealth Electric Company were formally consolidated on September 16, 1907. Meetings of the stockholders of the two were held on that day to vote upon the question of consolidating the companies as proposed by the respective boards of directors. All the stock of the Commonwealth company and over 95 per cent. of the stock of the Edison company was represented at the respective meetings. The vote was unanimous for consolidation in each meeting.

One change was made in the plan of consolidation as heretofore announced, it having been found possible to avoid the issuance of trustees' certificates in exchange for Commonwealth company stock and to issue at once the regular stock certificates of the consolidated company therefor. A slight change was also made in respect to the subscriptions for the additional Edison stock recently subscribed for and in favor of subscription receipt holders by permitting these holders to pay in advance the deferred subscription installments and to obtain regular stock certificates of the consolidated company on account of their subscriptions when fully paid.

Circulars giving information to stockholders are to be sent out by the consolidated company in a few days.

As previously announced, the name of the new company is the Commonwealth Edison Company. Headquarters will be, as heretofore, in the Edison Building at 139 Adams Street. Mr. Samuel Insull, president, and the other officers of the two old companies (which had identical lists of officers) will remain in charge of the new company. The Commonwealth Edison Company will have capital stock of $30,000,000 and will operate under the Commonwealth franchise, which covers the territory of the city of Chicago and has still nearly 40 years to run.

Telephonic Marine Signaling System in the St. Lawrence.

Something unique in navigation aids—the telephonic marine-signal system—has just been established in the St. Lawrence River between Quebec and Montreal. This service is to provide for a system of communication between ship and shore, and will enable owners and agents to know of the progress of ships between these two great Canadian ports, and will also keep vessel captains fully acquainted with the condition of affairs in the river, enabling them to avoid any unusual or unexpected danger. At present, or until this new system is working, a vessel is outside of communication once it leaves Montreal or Quebec until it reaches either port. At some seasons of the year smoke from bush fires is blown out and covers the river like a dense fog. There was some difficulty experienced in arranging for a service of this description, and with no previous experience by which they might be guided the engineers were obliged to originate a service. Eleven stations have been erected along the river. At each station a tall mast has been set up having a cross spar 25 feet in length. From this cross spar signals will be displayed. A set of flag signals has been prepared for day use and an arrangement of lights for night, and all information desired will be communicated by telephone from station to station.

ELEMENTS OF ELECTRICAL ENGINEERING.

By Geo. R. Metcalfe.

XXXIV.—Electric Railways.

Direct-current Railway Motors.

Direct-current railway motors are always series wound for a pressure of from 500 to 600 volts, and are of the four-pole type. A series winding is absolutely essential for railway motors, as the speed is necessarily variable and a very high torque is required in starting a car from rest and accelerating it up to normal running speed. Most all railway motors are very similar in general outline and appearance, due to the fact that the restricted space which they occupy beneath the car limits the size and shape of the motor. Most city and suburban cars, as well as the majority of interurban cars, are equipped with wheels 33 inches in diameter, and the standard gauge of the tracks is 4 feet 8½ inches. Allowing for the necessary clearances between the motor and the ground below, and the car flooring above, the height of the motor is thus limited to a little over two feet, while the length between the wheel hubs in which it must be placed is less than four feet, and, except where larger-sized car wheels are used, the design of the motor must conform to these limitations.

The usual type of car motor is therefore, roughly speaking, of rectangular shape, with rounded corners and with four poles projecting radially inward at angles of 45 degrees from the horizontal. Most of these motors are split horizontally through the center, forming two castings, which are hinged together and arranged so that the bottom half may be opened downward or the top half opened upward for the purposes of inspection and repair. In this type of motor two of the poles and field coils are built into the top half of the motor, and the other two in the lower half.

Another type of motor which is used to some extent is known as the box type, in which the frame is cast in one solid piece. The bearing housings of these motors are made of large circular castings slightly larger in diameter than the surface of the armature and bolted to the frame of the motor. By removing these bearing housings the armature may be drawn out sidewise from the fields.

The choice between the downward-opening and the upward-opening field frames or the box-type frames depends entirely upon the equipment of the railway repair shops. If the repair and inspection work is done in pits under the car floor, the downward-opening fields are necessary. Where overhead cranes are available for lifting the car body off from the trucks, the upward-opening fields are preferable. With the box-type frame it is necessary to remove the motor from the truck before the armature can be removed.

Another feature which is characteristic of all car motors is the pair of heavy lugs extending out from the back of the motor which carry the car-axle bearings. As car wheels are pressed onto the axle in a hydraulic press and therefore cannot be readily removed, the axle bearings are split bearings, so that the motor can be removed from the axle by means of taking off the bearing caps. A gear wheel which is generally made in two halves is keyed and bolted upon the car axle, and the armature shaft carries a pinion on one end of it which meshes into the axle gear. The front end of the motor is supported from some part of the truck frame, and this support, instead of being rigid, is by means of heavy springs. This spring support is necessary to avoid violent shocks in starting, and it helps to prolong the life of the pinion and gear.

The general scheme of supporting a street-railway motor is shown in the accompanying diagram, from which it will be seen that the motor is free to revolve through a very small angle about the car axle, the amount being limited by the tension of the supporting springs. When the car is started suddenly an enormous strain is thrown upon the teeth of the pinion and gear. This force, instead of acting like a blow, as it would in the case of rigid suspension, is cushioned by the suspension springs.

Street-railway motors are built in various sizes ranging from about 40 to 200 horsepower. A large number of sizes are called for because street cars are built of various lengths and weights; the grades to be overcome vary widely, and the schedule speeds and number of stops differ on almost every road. It is, however, impossible to judge the fitness of any railway motor for any particular service from its horsepower capacity alone. It is in reality the rise of temperature which the motor will stand which determines its capacity, and with every street railway motor a curve sheet is always furnished, giving the characteristics of the motor, from which its performance under any conditions of service may be judged.

Rapid acceleration is one of the chief requirements for street cars making frequent stops. Acceleration in speed takes place from the moment a car starts until it attains its normal speed, and where stops are frequent, and the schedule speed is high, it is very important to save time by means of rapid acceleration; that is, by passing from rest to full speed as quickly as possible. This condition requires a starting torque of the motor many times in excess of its full-load torque, so that a motor which might be able to maintain a given schedule speed with but few stops would be entirely insufficient to maintain the same speed if the stops were numerous. This condition is mentioned merely to show the necessity of judging a railway motor by its characteristic curves rather than by its nominal horsepower rating.

Owing to the location of street-railway motors close to the surface of the ground, where they are exposed to considerable dust, mud and water, it is necessary that they be built waterproof and practically dustproof. As frequent inspections of the commutator and brushes are advisable, handholes

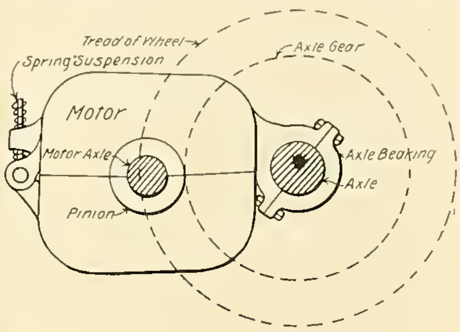


DIAGRAM SHOWING MOUNTING OF RAILWAY MOTOR.

for this purpose are made in the frame of the motor, and these handholes are provided with tight-fitting covers. Gear cases are also used to enclose completely the gear and pinion, and these cases permit the gears to be run in grease, which greatly reduces the wear on the teeth. Either oil or grease lubrication may be used on railway motors, but oil is generally preferred as being most efficient as well as more cleanly.

One, two or four motors may be used on street-railway cars, depending upon the size and weight of the car and the schedule speed at which it is operated. Street-railway cars are now always mounted upon trucks. Short cars may be placed on a single truck, while long ones require double trucks; that is to say, one truck near each end of the car. On very short light-weight single-truck cars a single motor may be used, but this is not considered good practice, and is rarely done, as only one pair of wheels is thus utilized for traction. If one 80-horsepower motor is sufficient to operate the car at schedule speed, it would be much better practice to use two 40-horsepower motors, placing one on each axle, so that both pairs of wheels could be used for traction; further, in the event of accident to one of the motors, the remaining one could be utilized for returning the car to the barns. On very long double-truck high-speed cars, four motor equipments are commonly used, and in some cases as much as four 150-horsepower motors per car have been employed. Two motor equipments are also frequently used on double-truck cars, in which case one axle of each truck is equipped with a motor.

Very recently there has been introduced a new feature in the design of street-railway motors which will undoubtedly be widely adopted in the future. This consists of the addition of auxiliary poles known as commutating poles or interpoles, whose function is to produce sparkless commutation. The theory of the auxiliary poles is as follows. The four auxiliary poles are very small in comparison to the poles producing the magnetic field, and upon these auxiliary poles there are placed coils of wire which are connected in series with the armature circuit and which therefore carry the full current taken by the motor at any time. In addition to the magnetic field generated in the poles of the motor, there is also a magnetic field due to the winding of the armature upon its core, and thus field of force from the armature current decreases, its reaction on the motor fields so that the point of commutation at some speeds is shifted several degrees from the normal neutral point.

The auxiliary poles are wound so as to produce a field which just counteracts the effect of the armature reaction upon the main motor field, and this prevents any shifting of the neutral point, and the point of commutation is therefore always the same whatever the speed of the motor. The armature reaction is greatest when the armature is carrying its maximum current, at which time the corrective influence of the auxiliary poles is also greatest, as the entire current of the motor is carried by the auxiliary pole windings. As the armature current decreases, its reaction on the fields also decreases, and the field of the auxiliary poles is correspondingly decreased.

As it is entirely impracticable to vary the position of the brushes on a street-railway motor, it is of great importance to have a fixed point of commutation. The commutator of a street-railway motor may be considered one of its weakest points, as it requires more care and attention than any other part of the equipment, and is also the part of the machine that attains the highest temperature. By providing a means of sparkless commutation the life of both commutator and brushes is greatly increased, and much of the work of repairing and turning down commutators is consequently eliminated.

The armature winding of street-railway motors is the series winding, so there is always an odd number of bars on the commutator. With this winding no cross connections are used, and only two brushes are required, which are placed 90 degrees apart. The number of slots in the armature core is usually much less than the number of coils, so that two or three coils are placed in one slot. If two coils per slot are used there will be one more coil than the number of commutator bars, in which case the ends of one cell are cut off and it always remains a "dead" coil. Where three coils per slot are used no dead coil is required. The armature coils on modern motors are wound on forms, and the wires in each coil are thoroughly shellacked and taped after being formed. These individual coils are afterward assembled on the armature core, the slots of which are previously lined with thoroughly insulated material. The coils are then secured in place by band wires wrapped around the surface of the armature and thoroughly soldered together. These bands are wound in recesses turned in the armature teeth, so that the band wires do not project above the face of the armature.

[To be continued.]

Note.—This series of articles, intended to survey, briefly, the whole field of applied electricity for light, power and heat, was begun in the Western Electrician of February 2, 1907.

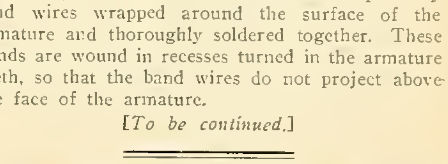
QUESTIONS AND ANSWERS.

Reading a Meter.

W. K. W., Chicago: Please give me some instructions about reading an electric meter. My meter has a dial numbered similarly to that in the sketch.

Answer.

The first circle, marked "1's," at the right-hand side of the dial, reads one kilowatt-hour for each division, or 10 kilowatt-hours for one complete



revolution of the hand. The second circle from the right, marked "10's," reads 10 kilowatt-hours for each division, or 100 kilowatt-hours for a complete revolution of the hand, and so on. It should be noted that the direction of numbering is reversed for adjacent dials on account of the multiplying gear train mechanism. When the hand is between two divisions, take the lesser as the reading. The dials shown read a total of 2,852 kilowatt-hours, not 3,852 as might appear, because the 1,000's hand cannot reach 3 until the next lower hand has completed its revolution to zero.

Trials of the Operating Man.[1]

By M. A. Sammett.

The difficulties in operating alternating-current systems may be subdivided into two main groups:

(1) Difficulties beyond control.

(2) Controllable difficulties.

Under the difficulties beyond control are to be included those met with every summer. Lightning still engages the attention of the best men of the engineering profession. Various types of arresters were developed, all more or less effective in lessening the disastrous results of lightning, yet none providing perfect protection. Numerous methods to protect the transmission line were introduced with a certain degree of success, but the annual visitor still does its work of destruction.

We shall not enter into the discussion of the existing protective apparatus. The subject has for some years past been most prominent in convention discussions.

The subject matter that will be considered is that of troubles that are controllable; trials that may be overcome by the operating man, provided he were given a plant of a certain amount of flexibility, and that he were provided with information which naturally belongs to him.

Taking up the various items, we will consider first the questions of liberality in the design of the plant. By liberality I do not mean the use of apparatus in capacities much in excess of the requirements. There is no necessity of installing units which will carry continuously 50 per cent. overload at moderate temperatures. This would mean a much larger installation, and naturally a more expensive one. What is essential is that the apparatus should be capable, under emergency conditions, to carry 25 per cent. or 50 per cent. overload for a specified interval. Higher temperatures will be allowed under these unusual conditions as long as the temperatures are not detrimental to the life of the machine.

Second in importance, under emergency conditions, will come regulation. What could be suffered under emergency conditions may not be tolerated under normally operating conditions, yet provision should be made for the service to be maintained with a fair degree of voltage regulation. Bearing these in mind, the design of the power house, sub-stations and the transmission circuits must be such as to provide for the temporary disability of a part of the plant and be in a position, at the same time, to handle the load without any serious interruption.

Under the present conditions of increase of raw material, and consequently of the finished product, the problem of maximum permissible units to be most advantageous under given conditions of operation is becoming prominent in power-house economy. This will naturally result in adopting units of larger capacity and will involve almost invariably transforming and regulating apparatus of artificial cooling. All these will tend to complicate matters for the operating man. The auxiliaries used in artificial cooling may at times become inoperative, and then it is for the operating engineer to be equal to the occasion and display his knowledge of the plant entrusted to him, executing his work with a degree of certainty and a full knowledge of existing conditions.

The operating man should know the behavior of his machines. With this information the operating engineer can handle his plant in an intelligent manner, and in emergency cases will be able to plan his work, being fully aware of the time at his disposal for safe operation of the machines under overload conditions, or under conditions of no artificial cooling.

It is evident that machines rated at a given capacity when operated under overload conditions will have a higher temperature. It takes a certain length of time before the dangerous temperature is reached, and it is essential that the curve of temperatures at overloads be known and should be used as a gauge when emergency cases arise.

In modern plants of liberal design, where provision of continuity of service is given due consideration, at least two lines should be constructed, and the design of these circuits should be such as to enable the carrying of the entire load on one circuit. The operating man, in such a case, will be confronted with the difficulty of low voltages on the receiving end. The increased load transmitted over one circuit would result in an increased drop in transmission. The provision made in the design of the line would only partially help matters, and to improve the receiving voltage it is necessary to increase the voltage of the generator. How far would it be permissible to increase this voltage? Reference to Fig. 1 will show that the increased voltage means increased iron loss in the armature laminations, consequently higher temperatures. It would also mean a larger field current, tending to increase the temperature of the apparatus still further. A higher impressed voltage on the step-up transformers will mean also a greater iron loss, resulting in higher temperatures.

1. Paper read at the Montreal convention of the Canadian Electrical Association, September 11, 1907. The author is in the testing department of the Montreal Light, Heat and Power Company.

Is it safe to increase the voltage of the machine by 10 or 15 per cent. to compensate for increased drop in the line? The answer to this question may be given only after the study of each particular machine. In the case under consideration we find from the core-loss curve, Fig. 1, that an increase of 10 per cent. in voltage of the generator is equivalent to an increased loss of 18 kilowatts. This increased loss is so much heat added to the body of the armature and the corresponding increase of temperature resulting from that will be approximately 5½° C., giving a maximum temperature of 41½° C. No difficulty should be anticipated from the above increase in voltage on the ground of increased potential between turns and layers of winding, or from increased strain to ground. The increase is too small, and the factor of safety is large enough so that no trouble need be expected from that source.

At the present state of progress in the electrical art, no difficulty is expected from running generators in parallel. With the refined methods of synchronizing, whether turbine or engine driven, generators will give no trouble. Engine builders have overcome the old-time difficulty encountered with engine-driven generators. The maximum fluctuations from absolute uniform rotation is kept within 2½ electrical degrees, and this problem has been solved.

With proper adjustment of field current the generators will divide the load proportionally. In this respect they are more under the control of the operating engineer than some of the less complicated apparatus, such as transformers. Over and under excitation of generators will cause a flow of circulating currents between the generators. The adjustment of the field currents will eliminate these idle currents. In this respect the use of power-factor meters on each machine is of considerable assistance.

In order that transformers may divide the load equally, or in proportion to their capacities, it is

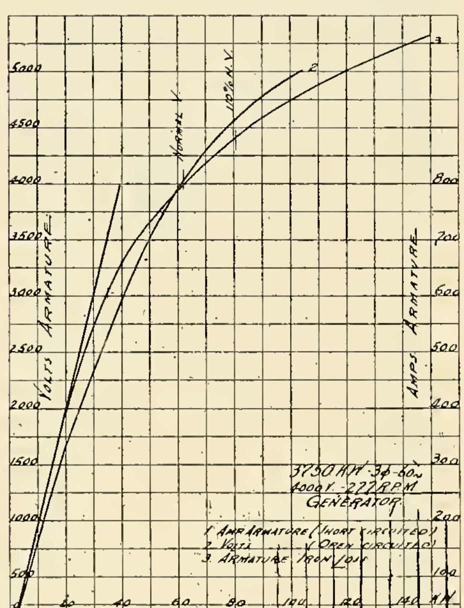


FIG. 1. CORE-LOSS CURVES.

necessary that their primary and secondary voltages be the same, also that they have the same impedance.

Many a station man has a tale of woe as a result of indiscriminate use of transformers, and, strange to say, sometimes using transformers of same make and type, but built at different times by the same manufacturer, guaranteed for successful parallel operation with transformers previously supplied.

To guard against unequal loading of transformers, the characteristics determining the division of load must be known. It is not necessary to have indicating ammeters showing the current on each transformer, as this would complicate the switchboard. It is advisable, however, to verify at the outset the division of load under actual conditions of operation, and results, if satisfactory, will remain unaltered.

In more than one instance was it the experience of the writer to find that transformers, though supposedly of the same characteristics, would not operate properly, and in one case when a bank of transformers was connected in service during the pressure of a heavy Christmas load, the bank burned out in a few days after installation, due to overload. Time could not be spared to test the transformers for impedance. They were connected in parallel on high and low-tension windings on the strength of the manufacturer's guarantee. A test made subsequently of two spare transformers supplied on the same order as those that burned out, revealed the fact that the new transformers had an impedance of 3.58 per cent., while the old transformers had 4.4 per cent., and consequently the new bank carried an overload of 19 per cent.

With transformers the question of proper parallel operation must be verified, and if they will not divide the load proportionally to their capacities, corrective reactances must be added to the transformers to equalize them in this particular respect.

Of the various types of transformers, the natural-draft transformer is obsolete in this country, whether in large or small sizes. The smaller sizes are almost altogether of the oil-insulated type, while in the larger sizes they are provided with forced ventilation, such as air blast or oil-insulated water-cooled. Let us consider the two types, air-blast and oil-insulated water-cooled transformers, as to the difficulty in connection with their operation.

Air-blast transformers are open to criticism on account of the ease with which they accumulate dust. This is objectionable, especially so in transformers of moderate voltage between 15,000 and 22,000 volts. In this type of transformers it is frequently found that the temperature of the upper portion of the coils is much in excess of the average winding temperature.

Whenever transformer coils are connected on top, the air passages are frequently blocked, and the temperatures reach a dangerous point, at which it will be unsafe to continue operation. To the above-mentioned objections must be added another, that of the danger of using compressed air for blowing out the dust. Unless the air is perfectly free from moisture, the use of it may result in the damage of the insulation and cause a burnout. If extreme precaution is not exercised, disastrous results will follow. To all these trials must be added another, that of the ease with which the flames are carried from one transformer to the other through the air chamber.

With the oil-insulated water-cooled transformer, many of the above enumerated defects will be overcome. With oil-insulated transformers a smaller amount of insulation wrapping the coils is necessary, hence the uniform ducts of larger magnitude are possible. The temperature of the coils with such construction of ample oil circulation will be more uniform.

The principal argument in favor of oil-insulated water-cooled transformers is their ability to withstand excessive overloads, and their immunity from breaking down at temperatures even as high as 200° C. This dangerous temperature was reached under abnormal conditions of phase transformation. One transformer was operating at about 72° C., while the other ran at a temperature of 200° C. Room temperature was 42° C. The difficulty was discovered when an inspection of the transformer installation was made. A thermometer of 150° C. range was lowered into the oil, and when removed to take the reading the mercury was up to the end of the scale, and the mercury bulb had broken. A larger range thermometer registered 200° C. When brought into the testing department the transformer was given an insulation test of 10,000 volts from primary to secondary and ground, also from secondary to ground of 5,000 volts, which it stood successfully.

Double voltage was applied across transformer terminals, and the insulation stood the test. The rating of the above-mentioned transformer is 24 kilowatts, 60 cycle, 2,000-550 volts.

A great advantage of the oil-insulated transformer is the higher effectiveness of insulation to resist induced high voltages, either through switching or through lightning disturbances. The fear of oil in the transformer as a fire risk is a matter of the past. Instances of stations destroyed by fire when oil-insulated apparatus such as transformers and regulators were the only machines saved, show the fallacy of the opponents of oil-insulated apparatus. Oil will extinguish the arc resulting from a short-circuit in the transformer, and prevent the burning of the insulating fabrics, thus doing away with the smoke filling the station, as is always the case with air-blast apparatus. The temperature of the oil-insulated apparatus is more uniform throughout than that of the air-blast type.

As to the oil siphoning through the leads and case joints, there is no reason why, with the proper construction and necessary precautions, the oil siphoning and leaks should not be done away with.

While it has many advantages, the oil-insulated water-cooled transformer has two main drawbacks:

1. Possibility of water getting at the winding.

2. Breaking up of the oil, forming a thick non-conducting mass.

A defective water coil or a coil allowed to have the water when the transformer is not in use during winter months will damage the transformer.

A water coil capable of withstanding 200 pounds hydrostatic pressure and proper connection of the coil to outside piping will guard against the former difficulty, while care exercised to remove the water from the coils by an air pump or by filling it with oil under pressure will guard against trials of water freezing in the pipes.

The breaking up of the oil takes place only at high temperatures, and if transformer temperatures are kept low no difficulty should be anticipated.

A sample of oil subjected to a temperature of 90 C. formed a heavy deposit in two weeks. Further tests could not be continued, due to lack of time, but it is safe to conclude, however, that it is not advisable to allow transformers to reach a temperature in excess of 70° C.

It happens sometimes that through no explainable reason the temperatures of transformers begin to rise. The cause may be due to either the iron aging, which would result in a higher iron loss, or to breaking up of the oil, or again to clogging of the water-cooling coils. In one instance where water was carried to the brass cooling coils through an iron pipe, the acidulated water passing through the iron pipe attacked the iron and then going through the brass tubes deposited the iron in the

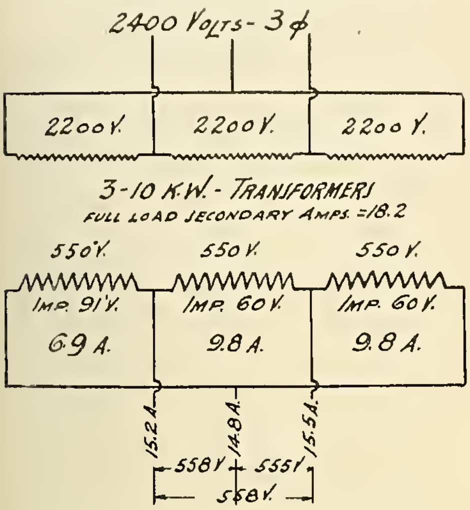


FIG. 2. UNBALANCING OF LOAD ON TRANSFORMERS OF SAME VOLTAGE BUT DIFFERENT IMPEDANCE.

form of a sediment, which reduced the coil opening to one-third its normal size, hence the consequent rise in temperature.

Transmission Line.

The connecting link between the generating and distributing ends is the transmission circuit. The trials here are caused by the insulators. Insulators should receive as much consideration as the power-house and sub-station machinery. They must have a liberal margin of safety. They must possess the requisite mechanical as well as electrical strength. While the dielectric strength is of great importance in selecting a suitable insulator, the surface leakage of the insulator should be such as to have, under conditions of rainstorm, a factor of safety of three times normal voltage for moderate voltage transmission. For voltages of 60,000 volts and above, this requirement will have to be modified and a smaller factor of safety will have to be adopted, since the insulator will otherwise prove too costly on account of size.

In selecting the kind of insulator attention must be paid to local conditions. The peculiarities of the country the line passes must be taken into consideration, and proper allowance made for local atmospheric and climatic conditions, for the effect of close-by chemical works, railway lines, with the unavoidable fumes, smoke, etc.

Rigid requirements of an insulator possessing a facor of safety of four times for arcing over under a breakdown test will justify the expenditure for a more costly insulator by minimizing breakdowns and insuring reliability and continuity of service.

Distributing Circuits.

The distributing circuits in Canada are almost invariably of 2,200 volts alternating current. The economy of distribution at the above-mentioned voltage and the severity of the Canadian winter compel the use of overhead distributing circuits. This system requires the extensive use of step-down transformers for both lighting and power service.

Transformers of 2,200 volts in sizes below 50 kilowatts, of pole-suspension type, are a very simple apparatus. They are self-contained and require no attention. If installed in sizes of ample capacity to handle the load there is no need of giving it any further thought. The experience of small plants will corroborate these conclusions. But as the plant reaches considerable magnitude, and the variety of types of transformers multiply, the difficulties begin to increase.

What are the trials in this connection?

They may be classified as follows:

1. Unequal division of load on parallel operation.
2. Unequal division of load on three-phase delta connections.
3. Phase transformation.

The chief requirement of transformers operating with proper division of load is the equality of impedance volts. In other words, given two transformers, either of same or different capacities but of same inductive drop at a given current, the transformers will divide the load proportionally to their capacities. Actual test figures should be accessible and the record of each transformer should contain this information.

Manufacturers from time to time improve their designs. As a result the impedance voltage may be diminished, while the type will still remain the same. Under parallel operation this may result in the better transformer burning out by overload. It is well to make it a rule not to operate small transformers in parallel. The practice will prove beneficial from considerations of efficiency, economy, as well as many trials attending parallel operation.

Single-phase transformers when connected on polyphase circuits for the supply of polyphase currents must possess the same characteristics with regard to division of load as one phase transformers connected in multiple on single-phase circuits. That is, three transformers connected for three-phase delta to three-phase delta must have their impedances the same, otherwise while the load on the group of transformers is balanced, each transformer will carry a load inversely proportional to its impedance volts, and the better transformer as to impedance will be forced to take a larger portion of the load and may carry a considerable overload. Figs. 2 and 3 will give a relative idea as to the inequality of the load on each transformer. In many instances transformers failed under overload conditions, yet records of connected load and actual ampere readings would lead one to believe that the transformer operated under normal conditions. To determine the load of each transformer, ampere readings must be taken on each transformer proper.

Phase Transformation.

Phase transformation, such as three-phase to two-phase, or vice versa, is more easily accomplished with shell-type transformers than with core-type transformers. Inasmuch, however, as for small units, the core-type transformer has become universal for distribution work, we will analyze this latter type. It is generally understood that in phase transformation the three-phase circuit requires the 50 per cent. of one transformer to be connected to the 86 per cent. of the other transformer. While it holds good with shell-type transformers, it will not apply to core-type transformers unless special provision is made for the interlinkage of coils of both primary and secondary winding. In the early days of the core-type-transformer development, the advocate of shell-type transformers maintained that a core type would not operate on a three-wire system. The table below will show same results when interlinkage of coils is not resorted to.

Test of 7½-kilowatt 60-cycle Core-type Transformer, 100-200 Volts. Three-wire Secondary Without Interconnected Coils.

	Side A.	Side B.
Load	0	0
Volts	104	104
Load	27 amps.	27 amps.
Volts	102.5	102.5
Load	27	0
Volts	87	125
Load	54	54
Volts	100.5	100.5
Load	54	0
Volts	63	150
Load	0	54
Volts	149	63

This difficulty was soon overcome by subdividing the secondary coils in two sections and interconnecting the sections. In phase transformation the

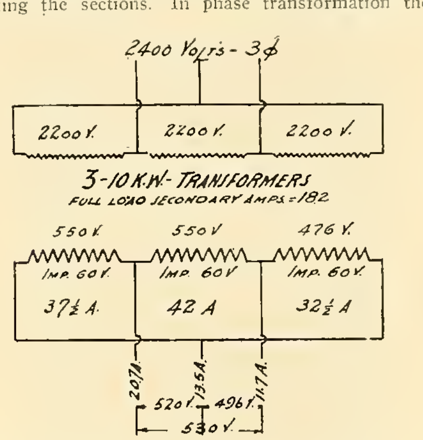


FIG. 3. TRANSFORMER OVERLOADED BY CIRCULATING CURRENT. SAME IMPEDANCE BUT DIFFERENT VOLTAGE.

same difficulty was encountered and the same remedy effected the change desired.

It may be said that in small sizes of 50-kilowatt and under the shell type has proven a failure, and that the core type is the recognized standard for both lighting and motor service.

The construction of the core-type transformer at once suggests the ease of insulating the high from the low-tension coils. In addition to that, whenever minimum material for a given capacity is not the principal object, the coils can be wound on a perfectly circular form, thus avoiding corners and insuring freedom from short circuiting the winding on account of the bends. While grounding of neutral points of low-tension transformer winding is effective in keeping the high tension out of the customer's premises, the possibility of the breakdown should be guarded against by selecting transformers possessing the necessary requisites as to construction features of the type and design.

A careful analysis will result in operating companies selecting transformers which, while of higher initial cost, will prove a better investment.

Often with the increased load, especially when the motor load predominates, it is difficult to maintain fair voltage regulation. Some stations run separate circuits for the lighting load, thus separating the lighting from the power circuits. Good regulation will be obtained from the use of automatic feeder regulators.

We will take up as the last point the question of aging. Aging of iron laminations has all these years been carefully studied by manufacturing companies, and at the present time the "eternal vigilance" has not ceased. Unless carefully guarded against inadequate iron, grievous results will follow. Poor iron affects the efficiency of the apparatus; it also influences the temperature of the machine. Sometimes the defect may not be evident at the outset, but will develop with time, and the aged iron, resulting in increased hysteresis loss, may cause the heating up of the iron to a dangerous temperature.

To keep track of the change in the iron it is well, wherever circumstances permit, that tests be made to verify the condition.

The aging of iron in many instances will explain abnormal rises of temperature with practically the same load. With artificial cooling, the difficulty is easily overcome by increased ventilation. It is well, however, to have full information with regard to the apparatus in use.

The phenomenon of aging applies to all electrical apparatus and affects largely the central-station companies on account of the extensive use of transformers. Inasmuch as aging increases with higher operating temperatures, it is preferable to purchase apparatus that will give the lowest temperatures.

To sum up, then:

Plants should be laid out with liberal provision for emergencies.

The performance of the apparatus under normal as well as emergency conditions should be thoroughly understood.

Small service transformers should be of the core type.

To insure proper parallel operation of transformers, records of transformers' impedance voltage should be kept.

Association of Edison Illuminating Companies.

The annual convention of the Association of Edison Illuminating Companies was held at The Homestead, Hot Springs, Va., on September 10th and 12th. Arrangements for the success of the meeting were prepared in the customary thorough manner and everything was carried out to the satisfaction of those in attendance. The social side of the gathering received much attention and was particularly enjoyed by the ladies present.

In the technical meetings among the papers presented were the following: "Smokeless Furnaces for Power Plants," by Mr. W. L. Abbott, Chicago; "Steam Heating from Central Stations," by Mr. B. R. Eales; "Experimental Data on Illuminating Values," by Dr. C. H. Sharp, New York; "The Boston Edison System in 1907," by Mr. L. L. Elden; "Organization of an Electric Supply Company with Particular Reference to Its Dealings with Customers," by Mr. R. S. Hale; "The Status of Municipally Owned and Operated Lighting Plants in Massachusetts," by Mr. L. R. Wallis.

Reports were presented by special committees on meters, storage batteries, electric heating, steam turbines, National Code, incandescent lamps. Each of these received considerable discussion, especially the subject of high-efficiency lamps. The tungsten lamp was looked upon as rapidly approaching a commercial proposition from the central-station viewpoint.

The following-named officers were elected for the ensuing year:

President—Alex Dow, Detroit, Mich.

Vice-president—George H. Harries, Washington, D. C.

Treasurer—Louis A. Ferguson, Chicago.

Secretary—W. W. Freeman, Brooklyn.

Executive Committee—Alex Dow, chairman, Detroit; Samuel Insull, Chicago; Joseph B. McCall, Philadelphia; John W. Lieb, Jr., New York; Charles L. Edgar, Boston; Thomas E. Murray, New York; T. G. O'Dea, Erie, Pa.; Louis A. Ferguson (ex-officio), Chicago; W. W. Freeman (ex-officio), Brooklyn.

Bailey Concrete Poles.

The manufacture of concrete poles under patent of William H. Bailey of Richmond, Ind., is to be taken up by the American Concrete Pole Company of Richmond, whose intentions are not only to construct concrete poles under contract but to sell the right to construct to other companies and users on a small royalty basis, or to sell the right to certain territory.

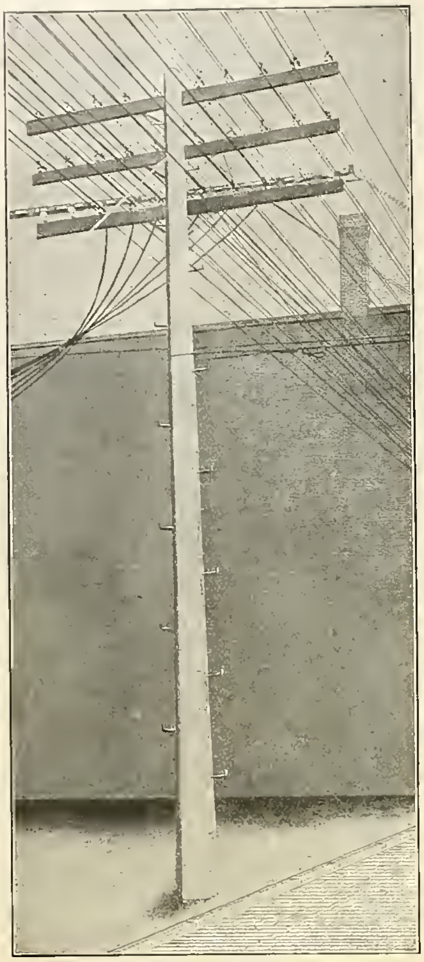


FIG. 1 CONCRETE POLE IN USE TWO YEARS.

Some of these poles have been in service for a year or more, and mention of their construction and durability in service has been made in the Western Electrician. With the reinforcement of electro-carbon twisted rods and spiral binding wires properly distributed in the column of cement the poles are said to be not only substantial and durable, but remarkable elasticity is displayed. A pole 30 feet in length will permit a deflection of 30 inches before the cement cracks. To obtain this result, it is pointed out, would require one-third greater horizontal strain at the top than would be sufficient to destroy a cedar pole of the same dimensions.

The cracking of cement under such a test would not impair the strength of the pole in the least, for after this takes place the reinforcement becomes active and takes the entire strain, the special rods being guaranteed to withstand a breaking strain of 50,000 pounds per square inch.

As will be seen in the illustrations, the poles are square, with the corners beveled off two or three inches, so that the top of the pole is octagonal in shape. This not only gives it a neat appearance but leaves the corners substantial and avoids a sharp edge that would be liable to chip off.

The rods are placed three-quarters of an inch off the surface of the cement at the corners and then bound together by a spiral wire encircling the four rods from top to bottom. This not only serves to tie the rods together but prevents danger of the cement shearing off, as the rods have a tendency outward when the pole is subjected to a lateral strain.

The smaller poles, up to and including 35 feet in height, are molded lying on the ground, and after they have been seasoned are set in place by means of a gin pole. The forms are laid with the butt near the hole and the reinforcement placed. Then the concrete is poured in and allowed to remain three to seven days, according to the weather. The forms are then removed so that they can be used again, and the pole is left to season. This process requires about three or four weeks. All poles should be built on the ground, upright in the hole or in position to be set up, thus saving the cost of hauling or unnecessary handling as this would increase the cost. Poles 40 feet in length and larger should be built standing, as this is the most economical method.

A line constructed across Whitewater River at Richmond, Ind., has poles from 40 to 60 feet in length, built in a perpendicular position. This piece of work is permanent. Fig. 1 shows a pole in detail, two years old, which has been subjected to all kinds of strain.

In Fig. 2, (1) (2) (3) (4) (5) and (6) give the detail construction of pole and reinforcement. (1) Shows the four electro-carbon rods as they are placed in the cement body, with the spiral binding wires pulled in place; (2) is a general view, showing shape of the cement body as finished; the steps and other bolts and holes are very easily made while the concrete is plastic; (3), (4) and (5) show cross-sections of poles with three different methods of binding; also two different methods of reinforcing, the scheme represented in (4) being only intended for extremely heavy construction; (6) gives detail method of the manner of securing cross-arms, a bolt or rod being placed in the form and removed within 24 hours after the concrete has been placed. This becomes a clean hole through which the bolt intended to hold the cross-arm can be placed; (7) represents the top or roof of the pole; this is easily put on after the pole is finished, but is not necessary except for appearance.

Mr. Bailey has also made application for a patent on forms varying in section from five to 15 feet each and divided up so as to be easily handled. The officers of the company which will manufacture the concrete pole are: President, A. C. Lindemuth; general manager, W. M. Bailey; secretary and treasurer, L. E. Browne.

Chicago Street-railway Situation.

At its meeting on September 12th the Chicago City Council granted the Chicago Union Traction interests an extension of time until February 1, 1908, in which to accept the settlement ordinance, by the terms of which the Chicago Railways Company would take over the North and West Side properties and improve them. If the disagreeing bondholders cannot get together by the time set the city proposes to compel the Chicago City Railway Company to take over the Union Traction lines.

In order to secure the extension of time, representatives of the traction companies were compelled to agree to put all the net proceeds of the lines into the work of reconstruction during the extension period. This plan will result in a default of interest on bonds, which probably will cause some equity holders to seek a decree of sale with a view to foreclosing. Such a turn, it is said, may bring the security holders together by agreeing to a reorganization plan to keep their holdings from the auction block.

Illuminating Engineering Gets Attention in England.

Under date of September 6th the London correspondent of the Western Electrician writes: "I have mentioned on one or two occasions that Mr. Leon Gaster has been agitating for a more complete study of illuminating methods and the science of lighting generally, aiming at the policy pursued in the United States. He has already attempted to form an association of illuminating engineers, although I am not aware to what proportions this has grown.

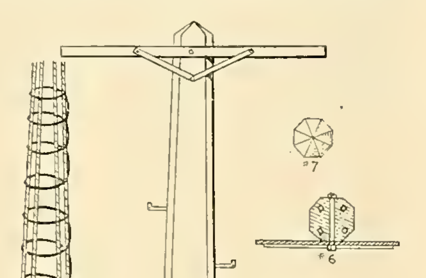


FIG. 2. DETAIL DRAWINGS OF BAILEY CONCRETE POLE.

"A further outlet for his energies in this direction has now been manifested, for I see he has registered a company for publishing a journal devoted to illuminating. This matter has a greater importance than may appear on the surface. The great need of combination between lamp makers is recognized by all, yet everyone seems afraid to move in the matter. The drawbacks attaching to the present inchoate position were exemplified at the discussion on lamps at the Institution of Electrical Engineers last winter."

Canadian Telephone News.

A new telephone company has been formed at Vancouver, B. C., to operate in that city. Steps are to be taken at once to secure a charter, and it is expected that construction work will be started this fall. The promoters say that they intend to install a complete plant at the start and so avoid the necessity of continual improvements that would keep temporarily impairing the efficiency of the service. The promoters are prominent citizens of Vancouver.

Contracts have been let for the construction of the Manitoba government exchange in Winnipeg. The exchange will be erected by James M. and John J. Kelly of Winnipeg. It will cost $97,172, which includes everything but plumbing and heating. The building is to be completed by August 1st of next year. The telephone subway contract was let to Stone & Green, Minneapolis, Minn., at a minimum of $83,000, as the exact amount of the work to be done has not yet been decided upon. The pole lines in Winnipeg will be built by the telephone department. In the trench contract there will be about 100 miles of conduit-feet. Orrin F. French, Winnipeg, Man., is superintendent of telephone construction for the province.

Walter Scott, premier of Saskatchewan, says that arrangements have been completed for the construction of government-owned long-distance telephone lines in Saskatchewan, and plans are now being prepared by Francis Dagger, telephone expert, for Saskatchewan. It is expected that a start will be made this fall.

Work on the provincial government telephones in the province of Alberta is progressing satisfactorily, and by the end of the present year fully 500 miles of government lines will be completed. In addition to the long-distance lines, some 12 or 15 local exchanges will be installed along the trunk lines. Construction work on the Lacombe-Stettler line is completed, and the Stettler-Daysland line will be the next, after which work will be transferred to the line now being built to connect Edmonton and Lloydminster. The exchange at Blairmore is now in operation, having been taken over from a private company and standardized. Eighty miles of the work on the line between McLeod and Blairmore is under construction and will be completed by the end of September. The rural line northward from Vegreville, which will supply a very rich farming country, will be completed about the same time. Work is in progress at Fort Saskatchewan standardizing the local exchange, which has been taken over by the government, and a metallic circuit is being put in. When the season's work is completed, it is said, the Alberta government will have in operation some 150 miles of line more than the Bell company has constructed in the province during the last 10 years. It is the intention of the government to build another 500 or 600 miles of line during 1908. R.

Indiana Telephone Items.

The United Telephone Company of Hartford City has decided to make improvements in its system that will require a large expenditure of money for material and equipment. A large force of men will soon be put to work costructing several new additional rural lines that are to run out of the local exchange.

The announcement of the New Long-distance Telephone Company and the Central Union Telephone Company that they would abolish their night rates for toll service in this state has occasioned a number of cities to examine ordinances under which the companies are operating. The city authorities of Kokomo are standing upon an ordinance provision, stipulated in 1904, regulating the companies and declaring that for no conversation within the limits of Howard County shall a charge in any contingency exceed 15 cents. Charles S. Norton, manager of the New Long-distance company, in explanation of the change, said: "All Independent toll-line companies with which we connect have gone to the three-minute basis, and have abolished a lesser rate for night service. Our operators do not know whether a message is passing entirely over our own lines or jointly over our lines and the lines of a connecting company. It is impossible for us to maintain separate schedules for business passing to and from the 6,000 or more stations with which we connect, and to enable us to handle the business with dispatch and uniformity, the easiest way out of the dilemma was to go to uniform basis with our connecting companies. We have found, by a careful method of checking, that the average initial period of business conversation is only a few seconds over three minutes."

The Town Board of Normal City has discovered that taxes that should have been paid by the Central Union Telephone Company during the last eight years to the town corporation have in fact been paid to the city of Muncie. The Town Board has made demands upon the company for the taxes, and the company in turn has cited the board to Muncie for payment. S.

Telephone News from the Northwest.

The North Dakota Independent Telephone Company is putting in a conduit system at Fargo, N. D. The Northwestern Telephone Exchange Company will begin work shortly on a similar system.

The Fox River Valley Telephone and Telegraph Company of Appleton has purchased the Wolf River Telephone Company's plant. This company went into the hands of a receiver several years ago. Creditors will now be paid in full.

The Brush Creek Farmers' Telephone Company has filed articles of incorporation at Ontario, Wis. J. O. Hoff is interested.

The Great Western Telephone Company has applied for a franchise at Pierre, S. D.

The Dell (Wis.) Co-operative Telephone Company has been incorporated with a capital of $25,000. Edward Clark heads the list of stockholders.

The night toll rates of the American Telephone and Telegraph Company in the Northwest have been made the same as the day tolls.

The Cannon Ball Telephone Company of Mott, N. D., has let the contract for the installation of a local telephone exchange and a line to Richardton.

The Northwestern Telephone Exchange Company will expend $75,000 to $100,000 in improvements to its toll lines in North Dakota.

The Mesaba Telephone Company has made a number of improvements to its local system at Virginia, Minn.

The Minnesota Central Telephone Company has closed its exchange at Kerkhoven, Minn.

Otto Kohn, local manager at New Ulm, Minn., for the Minnesota Central Telephone Company, has resigned.

The Wisconsin Telephone Company has annexed the Stevens Point, Wis., district to its Green Bay district.

A. R. Bloom of Minneapolis has taken a position at Fargo, N. D., with the Northwestern Telephone Exchange Company.

Alonzo Burt, president of the Wisconsin Telephone Company, has announced that the company will xepend about $1,50.0000 in improving its entire system. The construction work will begin next spring. R.

GENERAL TELEPHONE NEWS

Among the telephone companies incorporated in Nebraska recently are the Fox Creek Telephone Company of Curtice, J. W. Adams heading the incorporators; the Johnstown Telephone Company of Johnstown, William Coryell, and the Etna Mutual Telephone Company of Etna with C. O. Lind at the head.

The Canadian Independent Telephone Association at its recent convention in Toronto adopted a resolution expressing its disapproval of the affiliation or connection of the Independent telephone companies with the Bell company anywhere in Canada as being injurious to the cause of Independent telephony as a whole.

The Pacific Telephone and Telegraph Company's executive offices have been moved to the third and fourth floors of the Shreve Building on the northwest corner of Grant Avenue and Post Street, San Francisco. The engineering and construction departments are now located in the company's new two-story brick building at 140 New Montgomery Street.

Persistent criticism of the Chicago Telephone Company ordinance presented by the council committee on gas, oil and electric light caused the friends of the measure to abandon their plan of placing it upon its passage at last week's meeting of the council, and the ordinance was therefore not brought to a vote. Action was deferred on the measure until after the charter election. The voters on September 17th rejected the new charter for Chicago, which provided that any franchise to be granted by the city be subjected to a referendum vote. The telephone ordinance may be presented to the council next week.

Houston, Tex., is going to have the latest developments in its new automatic telephone system. The plans for it are now being made by McMeen & Miller of Chicago. Mr. S. D. Levings of this firm is engineer in charge of construction. He has just announced that overhead wires will be used as little as possible and conduits will be installed for the major portion of the lines. The stockholders of the Southwestern Home Telephone Company of Redlands, Cal., have authorized a bond issue of $1,000,000. Of this $100,000 is to be used to clear up the debts of the company and the remainder for extension and improvement of the lines.

CORRESPONDENCE.

Continental Europe.

Paris, September 4.—Three of the French transatlantic liners are now fitted with a very complete system of radio-telegraph apparatus which keeps them almost constantly in connection with the posts on shore at either end. The vessels are the Provence, Savoie and Lorraine, and the present apparatus has been installed under the direction of Chief Engineer Vivien. From the messages which are thus received from the coast stations of Poldhu and Cape Cod a journal is made up containing the most important news, and it is printed on board and distributed a few hours later. As to the greatest distance which can be covered by the present apparatus, it is said to be 1,700 to 1,800 miles, and thus the steamers are in constant connection with the posts on shore with the exception of a few hours. However, messages can be received from other vessels which lie within the range of the apparatus so as to fill up the gap. Regarding the character of the instruments which are now used on the French liners, the receiver is mounted in a form of helmet so as to be carried upon the head, and the operator receives the messages by sound. In order to find out at what time messages can be taken from other vessels passing within reach, each vessel is provided with a chart which shows the route of the vessels and the probable time when they are within range. With the present system the three steamers above mentioned are now publishing the daily Journal de l'Atlantique from their printing presses. Many other vessels are equipped with apparatus for short distances so as to be able to receive private messages.

At the recent Agricultural congress held at Vienna one of the interesting papers was that which Dr. Caro of Berlin read upon a new method of utilizing peat bogs for producing current in electric stations, the latter to be erected on the spot. The author showed in the first place that the manufacture of combustible by means of peat and the production of coke would hardly extend beyond a local interest. Peat, even when freed from water, is only a second-rate fuel, which cannot be transported to long distances. On the other hand, the coke manufactured from peat has a high price and thus cannot compete upon a large scale with good qualities of ordinary coke. Moreover, all these processes require the peat to be freed from water beforehand, down to 15 or 20 per cent. of water. Seeing that the method of natural drying must be used, great difficulties are found in preparing the combustible during the whole year. The new method proposed by the author consists in utilizing the peat on the spot. To this end it is burned in a gas producer of special form, and the resulting gas is used for different industrial purposes, especially for running an electric plant. By the author's process he is able to use peat all the year round which contains 50 per cent. of water. The by-products from the gas process serve to pay for the transport and other expenses of the plant, and thus there is practically no expense for the gas. Such electric plants can compete very well with hydraulic plants and will attract different industries to such regions.

To the different coast stations which have been installed on the coast of France by the postal and telegraph department is now added a post of considerable power at La Rochelle, on the Atlantic coast. It is erected in a tower located at the mouth of the harbor.

An electric tramway line is soon to be constructed between Boulogne, on the channel coast of France, and the suburban town of Outreau. Among other traction enterprises in France is a new line which is to run from the town of Maxeville, near the eastern frontier, to Champigneulles. A. de C.

Great Britain.

London, September 6.—The tale of woe continues from week to week in connection with the various London transport companies. This week half-yearly meetings of three of the tube railway companies affiliated to the Underground Electric Railways Company of London have been held, and it is patent that, although the concerns have not been in operation a sufficiently long time to warrant any direct comparisons being made, yet it is quite clear from the tone of the speeches to the shareholders that expectations have not been realized. The causes for this have been so repeatedly given that I will not go into them again. In fact, we have now reached the condition that all kinds of transport companies are attacking each other for undue rate cutting, and the whole position is one of complete indecision as to what the future is likely to bring forth. The directors of the tube-railway companies have turned their attentions in the direction of reducing the working expenses, but have run up against an item in the cost of working the electric lifts which defies reduction. In the case of the Great Northern, Piccadilly and Brompton tube the expense of working the lifts amounted, in half a year, to over $17,000. The three tube companies in question are practically working new routes, and the directors' explanation of an unsatisfactory state is that the public is slow to take advantage of new facilities. The position of these three companies is a serious matter for the Underground company, for they were the three lines selected by the late Mr Yerkes as affording the most profitable prospects, and the guaranteed dividends amount to a considerable sum annually.

A new view is being taken upon the question of linking up suburban termini by means of tube railways. Hitherto the very heavy burden of construction has been left to the manager of the tube lines, although the suburban companies' local traffic development has depended solely upon the existence of these terminal facilities. Now, however, the view is growing that in these circumstances part of the cost of construction should be borne by the other company. This is partly the reason for postponing the construction of an important extension of the Baker Street and Waterloo tube railway. This extension would link up with the terminus at Paddington, of the Great Western Railway Company, but how far the view expressed above will appeal to the management of that system remains to be seen.

An interesting letter appeared in The Times a few days ago, written by one of the members of the committee which considered the Radio-telegraphic Convention of 1906. This member, Mr. Macpherson, voted in the minority, and his explanation for writing the letter in question was that his action had given rise to a good deal of misconception. He, first of all, complains of the government for nominating both Mr. Buxton, the postmaster-general, and Mr. Lambert, who is at the Admiralty, upon the committee, seeing that both had expressed strong views in favor of the convention beforehand. He next states that the committee was absolutely incompetent to deal with the technical evidence placed before it, and that only Mr. Marconi really gave evidence in an impartial manner. But for Mr. Marconi's evidence he practically states that he would have been in the dark completely. He finally concludes with an appeal for postponement, and says that, although a Radical, he is not ashamed at putting in a word for the Marconi company, for if its business is a monopoly, he wishes there were more like it. I am afraid his letter has come at the wrong period of the year to be effective.

The final accounts of the Brighton Corporation telephone system, which was recently passed over to the postmaster-general at a price about $7,500 less than the capital cost, have just been published. Owing to the fortuitous circumstance that the corporation was enabled to purchase stock to pay off the remaining debt at a discount, the balance sheet shows that, after deducting the amount taken from the rates to maintain the system, there has been a net profit to the borough as the result of the sale of about $3,000.

Gradually the South Wales Electrical Power Distribution Company is disposing of its power stations to the local authorities in whose districts they are situated. The company possessed one large station, which it is continuing to work itself, and three small local power houses. It is these latter which are being disposed of at a considerable sacrifice.

A representative of a London daily paper has had an interview with Sir Charles Metcalfe, one of the consulting engineers to the Rhodesian Railways, and also to the Victoria Falls Power Scheme. He stated that, in addition to securing further valuable contracts for power, the power company had been of considerable service to the Johannesburg municipality in its recent trouble, and that this action had improved the prospects of the company very considerably. Mention of the Johannesburg plant reminds me that there is a strong possibility of the action of the corporation against the plant guarantors being heard in England.

Inquiries made among electrical manufacturing firms go to show that there is a strong disposition to eschew exhibitions of all kinds at present. It is quite possible that some large firms will not be found exhibiting at the Manchester electrical show next year for this reason. Those companies which experienced a bad time last year particularly are commencing their economies in this direction.

An announcement has been made that the Admiralty has approved the establishment of a separate branch for conducting radio-telegraphy in the navy.

Now, that descriptions of the New Haven single-phase equipment have reached this side, it is interesting to note that the engineers to the London, Brighton and South Coast Railway, upon the section of that line which is being equipped for single-phase working, propose to support the overhead wire by iron lattice girders standing at distances from 100 to 300 feet apart. I believe that upon the Midland Railway experimental line wooden poles are to be used. As I have previously pointed out, the company does not propose to erect a power station in the first instance, but to purchase energy from the local electric supply company. G.

New York.

New York City, September 14.—In order that it may be thoroughly and accurately informed as to the exact state of affairs in the Battery tunnel to Brooklyn, the Public Service Commission will shortly appoint two expert civil engineers, not in any way connected with the construction companies, to make a report upon conditions there existing, including the length of time it will take to finish the job. Last week it was stated that these tubes had been found entirely unsatisfactory, and would have to be lined with reinforced concrete in order to make them safe. William Barclay Parsons, consulting engineer of the Interborough Rapid Transit Company, after a thorough inspection of the tubes, states that 'the tunnel,' although much delayed, is now in good shape and that there is nothing to prevent its being opened to the public at an early date. Much interest is being attached to the date of opening, in view of the traffic conditions which are becoming more and more dangerous at the Bridge, due to the increasing traffic.

The United Wireless Telegraphy Company, which is reorganizing the American De Forest Company, is said to be capitalized at $20,000,000, of which $10,000,000 is common stock and the rest preferred. Sixty per cent. of this stock will be used in taking up the stocks and bonds of the American De Forest company. The United company now occupies the offices at 42 Broadway, formerly occupied by the De Forest concern. Abraham White, the president of the De Forest company, is said to be one of the largest creditors. It is declared that some of the patents have proved worthless and that others are infringements.

The air locks in each end of the Forty-second Street Astoria tunnel have already been removed and the work of preparing the tubes for actual operation has been begun and advanced to a point where the use of compressed air is no longer necessary. The cars to be used in the tunnel are at hand, and, in short, the operation of the tunnel is near realization. Actual work on this tunnel under its present control was begun July 12, 1905. Actual work on the Battery tunnel to Brooklyn was begun September 11, 1902, to be completed within three years. The time when the latter tunnel will be completed is still problematical. This fact shows what can be done when private rather than public interests are at stake. In order to possess themselves of the full value of the old Steinway franchise, the purchasers, the Belmont company, would have to have completed the tunnel to Astoria by January 1, 1907, and to this end a bonus of $200,000 was offered the contractors.

Such rapid progress is being made on the Hudson River tunnels from Manhattan to Hoboken that it is expected cars will be running between the shopping district and the Delaware, Lackawanna and Western terminal before the winter sets in. As to the cars which will operate between the terminals, the seats will run lengthwise, with doors at both ends and sides as well. Posts will be set up in each of the cars, to which passengers may "cling" in their three-minute passage under the river. For sanitary reasons the floors will be of cement and carborundum to prevent slipping.

An exhibition of Marconi wireless telegraphy will be seen at the electrical show at Madison Square September 30th to October 9th. It will be the endeavor of the Marconi company during the show to give practical demonstrations and instruction every afternoon and evening. There will be a receiving station in the Garden, which will be in communication with all incoming vessels employing wireless.

The cable steamer Silverton, with more than 1,300 miles of submarine cable on board, has left London. The cable is to be laid for the Commercial Cable Company between New York and Havana. The object of laying a new cable directly from New York to Havana, instead of following the old route between Cuba and Florida, is to create effective competition, to greatly reduce the time of transmission, and increase the reliability of the service. This latter could only be obtained by obviating the long coast lines along the Atlantic, which are subject to stormy weather, and substitute therefor an all-submarine line. E. H. S.

New England.

Boston, September 14.—In this city the telegraph companies have reopened the most of their branch offices and the Western Union officials report a practically full force in the main office. There is about 90 per cent. of the regular force at work in the Postal main office and the skill of the operators is good.

The Atlantic Insulated Wire and Cable Company's new plant at Stamford, Conn., has been completed, but all of the machinery has not been installed. The main structure is two stories high, 351 feet long and 80 feet wide. The power house is 44 by 100 feet. The mixing department has a daily capacity of 10,000 pounds of rubber compound and the insulating department can handle 600,000 feet of wire daily. The new plant has about three times the capacity of the one burned last November.

The New York, New Haven and Hartford Railroad Company expects to open its electric service between New York and Stamford, Conn., in about three weeks. Delays have been caused by the non-receipt of iron poles and other structural iron, and the overhead wiring has been slow in consequence.

During a large part of this week the Suffolk County grand jury has been listening to testimony offered by the New England Telephone and Telegraph Company's employes by which District Attorney John B. Moran expects to be able to obtain indictments based on the wrongful employment of men with political influence by the telephone company. The district attorney is getting after the politicians and not the company.

The Massachusetts Highway Commissioners' hearings on the conduct of the telephone business in this state are still being held. The commissioners have examined the company's daily charts of traffic. Frederick P. Valentine, an engineer in the New England Telephone and Telegraph Company's traffic department, gave some information regarding the expense of handling the business. E. W. Longley, auditor of the company, gave the number of times suburban subscribers called for Boston connections in May, 1907, as 228,123. The number of times Boston subscribers called for suburban connections during the same month were 88,251. Mr. Longley said that the company did not intend to furnish private telephones to municipal officials at a discount. He said that the company's investments in 1906 were as follows: For the Boston district, $14,489,383; for Massachusetts, exclusive of Boston and suburbs, $9,937,766; for territory outside of Massachusetts, $7,550,491; total, $31,977,640. The company's revenue from these investments was as follows: In Boston district, $1,400,782; in Massachusetts, exclusive of Boston, $361,832; in territory outside of Massachusetts, $183,520; total, $1,946,134. These figures are somewhat misleading, owing to tolls collected in the Boston division which were earned outside of the division. At a subsequent hearing Jasper N. Keller, vice-president of the company, explained the working agreement between the American and the New England Telephone and Telegraph companies. He said that the actual revenue per subscribers was $123.01 in 1896 and $56.69 in 1906. The company paid a dividend of six per cent. each of these years. The hearings are still in progress.

Otis F. Pettee, for many years treasurer of the Gamewell Fire Alarm Telegraph Company, died suddenly of heart disease at his home in Newton Upper Falls, Mass., on September 6th. He was 54 years old and left a wife. He retired from active business about 10 years ago.

Dominion of Canada.

Ottawa, Ont., September 14.—A special committee of the City Council of Hamilton, Ont., has recommended that the Council, as soon as possible, submit a by-law for the purchase of electric pumps for the waterworks system, with a capacity of 10,000,000 gallons a day. A deputation will visit Buffalo and other places.

An important special meeting of the shareholders of the Power, Light and Heat Company of Sherbrooke, Que., has been held to take into consideration the offer of the city to buy out the company's plant and business. The price offered by the city was $170,000, the city to assume payment of the company's bonds. It was decided to offer to sell to the city at $190,000 and the city to assume the bonds.

The striking telegraphers of the Canadian Pacific Telegraph Company have applied to the Department of Labor for a board of conciliation and arbitration under the new law passed last session of the Dominion Parliament and have named their arbitrator. The principal point in dispute is wages, though a variety of other topics will come up for adjudication.

It is expected that the wireless-telegraph service now being installed on the Pacific Coast by the government will be available, in part at least, within six weeks. The preliminary work, embracing the construction of stations and the introduction of the initial plants, is reported by Superintendent Morse to be well under way. The construction work at Pachena Point, Estevan Point, Shotbolts Hill, Victoria and Cape Laze is being advanced at rapidly as circumstances will permit.

The Royal Commission appointed to investigate the strike of the Bell telephone operators at Toronto last winter has made its report to the government. In a general way the commission reports the hours of work and strain of operating to be too severe for the young women who are employed at the switchboard and that their pay is too low. The company in 1903 reduced the length of day from eight to five hours. In January last the eight-hour day was resumed, and this caused the strike. The company said the shorter day had failed to promote efficiency of service, as the operators, having more time, tired themselves with housework or amusement. The pay was $20 a month for the first six months, increasing $2.50 for every six months to three years, when the maximum was reached. Both the Dominion and Ontario governments will introduce at their coming sessions legislation based upon the findings of the commission designed to improve conditions for the operators. W.

Ohio.

Toledo, September 14.—A fairly prosperous season is being felt by electricians and electrical supply houses throughout this section generally, although some portions, like Toledo, are suffering somewhat from local conditions, which are by no means applicable to the state of Ohio. Electric-railway construction in all parts of the state has been unusually active all summer, and while there is some let up now, the season has been a heavy one. The number of public buildings completed and now under way is large. Business blocks and private improvements have been perhaps as extensive as ever was known, taking the state as a whole.

Toledo, however, is still undergoing a season of depression in building operations, and the fall prospects are not as bright as might be wished for. There are several contracts under way that will furnish a fair business for the local dealers, but on the whole the season is far behind what it was last year. Buying among the electrical houses is limited at this time, this situation being due not only to local conditions but to the condition of the copper market. It is not thought that copper products will advance materially in the near future, but, on the other hand, predictions are being made that the present high prices will not continue. Supplies are therefore being ordered about as needed, and the surplus on hand is not permitted to increase. Local people are still hoping that a little later in the season there may be a rally from present conditions, but indications are not strongly pointing that way, and the chances seem to be that there will be no rush of business before next season.

The Hamilton Gas and Electric Company recently awarded the contract for a new building to J. R. Bender & Brother, the improvement to cost about $10,000 when completed.

A handsome contract is in store for Youngstown electricians when the awarding for the additions to the new Dollar Bank Building is made. The improvements contemplated will reach $125,000.

Plans have been prepared for a 15-story bank and office building for the Provident Savings Bank and Trust Company at Cincinnati. The building will cost $250,000, and a complete system of electric lighting will be installed, consisting of about 500 lights.

A large contract which will be awarded to Ohio electricians is that in connection with the new $1,000,000 courthouse to be erected at Youngstown. The lighting plans have not yet been completed, but will comprise no unimportant part of the equipment.

The Dayton Motor Car Company will erect a new five-story factory building. The work will be done by the Keppele Hall Engineering and Construction Company. About $15,000 will be expended.

More than $250,000 is being expended by the People's Railway Company of Dayton in the erection of a power house, office and repair shop.

The Citizens' Motor Car Company of Cincinnati has prepared plans and will erect a $100,000 garage in the near future. L. P. Hazen & Co. will also build a garage for the Reliance Motor Car Company of Cincinnati, at a cost of about $20,000.

Articles of incorporation have been granted to the Massillon, Wooster and Mansfield Traction Company, with a capital of $10,000. The purpose of the company is to build an electric road connecting Mansfield and Massillon.

The Cincinnati Traction Company contemplates the expenditure of $50,000 in the building of additions to its present car barns. The company is crowded for room at present.

Farmers along the right-of-way of the new electric line to run from Millersburg to Beach City have not only donated the right-of-way but are offering financial aid to the company. It is said the line will be in operation within a few months. A feature will be that there will not be a bridge, and but few culverts, along the entire 25 miles. H. G. S.

Indiana.

Indianapolis, September 14.—The Indiana Union Traction Company, with headquarters in Anderson, will expend $40,000 in the construction of a concrete arch bridge, of artistic design, over White River, near Chesterton.

A consignment of 18 carloads of steel rails has been received at this place by the Chicago New York Electric Air Line. This and other activities make it appear that the line will be constructed, through Indiana at least.

J. B. Crawford, superintendent of transportation of the Fort Wayne and Wabash Valley Traction Company, announces that through trolley service between Lafayette and Fort Wayne will be inaugurated October 1st, when new and modern fast limited cars will make regular trips between the two cities.

The Indianapolis Traction and Terminal Company, which spent $60,000 for new copper cable and new equipment for its line to the state fair ground, during the last week transported passengers to the state fair on the scheduled rate of one car every 15 seconds. Four hundred cars were operated on this line without a hitch or accident of any kind.

During the last week the 12 interurban electric lines operating in and out of Indianapolis carried over 100,000 persons to the state fair grounds, and, so far as known, no accident or mishap of any kind occurred to throw the cars out of their regular schedule.

That traction sleeping cars will be in demand in the immediate future is being seriously considered by a number of Indiana traction officials, who recently made a nine-hour trip between Indianapolis and Detroit by the way of Toledo. They say it is now possible for people to travel from Indianapolis by trolley to most any point in Ohio, Michigan and Illinois, and that sleeping berths will be in order in a short time can no longer be disputed. In this connection Mr. Harrison F. Holland of Indianapolis has just completed plans for a new palace car, similar to the former Holland car designed by him. The new car will be propelled by four 85-horsepower motors, which will make the car lighter by at least six tons than the original Holland car. This change will make the cost of the car at least $5,000 less than the former car, the cost of which approximated $20,000. The new car will be equipped with comfortable chairs and roomy berths, with capacity for 44 passengers. A company will be organized to construct the new palace cars, by which time it is thought a good demand will be made for them by the progressive interurban lines of the Central States.

The Warsaw City Council is attempting to force the Warsaw Gas and Light Company, which is controlled by Detroit men, to accept the terms of a new franchise submitted by the city. The franchise is to have a life of 25 years, and regulates the rate to be charged for the commodities.

The Town Board of Summittville is experiencing trouble with the municipal electric-light plant. The plant was erected and equipped in 1902 by two Summittville men, who eventually sold it to the Summittville Town Board for $55,000, making a good profit. The board has continued to operate it at a loss. The board has resolved to separate the electric-light and water funds from other funds in the treasury, so that other funds may not be applied to electric light and waterworks, and in this way involve the town beyond its capacity. In other words, it is an attempt to make the electric-light plant stand or fall by the grace of its earning power.

The City Council of Terre Haute has again refused to authorize the payment of the quarterly street-lighting bills to the Terre Haute Electric Street Railway and Lighting Company, the whole amount now due being $24,000. It is asserted that the light is not up to the standard contracted for.

Articles of incorporation have been filed by the Miller Electric Company of Terre Haute. The company proposes to establish and equip a factory for the manufacture of electrical machinery and supplies of all kinds. The incorporators are Frank B. Miller, Jacob W. Miller and W. E. Coordes.

S. S.

Illinois.

Peoria, September 14.—A party of Montreal men accompanied by G. M. Mattis, assistant treasurer of the Illinois Traction Company, and Secretary Everson, made a visit to this city this week to inspect the properties of the company. The party included R. D. McCraig and C. H. Lewis, Canadian men who are interested in the Illinois Traction Company.

The Clayton Farmers' Union Telephone Company of Clayton has been incorporated with a capital stock of $1,000 by John W. Wallace, Charles C. Cain and Henry J. Beckman.

Work of grading has been commenced on the Carthage-Nauvoo interurban electric line. The road goes through a country that requires a very little grading, and it is expected to have the line in operation by the first of the year.

A new interurban is to be surveyed from Kirkwood to Monmouth. George M. Jamieson, who is behind the project, has engaged an engineer to survey the proposed route and make a report as to the cost to build the line.

The Village Board of Chandlerville has allowed F. P. Schaaf, to whom the electric-light franchise has been granted, a period of six months in which to consider the proposition. The promoters will undoubtedly have the plant in working order in a much shorter time.

The Illinois Traction Company interests have incorporated another company under the name of the Danville and Southeastern Railway Company, the principal office to be in Danville, with capital of $10,000. It is proposed to construct a line from Danville to a point in the southeast corner of Georgetown Township, Vermilion County. The incorporators and first board of directors are W. H. Carnahan, B. E. Bramble, George M. Mattis, Charles Zilly and C. E. Cox, all of Champaign.

The grand officers and the grand executive board of the Electrical Workers' Union are holding a meeting in Springfield this week, and it will continue for a week or so. One of the matters to be brought before the board is that of a building for the national headquarters. A number of [illegible] under consideration.

The Illinois Traction Company has let the [illegible] tract for the nine piers that will be required for the bridge across the Mississippi to the Missouri Valley Bridge and Iron Company for the sum of $385,795.50. The piers are to be built to a footing 70 feet below low water mark and will be 130 feet high. Contracts for the upper parts of the bridge will be let about the first of the year. The intention is now that the bridge shall be ready for use in February, 1909. The total cost is estimated at $2,500,000. The bridge will carry the cars into St. Louis and will also be able to carry wagons and foot passengers, but it is not expected to accommodate steam railroad.

The Hoskins Electric Heating Company of Chicago has been incorporated with a capital of $130,000 to manufacture and deal in heating apparatus. Incorporators are E. F. Hoskins, Daniel Weber and Elmer E. Beach.

The Tri-county Mutual Telephone Company of Creston has increased its capital stock from $2,500 to $6,000.

V. N.

Michigan.

Grand Rapids, September 14.—At the special election held at Paw Paw for the purpose of bonding for an electric-light plant and waterworks, the proposition carried by 201 to 7. The amount to be bonded for is $50,000.

Recently the Cartier Lumber Company of Ludington leased to Arthur J. Whipple and Lewis J. Highland, for 20 years, for an annual rental of $480, the Hamlin dam and waterpower. It is stated that these men will soon organize a corporation to be known as the Chicago-Michigan Power Company. They get the right, so far as the lease is concerned, to maintain a head of 15 feet, and get the right-of-way for poles. It is reported that the power will be utilized for an electric road from Ludington to Manistee, but some doubt is expressed as to whether sufficient power can be generated at Hamlin for this purpose.

The Niles Milling Company, the oldest manufacturing concern in the city, will go out of existence within a few days. Several months ago the company's big brick flour mill was destroyed by fire, and the waterpower and the company's frame buildings will be taken over by C. A. Chapin, who desires, it is said, to raise his dam in the St. Joseph River at Buchanan.

The Michigan Agricultural College is to have a complete electrical engineering course with the completion of the new $100,000 engineering building. A combination electrical and mechanical laboratory in the rear wing of the building is 40 by 60 feet, and it will be fully equipped.

Though the franchise granted to the McMichael interests for the building of an electric road to Dowagiac from Benton Harbor has expired, with the line constructed as far as Eau Claire, officials declare that the line will go through within a few months. F. M. Mills, president of the concern, has bought a farm near Dowagiac for $25,000, which, it is expected, will be converted into an amusement park.

L. W. B.

Northwestern States.

Minneapolis, September 14.—Capitalists of La Crosse, Wis., are planning the purchase and further development of the waterpower at Hokah, with the object of furnishing light and power to the villages of Hokah, Caledonia and Spring Grove, Minn.

Henry Sherry of Neenah, Wis., proposes to form a stock company to develop the waterpower on Wolf River near Antigo. It is estimated that 5,000 horsepower could be developed.

F. E. Hatch of Pellston has secured an option on Boney Falls, near Escanaba, Mich., and proposes to build a large power plant there.

The Mille Lacs Power, Light and Heating Company has been formed and will build a light and heating plant at Wahkon, Minn.

The Wausau (Wis.) Street Railroad Company has closed the contract for the erection of a new car barn.

The Northwestern Interurban Railway Company has filed an application at Grand Forks, N. D., for a franchise.

It is proposed to build a municipal electric-lighting plant at Cudahy, Wis.

The City Council at Valley City, N. D., has reconsidered its former action and has voted to sell the municipal light plant.

The Rodolf mill and electric-light plant at Muscoda, Wis., is to be purchased by that village.

J. C. Enright of St. Cloud has given orders to begin work at once on a new concrete power dam to be constructed at Cold Spring, Minn., for a power plant for the mill there.

The City Light and Gas Company of Beatrice, Neb., has filed articles of incorporation with a capitalization of $90,000.

The City Council at Valley City, N. D., has reconsidered its former action and will offer the municipal lighting plant for sale.

A company has been formed at Hartley, Iowa, for the purpose of building a trolley line from [illegible]

The [illegible] Interurban Railway Company has withdrawn its petition for a franchise at Grand Forks, N. D., and announced it intends to [illegible] that field.

The South [illegible] Company has purchased the machinery for a new electric light plant at Redfield, Iowa.

Surveys have been started on the proposed Spirit Lake, Emmetsburg and Fort Dodge (Iowa) interurban railway line.

R.

Pacific Slope.

San Francisco, September 11.—The first authentic information relative to the plan of the Great Western Power Company to establish on the Oakland estuary a large auxiliary electric generating plant is given out by H. P. Wilson of the firm of Brown, Wilson & Co. Mr. Wilson confirms the purchase of a tract of about seven acres. The adopted plans contemplate a building 250 feet long and 100 feet wide. It is proposed to install turbine generators of 5,000 horsepower each besides the necessary steam-generating plant. The auxiliary station is to be independent of the long-distance transmission and is designed to furnish power in an emergency. The company will expend $2,500,000 on the auxiliary plant on the estuary. Contracts have been let for turbines, generators, boilers and all other machinery required, according to the company's announcement.

A contract for two 650-kilowatt Westinghouse-Parsons turbo-generators has been closed through Hunt-Mirk & Co., the Pacific Coast agents, which are to be installed in the new power station which is to supply light and power for the Claus Spreckels Building on the corner of Third and Market streets, San Francisco.

John Hayes Hammond and other owners of the Mt. Whitney Power Company, whose plant is located near Visalia, Cal., are the movers in a new corporation known as the National Park Electric Company, which is preparing to put in an electric power plant near Sonora in Tuolumne County. It is rumored that the new company will take over some of the other electric enterprises on the Tuolumne River.

Work has been commenced on the southern extension of the power lines of the California-Nevada Electric Power Company. This line will extend from Pickle Meadows, near Bridgeport, Cal., to Tonopah and Manhattan, a distance of 220 miles.

The Board of Supervisors of San Francisco has voted unanimously to deny the petition of Daniel O'Connell and others for the revocation of the street-railway and telephone franchises in this city and asing that bonds amounting to $22,000,000 be issued for the acquisition of the street-railway and telephone systems.

The City Council of Alameda, Cal., has set Saturday, September 21st, as the date for the bonds election for public improvements. The proposed bond issue will include $50,000 for the municipal electric-light and power plant. If the bonds carry a substantial two-story power station building will be erected.

This week the Southern Pacific Railway Company applied for franchises in the cities of Alameda and Oakland, which, when granted, will enable the company to transform its local steam lines in the city of Alameda into electric lines, in following out its avowed policy of changing all its local system on the east side of San Francisco Bay into electric lines. So far, the applications in Oakland apply only to the line which runs into Alameda, but additional franchises will be asked for soon.

The City Council of Los Angeles, Cal., has called for bids for street-railway franchises on Hill and Sixteenth streets on which the Los Angeles Pacific company was recently prevented from laying a third rail. The council has ordered that a bond of $25,000 be given for each franchise.

The Board of City Trustees of Sacramento, Cal., has granted a freight franchise in that city to the Northern Electric Company. The franchise provides that other roads may pass over the lines of the Northern Electric Company.

H. E. Huntington has issued orders to discontinue all preparations for further extension work on the Pacific Electric and Interurban electric systems in Los Angeles, Cal., the order taking effect at once. General Traffic Manager McMillan says in regard to the move: "It appears to be the policy of the present administration to make it as difficult as possible to operate our lines. We are made to pay for franchises, and these are taxed, and all improvements made are assessed at exorbitant rates, and then we are made to use fenders which cannot be operated safely on our large swift cars. The Pacific Electric and the Interurban have not paid expenses for the last three years."

The entire issue of common stock of the Pacific Gas and Electric Company, amounting to $20,000,000, has been turned back into the treasury of the company as a result of the failure of the holders of all of the stock to pay the last $10 assessment. The assessment on the preferred stock, amounting to $1,000,000, has been paid in full in cash. The issue of $20,000,000 of the common stock has been held by N. W. Halsey & Co., and their representatives here say that the action of the house in turning the entire stock held by them into the treasury has resulted in putting the corporation on a firmer financial footing. The sum realized on the assessment of the preferred stock will be used for restoration work and extensions of the service made necessary during the last 16 months. The general belief among financial men here is that the latest move in the stock of the company is preliminary to a completion of a merger with the Great Western Power Company, which was rumored some months ago.

A controlling interest in the Lytle Creek Power Company has been sold by Judge John L. Campbell of San Bernardino, Cal., to F. A. Worthley of Riverside, Cal., who is superintendent of the Riverside municipal lighting plant and a large owner in the Southwest Electrical Company. It is given out that a number of extensions will be made at once.

Contracts have been closed in the East by one of the electrical engineers of the Southern Pacific Railroad Company for 10 large boilers which are to furnish steam for the operation of the two 5,000-kilowatt Westinghouse-Parsons turbo-generators that were recently contracted for. It is probable that a third unit, of the same capacity, will also be ordered from the same company, for installation in the power house which is to be erected in Oakland, Cal., near the foot of Fruitvale Avenue. The alternating current will be transformed at sub-stations and direct current used to operate electric cars on the railroad company's local lines in Oakland and Alameda. B.

PERSONAL.

C. W. Reese has been made manager of the Northwestern Telephone Exchange Company for the St. Paul office.

Otto Schilling has been appointed superintendent of the Mattoon and Charleston (Ill.) interurban electric road. Mr. Schilling was formerly with the Illinois Central Railroad as division superintendent.

W. S. Townsend, master mechanic of the East Liverpool Traction and Light Company, East Liverpool, Ohio, has been appointed a member of the Central Electric Railway Association standardization committee to succeed W. H. Evans, formerly of Indianapolis, but now of Buffalo, N. Y.

The Holophane Company has added to its engineering department Mr. T. W. Rolfe, engineer, and Mr. C. W. Heck, designer. Mr. Heck resigned from the Safety Car Heating and Lighting Company to establish a department of special fixture designing for the Holophane Company, this department being necessary to take care of the growing number of large lighting installations being handled by the Holophane illuminating engineers.

Hugh J. McGowan, president of the Terre Haute, Indianapolis and Eastern Traction Company, and also of the Indianapolis Traction and Terminal Company, has returned from a three-month tour of Europe, where he traveled 5,200 miles in an automobile. Mr. McGowan reports traction facilities in Europe, especially in England, as away behind. "There are scarcely any interurban trolleys, and in the cities there is little or no effort made to carry or accommodate the people," he said. "We are away ahead of them when it comes to the traction business. Between Liverpool and London, about 110 miles, there is not an electric line, and the land is as level as a floor. Within a radius of 50 miles of Liverpool there is a population of 7,000,000 and no trolley lines for their accommodation. Throughout Great Britain, France, Germany and the most of the other European countries there is a great opportunity for developing the electric-railway business."

ELECTRIC LIGHTING.

L. W. Chilton has been granted a franchise for an electric-light system in Goliad, Tex.

The City Light and Power Company of Beatrice, Neb., has been incorporated with a capital stock of $25,000.

The Ola Lumber Company contemplates establishing an electric-light plant, to furnish lights to the town of Ola, Ark.

The Chickasha (I. T.) Water Power Company is now ready to begin the construction of its electric-light and power plant.

J. J. Osborne and associates have incorporated as the Texahoma (Tex.) Light, Water and Ice Company, with a capital of $15,000.

J. C. Berger and others of Denver, Colo., have purchased the Sterling (Colo.) Electric Light Company and will enlarge the plant.

The Greenville (Ky.) Light and Water Company was organized last week with a capital stock of $35,000, all subscribed. Work will be begun at once on a modern light and water plant for the city. A dam will be constructed near town which will give a supply of 50,000,000 gallons of water annually. J. A. Gilman has planned the plant and will superintend its construction. He will be general manager of the plant when put in operation.

George I. Waters of Victor, Mont., and others plan establishing a power plant on a nearby stream which will supply electric lights to Stevensville and Victor.

The Superior (Wis.) City Council recently voted to abandon further plans for a municipal lighting plant and decided to renew the contract with the local lighting company at a lower rate than formerly. Most of the aldermen and the mayor were elected on municipal-ownership platforms, and, after employing an engineer to make plans and estimates, came to the conclusion that no money would be saved by the municipal project.

The large number of gas and electrical engineers, architects and central-station men who are becoming interested in illuminating engineering, and who call upon the Holophane Company for data on this science, has led to the engagement by the company of Mr. T. R. Pemberton, in the position of office salesman and demonstrator. The Holophane Company has a very complete demonstration room, in which the illumination value of its product is shown.

The Utah Light and Railway Company of Salt Lake City, which controls all the electric lighting and street railways of that city, has decided to relinquish all its restrictions of the city's use of the power deeded to the city from its power rights in Big Cottonwood Creek by the franchise of 1905. This is on condition that the City Council validate the 1905 franchise and extend its life to 50 years. The city has been trying to secure this privilege so it could use the power as it wished instead of for purely municipal puroposes only.

ELECTRIC RAILWAYS.

The Little Rock (Ark.) and Pine Bluff Traction Company is preparing to let the contract for its power plant. J. J. Fiske is president.

The Northern Texas Traction Company of Fort Worth, Tex., will double the capacity of its power house. H. T. Edgar is general manager.

The Lancaster, Oxford and Southern, now operating as a steam railroad near Lancaster, Pa., will probably be electrically operated after the McCalls Ferry dam is completed. President W. M. Franklin of the road recently sought permission of the Oxford Borough Council to extend the line through some of Oxford's streets and to the fair grounds, promising to use electric power over the entire system.

The Board of Trade of Red Lodge, Mont., has practically decided to build an electric road from Red Lodge to the Bear Creek coal-mining camp, four miles away from Red Lodge. This is a rich mining district that has not been developed to any extent on account of the topographical difficulty of building a mining town there. The projected line will make Red Lodge the business and residence town of this coal district.

The Los Angeles Pacific Company has made an issue of $20,000,000 mortgage bonds, of which about $8,000,000 will be used for extension and improvement of its lines and the remainder for refunding an old bond issue. Among the improvements will be new power houses and sub-stations, a large new depot in Los Angeles, besides many other modern stations along the lines. The new extensions to Hollywood and Santa Monica will require several subways and will have a rock-ballasted roadbed laid with 90-pound rails. The new rolling stock will be of the finest type obtainable.

RADIO-TELEGRAPHY.

An Australian record in wireless telegraphy has been achieved by the successful transmission of messages from the British warship Challenger, of the Australian squadron at present stationed in Hobson's Bay, to the flagship Powerful, which at the time was moored in Farm Cove, Port Jackson. The Challenger was in communication with the flagship, by means of wireless telegraphy, the whole of its voyage and never once lost touch with it. The longest message, one flashed over a distance of 410 miles, in a direct line, constitutes an Australian record.

POWER TRANSMISSION.

The Flathead Water Power Company is building two power houses at Kalispel, Mont., each to develop 1,000 horsepower.

The California-Nevada Power Company, which purposes to transmit electric power at 100,000 volts from a hydro-electric plant in the mountains of California over a long transmission line extending to Goldfield and other Nevada mining camps, has matured its plans. It is reported that it has been decided to award the contract for the generators for the plant to the Westinghouse Electric and Manufacturing Company. The power company has offices in the Chronicle Building in San Francisco and also in Denver.

PUBLICATIONS.

The publication office of The Electric City, published by the Chicago Edison interests, has been moved from the Edison Building, 139 Adams Street, to the Electric Block, 84 to 88 Market Street, where the entire second floor has been equipped for the publication of the magazine. The telephone service remains the same as before, Main 1280.

The McGraw Publishing Company has moved into its new building at 239 West Thirty-ninth Street, New York city. The building is 11 stories high and is interesting because constructed entirely of reinforced concrete. From it the Electrical World, Street Railway Journal and Engineering Record will be issued. These journals are to be congratulated on what are apparently admirable quarters.

SOCIETIES AND SCHOOLS.

The annual reunion of the Old Time Telegraphers and the United States Military Telegraph Corps, which was to have been held at Niagara Falls on September 16th, 17th and 18th, has been postponed to a date to be determined later. Unsettled conditions prevailing in the telegraph field at this time are given as the cause of postponement.

MISCELLANEOUS.

The steam end of the 6,000-kilowatt Allis-Chalmers turbine-alternator unit which was recently shipped to the Kings County Electric Light Company of Brooklyn, a subsidiary company of the Brooklyn Edison Company, is said to be one of the largest and most powerful so far built. As an indication of its size it is interesting to note that a piece of steel forging weighing 240,000 pounds, made by the Bethlehem Steel Company, went into the construction of its spindle.

The trustees of the Sanitary District of Chicago have decided to begin work on the North Shore channel running from Lake Michigan a little north of Evanston to a point on the North Branch of the Chicago River. A pumping station near Evanston will be required. To save that city from another smoke nuisance, it has just been decided to use electrically operated pumps. Mr. E. B. Ellicott, electrical engineer of the District, estimates that there will be a saving of $55,573 in initial expenditure by the adoption of this plan. The cost of the building and equipment he places at $255,927.

The Graphic Arts Company of Buffalo, N. Y., recently purchased a new Allis-Chalmers 45-kilowatt type "H" generator with a complement of seven five-horsepower type "K" direct-current shunt motors built by the same company for operation at a speed of 1,050 revolutions per minute and two three-horsepower type "K" motors for operation at 1,025 revolutions per minute. Five of the five-horsepower motors are for belting to presses, one will be belted to a paper cutter, another to a roughing machine, while a three-horsepower machine will be mounted on the bronzing machine.

Experiments are being carried on with a view to replacing the rails now in use on the railway lines owned and operated by the Belgian government by rails of heavier weight—a change necessitated by the increased weight of the rolling stock. The weight of locomotives now in use has doubled, being from 80 to 90 tons, with cars of from 20 25 tons in weight. So far the heaviest rails used are what are known as the Vignole rails, having a maximum weight of about 90 pounds per meter (39.37 inches). The weight of the new rail with which experiments are being made is about 125 pounds per meter. The line selected for experimental purposes is that from Liege to Germany. It is obvious that the use of these heavier rails will necessitate corresponding modifications in other appliances on the lines affected by the change.

TRADE NEWS.

The Domestic Supply Company of Chicago has certified to a change of name to the Ray Electric Company.

The Standard Electric Company of Omaha, Neb., has been incorporated with a capital stock of $25,000 by E. F. Schurig and associates.

The Edgecombe Company of Cuyahoga Falls, Ohio, announces that it has taken up electrical contracting in connection with its mechanical and electrical engineering business, and will be pleased to receive copies of late catalogues of electrical supplies.

The sales force of the Holophane Company has recently been augmented by the addition of Morgan P. Ellis and Harry P. Struben. The former comes from the Electric Appliance Company of Chicago, and will travel the Northwestern States. Mr. Struben was, until lately, connected with the engineering department of the Pennsylvania Railroad Company, with headquarters at Baltimore.

He will have the southwestern territory for Holophane.

The United States Circuit Court for the District of New Jersey filed an opinion a few days ago in the suit of the Westinghouse Electric and Manufacturing Company against the Prudential Insurance Company of America on Nolan patent No. 582,481, granted May 11, 1897. This opinion is the outcome of a suit brought by the Westinghouse company against the Prudential company, charging the latter with infringement of Nolan patent No. 582,481, in the generator manufactured by the Bullock Electric Manufacturing Company of Cincinnati. The Nolan patent in suit relates to means for fastening the laminae of the cores of electrical machines together and to the casting by which they are supported. Judge Lanning in this opinion holds that claims two and four of the Nolan patent are valid and infringed.

BUSINESS.

The J. W. Morrison Lumber Company of Minneapolis, Minn., has just finished pulling its large stock of white-cedar poles from the river at Cohasset, Minn., and will commence shipping at once. This stock runs largely to long poles, and the company solicits inquiries from electric railway and light people.

The Cherry Cotton Mills of Florence, Ala., have recently placed a contract with the Allis-Chalmers Company, Milwaukee, covering a 500-kilowatt steam turbine and alternator unit, together with turbo jet condenser and engine-driven exciter complete. The cotton mill industry of the South, which has known such phenomenal growth in the past decade, owes no small portion of its success to the use of electricity to drive its looms and spindles.

An up-to-date exhibit of incandescent lamps, reflectors and globes at the Montreal Electrical Show was that conducted by the National Electric Lamp Association on behalf of the Sunbeam Incandescent Lamp Company of Canada, Ltd., together with the Holophane Company. Among the many lamps displayed were the following: Fifty, 100 and 250-watt Gem metalized-filament, operating in multiple at $2\frac{1}{2}$ watts per candle efficiency; meridian of large round bulb as well as straight side tantalum, in 40 and 80-watt sizes, two watts per candle; multiple and series tungsten, $1\frac{1}{4}$ watts per candle, the former being 110 volts, 80 candle-power, and the latter 40 candlepower, four, $5\frac{1}{2}$, 6.6 to, $7\frac{1}{2}$ amperes, miniature tantalum and tungsten from one half to eight candlepower, $1\frac{1}{2}$ to 28 volts. One of these lamps was running on an ordinary dry cell. Very interesting demonstrations were given. Many of the lamps in this exhibit were used in conjunction with Holophane reflectors. The efficiencies given herein, however, are of lamps bare. The Holophane Company had a very pretty display of reflectors and globes, notable among same being the Holophane arc or cluster. In a dark room it was easily seen that lamps equipped with these reflectors would give much more downward light. Bulletins containing information on high efficiency, metalized and metal filament lamps, and also on modern illumination, were placed within easy reach of all who cared to help themselves. These bulletins, nine in number, can be had for the asking. Among the representatives present were B. G. Tremaine of the National Electric Lamp Association, S. E. Doane, chief engineer of the association; W. E. Irving, manager of the Sunbeam company; W. M. Skiff, George Loring and George Merrill of the engineering department of the association, and T. W. Rolph and Mr. Jones of the Holophane Company.

ILLUSTRATED ELECTRICAL PATENT RECORD.

Issued (United States Patent Office) September 10, 1907.

865,307. Fluorescent Electric Lamp. Thomas A. Edison, Llewellyn Park, N. J. Application filed May 19, 1896. Renewed April 29, 1902.

This is a Röntgent X-ray tube or screen, the glass having a crystalline fluorescent powder, such as tungstate of calcium, fused to it.

865,368. System of Electrical Distribution. Justus B. Entz, Philadelphia, Pa. Application filed December 30, 1905.

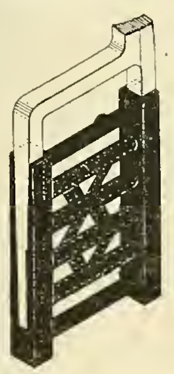
A booster for storage battery work has two main fields, one in the main load circuit and the other in the booster armature circuit, and an auxiliary coil adapted to oppose the first field.

865,377. Automatic Suspending Reel for Electric Incandescent Lamps. John H. Gordon, Snoqualmie, Wash. Application filed January 11, 1907.

The line wires connect through the horizontal axles to brushes inside the drum. The lamp wires connect to the brush terminals in such a way as to permit these wires to be wound up on the drum.

865,379. Combined Jack and Restoring Drop. Emadia J. Grenier, Menominee, Mich. Application filed April 18, 1906.

The drop is provided with a vertically pivoted shutter and a restoring mechanism. Below the number plate and shutter is a spring-jack mounted on the same block.



NO. 865,503.—ACCUMULATOR.

865,383. Controlling Device. Arthur E. Handy, Providence, R. I., assignor to the Rhode Island Elevator and Machine Company, Providence, R. I. Application filed December 31, 1904.

An electric controller has an electromagnet provided with a plunger core and armature. A series of circuit closing fingers arranged in sets is connected to the armature so as to alternately release the fingers of each set and thus cut out resistance step by step. Pivoted arms are connected to the plunger core so as to simultaneously render all the fingers inoperative.

865,384. Timer. Charles S. Hardy, Summit, N. J. Application filed January 21, 1907.

This is a periodic contact maker having a contact arm that can be turned in one direction only. This engages, one by one, a series of contacts, each consisting of a rod held in a bushing by a spring tangentially against the rotating arm.

865,387. Portable Dust-suction Apparatus Worked by Means of an Electromotor. Adolf Hein, Berlin, Germany, assignor to the Vacuum Cleaner Company. Application filed February 21, 1906.

A motor is connected by flexible transmission to a double throw crank shaft that operates two suction bellows, all but the motor being in a dust-tight casing.

865,388. Control of an Electrically Driven Air Compressor. Ebenezer Hill, Norwalk, Conn. Application filed April 1, 1907.

The motor controller is actuated by the differential action of pistons in two cylinders, one trying to put the arm into running position, the other forcing it back.

865,389. Control of Electrically Driven Air Compressor. Ebenezer Hill, Norwalk, Conn. Application filed May 24, 1907.

The controller arm is moved by a plunger working in a cylinder containing a liquid to move it slowly. The variations in pressure govern the action of the plunger.

865,412. Attachment for Electric Motor Controllers. Albert H. Mathewson, Thompsonville, Conn. Application filed March 28, 1907.

This attachment has arranged in a circle a series of pockets holding balls. A finger fastened to the controller handle is arranged to pass over the balls when turned in one direction, but to engage them in the other direction and to be thus held till moved to the proper position.

865,428. Automatic Time Switch and Alarm. Frank H. Quade, Jr., San Francisco, Cal. Application filed December 28, 1906.

An automatic automatic alarm mechanism has an electromagnet, automatically energized at a predetermined time. A segment carrying an armature for the magnet is provided with a pawl turning a ratchet that has a series of contact studs, engaging a stationary contact successively which rings an alarm.

865,432. Electric Time Switch. William D. Ross, Providence, R. I. Application filed December 1, 1906.

A rotary dial carries adjustable arms provided with projecting pins that engage escapement levers for operating the switch.

865,470. Printing Telegraph. John E. Wright, New York, N. Y. Application filed May 6, 1904.

A printing telegraph receiver has two independent line circuits. A type wheel having a plurality of circular rows of characters thereon is moved by an electromagnet in one of the independent circuits step by step in line with its axis. An electromagnet in the second independent circuit simultaneously rotates the type wheel about its axis.

865,473. Break-arm for Electric Wiring. Walter A. Arthur, Manchester, N. H. Application filed April 5, 1907.

Two branches extend on opposite sides of the base. At the ends of the branches are angularly adjustable insulator brackets.

865,474. Trolley. Joseph Ashurst, Chicago, Ill. Application filed March 25, 1907.

A trolley head has a pair of current collecting wheels on vertical axes on each side of the wire, bearings for the wheels and guard plates. The whole is arranged to oscillate vertically and horizontally.

865,482. Wire Payout Reel. John F. Delphey, Toledo, Ohio. Application filed April 8, 1904.

This is a frame with a number of U-shaped members joined together at their ends, at which pivots are supported that carry the reels.

865,483. Insulating Coupling. Gustave F. Dreher, Schenectady, N. Y., assignor of one-half to Gustave F. E. Dreher, Schenectady, N. Y. Application filed April 9, 1906.

This coupling is made of two parts. One has a T-shaped head, the other a hooked end adapted to fit over the head of the first, an insulating strip separating the adjacent portions.

865,501. Motor Truck. William F. Kiesel, Jr., Altoona, Pa. Application filed March 25, 1907.

A car truck has motor frames mounted upon the axles, the frames having noses resting on a suspension bar fastened by links to the center-plate of an independent bolster.

865,503. Electrical Accumulator. John Knobloch, New York, N. Y. Application filed December 26, 1906.

This storage battery plate has a conducting framework with consecutive compartments holding the paste. The whole is surrounded by a pervious insulating envelop secured to it. Special insulating separators are arranged to separate and brace the plates. (See cut.)

865,516. Electric Regulator. Frank C. Newell, Wilkinsburg, Pa., assignor to the Westinghouse Electric and Manufacturing Company. Application filed October 22, 1904.

This regulator is for a generator having a rheostat in series with its main circuit. The field circuit connects on one side to the main terminal and on the other to adjustable contact on rheostat. This contact is operated by a coil placed inside the resistances.

865,527. Heating Device. Albert A. Radtke, Chicago, Ill. Application filed October 27, 1906.

An electrical egg-cooking device is made of a base and cap shaped to fit closely about the egg. Each is lined inside with resistance wires connected through a switch to a source of current. The windings are brought in series when the cap is placed over the base.

865,536. Selector for Automatic Telephone Exchanges. Charles E. Scribner, Jericho, Vt., and Claude D. Enochs, Chicago, Ill., assignors to the Western Electric Company, Chicago, Ill. Application filed April 10, 1905. Renewed July 11, 1906.

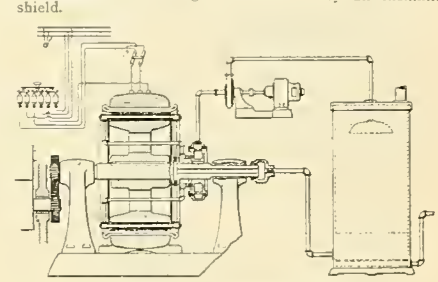
This selector comprises a series of connection terminals and a ratchet wheel carrying an arm with insulated switch fingers adapted to engage any pair of terminals. A magnetically oscillated pawl actuates the ratchet and advances it before the inertia imparted to it by a heavy disk on its shaft is overcome.

865,555. Automatic Electrical Signal System. Edwin T. Ackerman, Chicago, Ill. Application filed September 26, 1904.

The system has a number of circuits including relays closed by the hands of a clock, the relays each operating circuit closers for a number of signal circuits. Means are provided for cutting in or out any of the circuits and of interchanging them.

865,567. Fuse-plug. Robert C. Cole, Hartford, Conn., assignor to The Johns-PrattCompany, Hartford, Conn. Application filed March 4, 1907.

This plug is arranged to fit into a standard socket and contains a cartridge fuse covered by an insulating shield.



NO. 865,617.—INDUCTION MOTOR.

865,574. Recording and Reproducing Sounds. John F. Dirzuweit, Philadelphia, Pa. Application filed April 29, 1907.

This is an apparatus on the order of the phonograph, but works on different principles. A microphone transmitter acted on by the sound waves produces electric pulsations in a Tesla tube mounted so as to move over a photo-sensitive plate. The fluctuating actinic rays from the tube thus leave a permanent record on the sensitive plate. To reproduce the sounds the process is reversed.

865,588. Electric Switch. Edward M. Hewlett and Theodore E. Button, Schenectady, N. Y., assignors to the General Electric Company, New York. Application filed November 19, 1902.

This switch is operated by a reversible electric motor connected to a three-wire system, one brush being permanently connected to the neutral wire and the other arranged to connect to either of the outside wires, the motor being operated through a distant control switch.

865,598. Programme Clock. De Witt H. Leas, Delaware, Ohio. Application filed October 24, 1906.

A device for operating electric signals at predetermined intervals has a gear wheel carrying pins that successively close an electric contact. Electromagnetic means are provided for repeating the series of signals.

865,604. Target. August C. Meyer, Worcester, Mass. Application filed January 4, 1906.

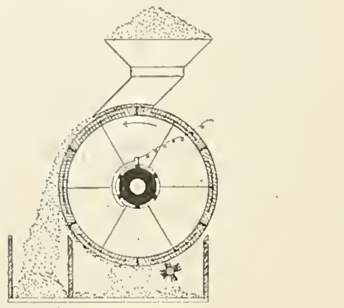
A score-keeping device has a target having movably mounted value rings, and an electric circuit arranged to be closed by the movement of the rings. An indicator has corresponding value rings, a marker for each ring and means operated by the closing of the circuit to expose a marker in a position corresponding in value to the location of the hit upon the target. A register has a dial with an index, a pointer, and means operated by the closing of the circuit to advance the pointer along the index to register the total value of such hit added to the previous scale.

[illegible] Insulating Material and Method of Producing the Same. Charles L. Norton, Manchester, Mass., assignor to the Asbestos Wood Company. Application filed February 23, 1907.

The process consists in heating a body composed of asbestiform fiber bonded with magnesium hydrate, and impregnating it while heated with a liquefiable hydrocarbon, such as ozocerite.

865,608. Process of Baking Carbon Electrodes and Heating by Electricity and Combustion. Edgar F. Price, Niagara Falls, N. Y. Application filed April 22, 1905.

This process consists in initially heating the electrodes by combustion, and then heating the hot electrodes to a higher temperature by passing an electric current through them.



NO. 865,711.—METAL SEPARATOR.

865,609. Process of Smelting Refractory Ores and Producing Low-carbon Ferro Alloys. Edgar F. Price, Niagara Falls, N. Y. Application filed November 14, 1905.

This is a process for producing ferrochromium, and consists in smelting a charge containing ferrosilicon, an oxidized compound of chromium and a basic flux by means of an electrically-heated resistance-conductor.

865,612. Insulating Machine. Howard D. Saylor, Philadelphia, Pa. Application filed August 13, 1906.

The machine is used for winding cotton or silk insulation on wires. It has sleeves for grinding the wire, means for moving the wire, thread cups carried by each sleeve and eye members for moving the thread around the wire.

865,617. Induction Motor. Charles P. Steinmetz, Schenectady, N. Y., assignor to the General Electric Company of New York. Application filed August 7, 1905.

The rotor of this motor has hollow high resistance conductors, hollow end-rings forming both electrical and pipe connections between like ends of all the conductors and means for forcing a cooling fluid to circulate through the conductors from one end-ring to the other. (See cut on preceding page.)

865,618. Production of Nitrous Compounds. Charles P. Steinmetz, Schenectady, N. Y., assignor to the General Electric Company of New York. Application filed April 20, 1907.

This process consists in forcing a current of air through a chamber in which there is an electric arc that is deflected and rotated by a rotating magnetic field.

865,638. Thermostat. Harry G. Geissinger, New York, N. Y. Application filed July 16, 1906.

A U-shaped thermal bar has the end of one leg fastened near the pole of an electromagnet and carries a contact point at the end of its other leg, which can close the circuit of the magnet coil.

865,648. Electrolysis of Fused Salts. Franz von Kügelgen and George O. Seward, Holcombs Rock, Va. Application filed May 26, 1905.

This relates specifically to the production of magnesium-calcium alloy by the electrolysis of a fused mixture of $CaCl_2$ and MgF_2 regulated so that the secondary reaction between calcium and MgF_2, takes place only to a limited degree.

865,650. Valve and Sparking Mechanism for Hydrocarbon Engines. Levi E. Lowe, Columbus, Ohio. Application filed December 3, 1906.

The sparking device has a contact point at the end of a finger attached to an oscillatory arm which periodically engages a stationary contact in the path of the gas flow past the valve head.

865,662. Igniter System. Richard Varley, Englewood, N. J., assignor to the Autocoil Company. Application filed May 11, 1906.

This system has a battery and a dynamo as alternative sources of current, a single point cam lever that can be in circuit with either source and that can be momentarily shunted.

865,663. Ignition System for Explosion Engines. Richard Varley, Englewood, N. J., assignor to the Autocoil Company. Application filed October 8, 1906.

A cam causes one vibrator to open a dynamo circuit and another vibrator to close a battery circuit.

865,687. Process of Making Nickel Films. Thomas A. Edison, Llewellyn Park, Orange, N. J., assignor to the Edison Storage Battery Company, West Orange, N. J. Application filed January 19, 1907.

This process for making a film of metallic nickel consists in first chemically depositing on a suitable cathode a film of metallic copper, electrolytically depositing a copper film thereon, then depositing on the latter film a film of nickel, next stripping the composite sheet from the cathode, and finally dissolving the copper in an [illegible] copper sulphate solution.

865,688. Process of Making Metallic Films or Flakes. Thomas A. Edison, Llewellyn Park, Orange, N. J., assignor to the Edison Storage Battery Company, West Orange, N. J. Application filed January 19, 1907.

This patent is similar to the preceding one, but is broader so as to include other metals than copper and nickel, such as cobalt, for instance.

865,697. Insulator. Robert E. Henderson and John N. King, Los Angeles, Cal., assignors of one-fourth to E. O. Williams and one-fourth to James W. King, Los Angeles, Cal. Application filed May 16, 1906.

This insulator is mounted eccentrically on the pin. The thick side is flat and has a groove extending inwardly and slanting upwardly to hold the wire.

865,701. Alternate-current Generator and Motor. Alexander Heyland, Brussels, Belgium. Application filed June 9, 1902.

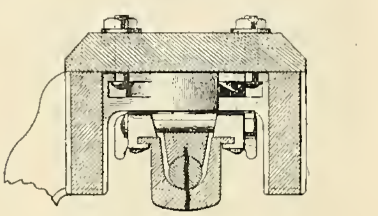
This machine has a stator winding and two rotor windings, one of which is a direct-current circuit and the other an alternating-current circuit in series with the stator winding. The latter winding includes a commutator and is used to overcome the armature reaction of the machine.

865,707. Self-sustaining Field-magnet Coil. Elbert W. Jodrey, Lynn, Mass., assignor to the General Electric Company of New York. Application filed December 28, 1906.

This method of producing a self-sustaining universally-wound wire coil consists in winding a few layers, securing a strip of paper about these layers, and then winding on the remaining layers.

865,711. Separating Metal from Deposits. Isidor Kitsee, Philadelphia, Pa. Application filed June 20, 1907.

A method of separating particles of metal from natural deposits consists in passing the mixture over the surface of a non-conducting drum, in which surface are embedded both eelctrodes of a high-tension circuit. (See cut.)



NO. 865,879.—CONTACT RAIL.

865,730. Controlling System for Railways. Max Trautmann, Dresden, Germany, assignor to Bertha Trautmann, née Sprie, Dresden, Germany. Application filed March 21, 1907.

A series of conductors corresponding to the number of passing trains is arranged in two groups. Line contacts are actuated by the trains and operate indicating devices in the circuit of the conductors. Means are provided for restoring the indicators to initial position when train arrives at next station.

865,732. Dynamo or the Like. Charles A. Vandervell, London, and William H. W. Proctor, Coventry, England. Application filed March 6, 1905.

In a machine in which both armature and fields are rotatable, one is driven and the other is provided with a brake adjustable by hand so as to keep the relative speed of rotation of the two parts at a desired value.

865,771. Electric Signal Bell. Harold W. Eden, Detroit, Mich., assignor to the P. R. Manufacturing Company, Detroit, Mich. Application filed July 18, 1906.

The new feature about this bell seems to be that the brackets for supporting the magnet coils and armature are struck up from a plate of sheet metal.

865,781. Electric Railway Signaling Device. Edward B. Howell, Butte, Mont. Application filed June 25, 1906.

This system has poles alongside of the track carrying one or more continuous signaling wires upon which runs a trolley connected by means of a flexible cable to signaling devices in the moving car.

865,811 to 865,819. System of Motor Control, Method and Means for Controlling Electric Motors and Motor-control System. William H. Powell, Norwood, Ohio, assignor to the Allis-Chalmers Company and the Bullock Electric Manufacturing Company. Applications filed April 16, 1906, to January 28, 1907.

These nine patents relate to systems of controlling motors for variable speed operation and cover various methods of accomplishing this, as by the simultaneous regulation of the field strengths of generator and motor, the use of auxiliary generators and motors, and the use of self and separate excitation for the fields.

865,820. Motor-control System. Walter J. Richards, Norwood, Ohio, assignor to the Allis-Chalmers Company. Application filed March 25, 1907.

A number of motors and generators have separately excited fields all connected in series. An auxiliary dynamo is shunted across one of the field windings.

865,821. System of Motor Control. Walter J. Richards, Norwood, Ohio, assignor to the Allis-Chalmers Company. Application filed March 1, 1907.

The armature current of the motor is supplied by a dynamo and the motor fields have a cumulative winding supplied by two additional sources of current. The fields of the dynamo are differentially supplied by these same additional sources.

865,822. Method of and Means for Controlling Electric Motors. Louis E. Bogen, Cincinnati, Ohio, assignor to the Allis-Chalmers Company and the Bullock Electric Manufacturing Company. Application filed May 27, 1907.

This method comprises a generator and motor with armatures connected together, two separate sources of current for the field windings of the generator and motor respectively, and regulating devices for these two separate sources, the electromotive force of the generator exciter being reversible.

865,848. Automatic Signaling Apparatus. James S. Anderson, Ames, Neb. Application filed May 20, 1907.

Adjacent to the railroad track is placed a series of poles, each having a box and an arm, the latter being moved by a passing locomotive to close a circuit through buttons in the box.

865,862. Thermostat for Centrally Heated Plants. Robert Brukenhaus, Haspe, near Hagen, Germany. Application filed January 22, 1904.

A maximum and minimum thermometer has electric contacts and through electromagnetic devices operates a branch steam valve.

865,866. Block Signal. Pierre I. Chandeysson, St. Louis, Mo. Application filed December 23, 1905.

A semaphore signal has a movable color disk in front of a lamp. A semaphore arm and the color disk rotate on a shaft operated by an electric motor connected to the shaft by a magnetic clutch.

865,879. Electric Contact Rail. Ed W. Farnham, Chicago, Ill., assignor to the Farnham Company, Chicago, Ill. Application filed July 17, 1905.

This rail has a U-shape cross-section, the closed end of the U being on bottom and forming the contact side. A continuous conductor lies in the groove of the rail. (See cut.)

865,888. Sound Magnifier for Telegraph Instruments. Frederick O. Hanson, Victoria, Kan., assignor of one-half to William Schrenkler, Walker, Kan. Application filed February 21, 1907.

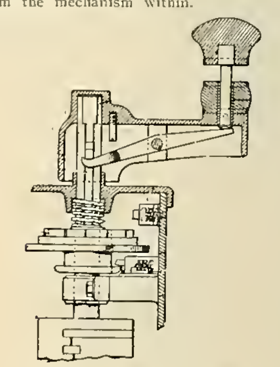
The armature lever strikes an anvil plate and the sound is transmitted to a diaphragm in an adjustable horn.

865,907. Coil for Electrical Purposes. Elbert W. Jodrey, Lynn, Mass., assignor to the General Electric Company of New York. Application filed October 26, 1905.

A tubular support of insulating material has several coils wound upon it, adjacent ends being separated by a space. A conductor, connecting terminals of the coils is embedded in the support.

865,937. Telephone Receiver. Edwin J. Quinby, Portland, Me. Application filed November 22, 1905.

This receiver has a metallic casing insulated by bushings from the mechanism within.



NO. 865,970.—MOTOR CONTROLLER.

865,970. Controller for Electric Motors. Charles S. Lee, Troy, N. Y. Application filed June 4, 1906.

This controller operates a circuit-breaker and has means for compelling the operator to close the controller contacts successively, after the circuit-breaker is once closed, and also means for opening the circuit-breaker when the operator releases the controller handle. (See cut.)

PATENTS THAT HAVE EXPIRED.

Following is a list of electrical patents (issued by the United States Patent Office) that expired September 16, 1907:

436,335. Telephone. W. Burnley, North East, Pa.
436,387. Socket for Incandescent Electric Lamps. H. E. Swift, Boston, Mass.
436,408. Dynamo Electric Machine. S. D. Field, Yonkers, N. Y.
436,410. Electro Magnetic Bell. J. Greary, Philadelphia, Pa.
436,425. Electric Railway. H. W. Libbey, Boston, Mass.
436,432. Electric Conductor. W. E. Oehrle, Philadelphia, Pa.
436,439. Electric Motor Car. W. Robinson, Boston, Mass.
436,440. Electric Motor Car. W. Robinson, Boston, Mass.
436,512. Telephone. S. Lloyd Wiegand, Philadelphia, Pa.
436,513. Telephone. S. Lloyd Wiegand, Philadelphia, Pa.
436,514. Telephone Relay. S. Lloyd Wiegand, Philadelphia, Pa.
436,516. Galvanic Battery. J. F. Wollensak and W. E. Gill, Chicago, Ill.
436,560. Electro Mechanical Gong. G. Doyle, Watertown, Mass.
436,571. Trolley for Electrical Railways. D. A. Ainslie, Richmond, Va.
436,602. Storage Battery. W. B. Hollingshead, Bronxville, N. Y.
436,640. Electrical Automatic Fire Alarm System. W. F. Singer, Carthage, N. Y.
436,677. Electrical Head Light. J. Thorne and E. B. Burr, London, England.

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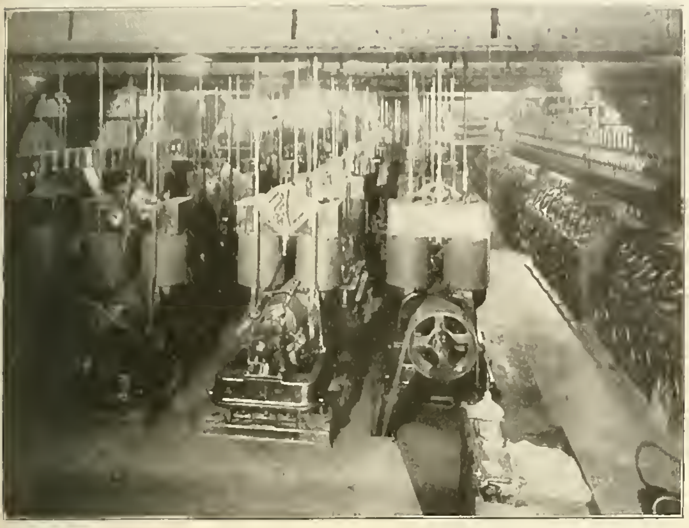
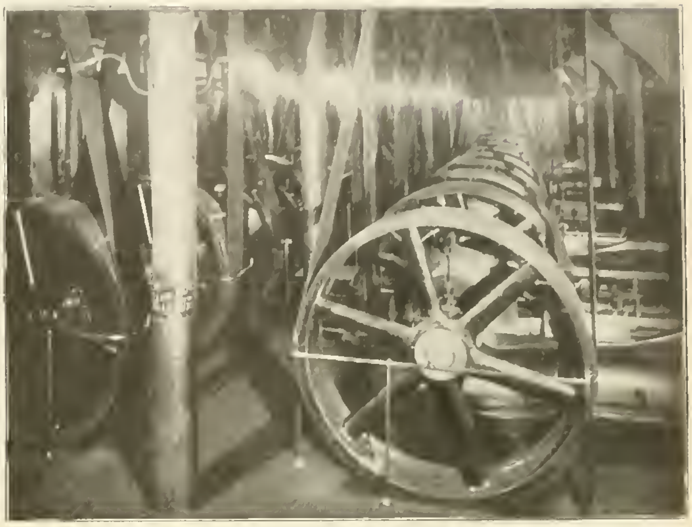
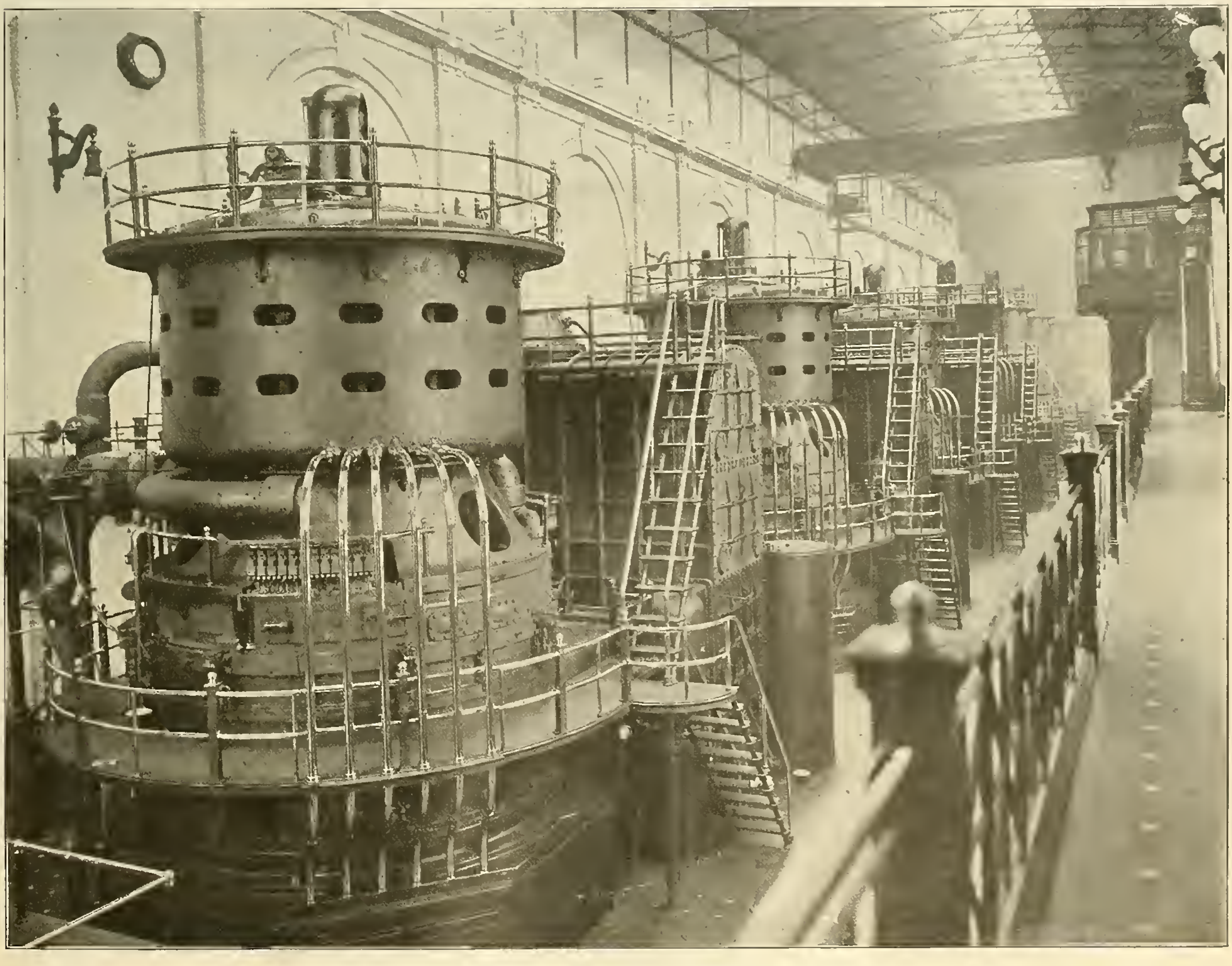


Bipolar Edison Dynamos on Upper Level.



Small Belted Steam Engines Driving Dynamos from Lower Level.

INTERIOR VIEWS OF OLD ADAMS STREET EDISON STATION, CHICAGO, IN 1890.—CAPACITY ABOUT 4,000 HORSEPOWER.



This Station has a Present Maximum Capacity of 130,000 Horsepower in Ten Turbine Units, Two of which are not Shown in Picture.

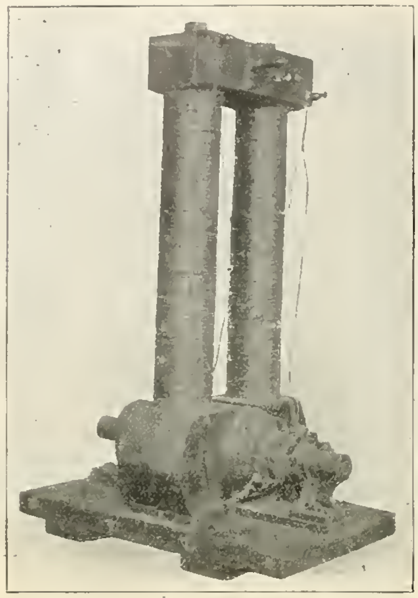
INTERIOR VIEW OF FISK STREET STATION OF COMMONWEALTH EDISON COMPANY, CHICAGO, SUCCESSOR TO THE ABOVE, IN 1907.

STRIKING CENTRAL-STATION ADVANCE IN LESS THAN TWENTY YEARS.

Some Recollections of Central-station Development.

By Samuel Insull,
President, Commonwealth Edison Company, Chicago.

THE first central-station installation which I ever saw was the first one that was ever built. It was installed at Menlo Park, N. J., by Mr. Thomas A. Edison in the winter of 1880-81 for the purpose of demonstrating the success of what

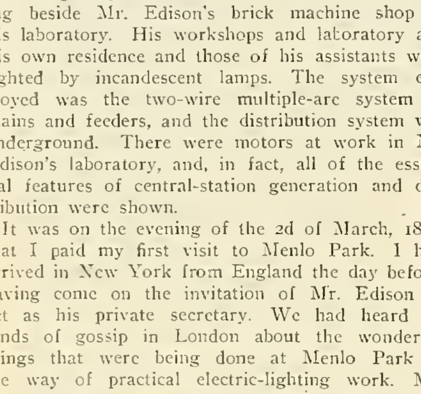


EDISON "Z" TYPE DYNAMO (CAPACITY, 60 LAMPS) OF 1882.

was popularly called the subdivision of the electric light.

The generating station was composed of nine or ten 60-light dynamos and was situated in a building beside Mr. Edison's brick machine shop at his laboratory. His workshops and laboratory and his own residence and those of his assistants were lighted by incandescent lamps. The system employed was the two-wire multiple-arc system of mains and feeders, and the distribution system was underground. There were motors at work in Mr. Edison's laboratory, and, in fact, all of the essential features of central-station generation and distribution were shown.

It was on the evening of the 2d of March, 1881, that I paid my first visit to Menlo Park. I had arrived in New York from England the day before, having come on the invitation of Mr. Edison to act as his private secretary. We had heard all kinds of gossip in London about the wonderful things that were being done at Menlo Park in the way of practical electric-lighting work. Mr.



"JUMBO" STEAM DYNAMO OF 1882, EXHIBITED AT CHICAGO WORLD'S FAIR 11 YEARS LATER AS AN ANTIQUE.

Edison had been writing to his English friends for two years prior to the date of my arrival in New York telling of his success, but as we had had no demonstration of it on the other side of the water and as scientists on both sides of the Atlantic expressed their doubts as to the results of Mr. Edison's experimental work, my natural desire when I arrived here was to pay an immediate visit to Menlo Park and cable my English friends that I had actually seen Mr. Edison's central-station system at work.

So far as the service rendered, this first experimental plant at the birthplace of the central-station industry was as perfect as the service now given by any of the central-station companies in our large cities. And although, instead of using in the generating station steam turbo-generators of a capacity from 10,000 to 15,000 kilowatts, small bipolar machines of from six to ten kilowatts capacity were used, yet the main essentials of central-station engineering, as practiced today, were shown in this original and successful effort at central-station building. There was the multiple-arc distribution system with feeders running from the generating station to various points in the system of mains in order to equalize the pressure, incandescent lamps and motors running in multiple, and the street wiring system thoroughly insulated and laid underground; in fact, all the essentials of modern central-station distribution.

At the same time and running from the same generating station Mr. Edison had in operation about a mile of electric railway, the track being partially insulated and used for conducting the current. A speed of 42 miles an hour was attained, and over 5,000 people rode on this experimental electric railway.

While Mr. Edison used the bipolar form of machine in his first experimental station, belted to a slow-running Corliss engine, he had in mind, even at that early date, that the direct-connected unit was the true engineering practice, and he had built an experimental Porter-Allen engine of about 100 horsepower, running at a speed of 600 revolutions per minute, directly connected to a bipolar machine laid on its side with an armature of the bar-and-disk type. It was found, however, that the speed of this unit was too great, and, beyond a few experimental runs, nothing was done with it.

The exhibition of this first central-station plant at Menlo Park closed what might be called the experimental development period of the business, and the next step was the building of the first commercial central-station system, which was located in New York in the downtown district, between Wall Street on the south, Fulton Street on the north, Pearl Street on the east and Nassau Street on the west, the generating station being located near the corner of Fulton and Pearl streets, and consisting of six direct-connected units, driven by Armington & Sims engines running at about 350 revolutions per minute, each unit having a capacity of about 700 16-candlepower lamps, the lamps in use at that time consuming about one ampere at 110 volts. It is interesting to note that the machine was the first successful direct-connected steam dynamo, and was known as Edison's Jumbo machine. This same type of machine was subsequently used in London (England), Milan (Italy) and Santiago (Chile). This plant was started on the 5th of September, 1882, with 5,500 lamps connected, and at the end of 14 months of continuous running had 508 customers and was wired for between 12,000 and 13,000 lamps.

At the same time that this station was under construction in New York city a much smaller central-station plant was built at Appleton, Wis., and on account of its smaller size was in operation a few months earlier than the New York plant, so that the first commercial central-station incandescent lighting plant started anywhere in the world was at Appleton, Wis.

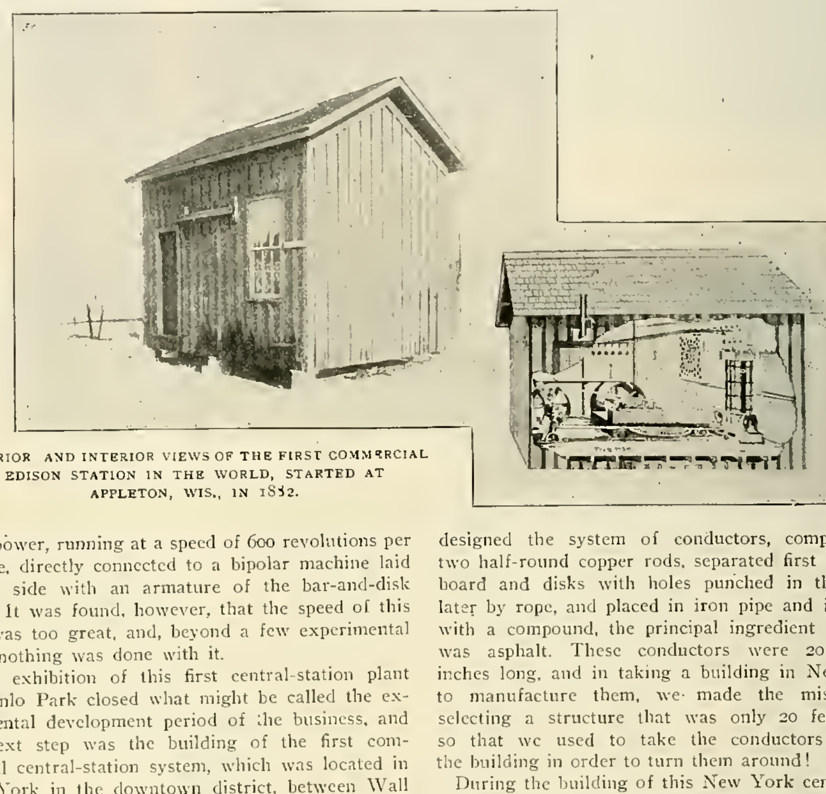
I can well remember the early experiences in central-station construction in New York in the winter of 1881 and the summer of 1882. The men familiar with the work could at that time be counted on the fingers of one hand. There were Mr. Edison and three or four assistants.

After Mr. Edison got through with his experimental work at Menlo Park, he and his assistants had to pick out the territory in New York for central-station distribution, decide on the generating capacity necessary and the size of conductors required. Then, after the general specifications for the work had been prepared, it was necessary that there should be provided factories in which to build the generating machinery and underground conductors needed; also supplies, such as lamps, sockets, switches, meters, etc. All these establishments had to be started and organized and the machinery produced and put in place and the necessary central-station operating force taught to operate and take care of the central-station system.

This work—all of it—had to be done by a few men whose only experience was that gained in demonstrating experimentally at Menlo Park Mr. Edison's inventions and ideas for central-station work.

One of the greatest troubles Mr. Edison had to contend with was the manufacture of the underground conductors. No manufacturer at that time would undertake the work. No one believed that large volumes of current, even at so low a potential as 100 volts, could be successfully distributed by an underground system in the city of New York.

Mr. Edison, assisted by the late Mr. John Kruesi,



EXTERIOR AND INTERIOR VIEWS OF THE FIRST COMMERCIAL EDISON STATION IN THE WORLD, STARTED AT APPLETON, WIS., IN 1882.

designed the system of conductors, composed of two half-round copper rods, separated first by cardboard and disks with holes punched in them and later by rope, and placed in iron pipe and insulated with a compound, the principal ingredient of whch was asphalt. These conductors were 20 feet 6 inches long, and in taking a building in New York to manufacture them, we made the mistake of selecting a structure that was only 20 feet wide, so that we used to take the conductors outside the building in order to turn them around!

During the building of this New York central-station system I was mainly engaged in the daytime in looking after Mr. Edison's business affairs. The laying of underground conductors used to take place at night, and the work of laying was superintended by Mr. Edison and Mr. John Kruesi, the latter being occupied in the day in manufacturing the conductors, or, as they were then known, "Kruesi tubes." I was in the habit of assisting them at night, my main duty being to sit on a street corner and watch a galvanometer used in testing the tubes for insulation.

While the original system in New York city was financially successful, it was very difficult to get capital to embark in the business generally throughout the United States. For some years the business went very slowly indeed. Efforts were made to cheapen construction and adapt the apparatus to the requirements of small towns. Mr. Edison invented the three-wire system in 1882; and the development of the central-station business, while really starting on a large scale in New York, was for a number of years afterward confined to the smaller towns of Pennsylvania and New England, and the development and growth of the business in the larger cities outside of New York did not commence to make substantial progress until some years later.

While the direct-current business was being exploited by the Edison companies, the Westinghouse Electric Company and the Thomson-Houston Elec-

ELECTRICITY BUILDING AT NIGHT.—CHICAGO WORLD'S FAIR OF 1893.

tric Company were engaged in pushing the alternating-current business and using as a basis for it the old arc-light companies which in a number of cities had been formed mainly by the Brush Company for doing city lighting. For a number of years there was the most heated and acrimonious discussion between the champions of the two different forms of current (direct and alternating), but all this has long since passed away, and current of both descriptions is being used by the large companies at the present time; in fact, among the largest manufacturers of alternating current in the country are the old Edison local companies, which have always kept the lead in connection with central-station development.

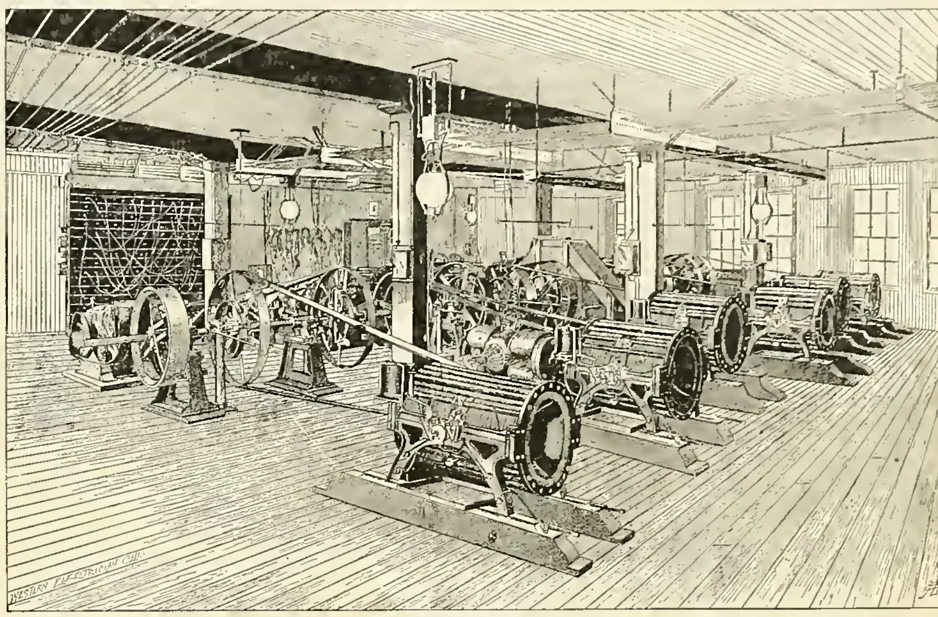
Some of the earliest three-wire central-station installations with overhead conductors were made at Sunbury, Shamokin and Mt. Carmel, Pa., and at Piqua, Ohio, the early three-wire underground systems in the smaller cities being laid in Brockton, Fall River and Lawrence, Mass., Rochester and Newburgh, N. Y., and Detroit, Mich. Among the larger cities, Brooklyn, Boston and Philadelphia had Edison three-wire plants in operation before any attempt was made to install large central-station three-wire plants in the West. It was not until 1887 that the Chicago Edison Company was organized by the men who originally controlled the Edison light and power patents for Illinois and some of the surrounding states. The Chicago Edison Company started with a capital of $500,000.

In 1885 the Edison companies had grown to such proportions that there were enough Edison companies to form the "Association of Edison Illuminating Companies." The first convention of this association was held at Harrisburg, Pa., on April 15th of that year, under the presidency of Mr. James S. Humbird, who at that time was interested in the Cumberland (Md.) company.

Just prior to that, on February 25, 1885, the "National Electric Light Association" was formed, holding its first convention at the Grand Pacific Hotel, Chicago, Mr. J. Frank Morrison of Baltimore being the first president.

Both of these associations have had great influence in assisting in the development of the central-station business, and are today the two representative bodies of the industry.

The development of the central-station business in the West dates practically from the formation of the Chicago Edison Company in 1887. While at this time there were a very large number of series arc lighting companies throughout the Central West



Reproduced from the Western Electrician of May 5, 1888.
DYNAMO ROOM OF THE CHICAGO ARC LIGHT AND POWER COMPANY.

and the far West, a number of which were operating alternating-current plants, the rapid growth in the West of the central-station business on a large and comprehensive scale did not take place until after the first Edison station started in Chicago in 1888.

This was followed by the establishment of Edison low-tension plants in most of the larger western cities, until by 1892 there was scarcely a large center of population in the United States that had not a flourishing central station company in operation. In later years, the old rivalries having passed away, the Edison and alternating-current plants have consolidated, as a rule into one organization in each city, much to the advantage of the public in the direction of lower prices and better service, and to the investor in a better return on money invested owing to the stoppage of the duplication of investment and organization.

Today in the cities of the first rank the central-station business has got to the point of a vast manufacturing business, the tendency being to install large turbo-generators of from 10,000 to 15,000 kilowatts capacity, producing high-tension alternating current, which is transmitted to rotary sub-stations where it is transformed into direct current of various pressures dependent on whether it is to be used for electric light and industrial power purposes or street-railway work. In other cases the sub-stations are composed of step-down transformers to reduce the voltage to that ordinarily used for alternating electric light and power distribution.

The experiences of the last few years have shown very distinctly that if the central-station companies of the large cities are to maintain their positions, they must go more and more into the wholesaling of current to large users, such as street-railway companies, elevated-railway companies, and possibly later on to the larger transportation companies of the country.

There is no business that I know of that is benefited more than the central-station business in the way of reduced cost of production by the increased amount of output. The introduction of the steam turbine is especially conducive to the economical production of electric current in very large quantities, both from a capital and operating point of view; and I look forward with confidence to the day when the electric energy required in each of our large cities will be produced under one organization for each city, with a few large generating stations for the production of alternating current, the electric energy being converted into whatever form may be best adapted for the purposes for which it is required.

A canvass of any of the central blocks of buildings in any of our large cities will show an amount of investment in power-producing machinery out of all proportion to that which is really required to render the service demanded within a given territory. As these plants deteriorate and go out of use, central-station connections are taking their place, leading to a saving alike of capital expenditure and operating expenses.

The same remark will apply to a canvass of the power facilities of the various companies using electric energy, such as the street-railway companies, the elevated-railway companies and the interurban-railway companies, in any given territory.

It is easy of demonstration that the most economical thing to do is to produce all the electric energy required in a given territory under one organization, and the central-station company that

ELECTRICITY BUILDING AT ST. LOUIS WORLD'S FAIR OF 1904.

works toward this end will, in my opinion, show a far greater return on the money invested by its stockholders and be able to quote a lower price to its customers than the company which undertakes to do the purely retail electric light and industrial power business of the community, as the latter forms but a small portion of the possible business offering.

The Rise of the Electric Railway.

By Bion J. Arnold,
Chairman, Board of Supervising Engineers, Chicago Traction.

VARIOUS histories of the electric railway have been written at different times, but the development has been so rapid and the progress so remarkable that no article on this subject will fairly represent the magnitude of the work done in this field of electrical endeavor unless of comparatively recent date.

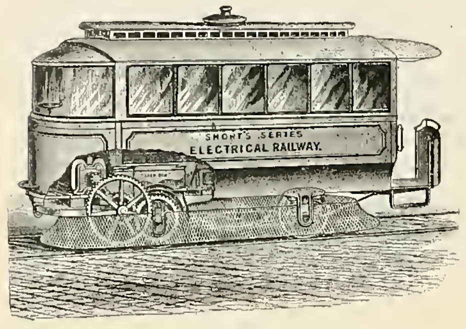
Although the principle of the electric motor was discovered by an Englishman (Barlow) in 1826, and this principle first put into practice in a scientific way by an Italian (DalNegro) in 1830, while its application to the propulsion of a traction vehicle in a miniature way was made by an American (Davenport) in 1835, to be followed by a score or more of scientific experiments of more or less practical value, the first extensive application of the electric motor to the propulsion of electric cars, and the one which probably gave the greatest impetus to the remarkable development which followed, was made by an American (Sprague) in 1887.

BION J. ARNOLD.

While the results of the struggles of the early pioneers were of great scientific value, they nevertheless brought forth no device which could be utilized in the propulsion of electric cars until the invention of the direct-current dynamo by an Italian (Paccinoti) in 1861, the development of which by a Belgian (Gramme) in 1871, combined with the discovery that one dynamo could be operated as a motor from another dynamo, made by two French engineers (Fountain and Breguet) at the Vienna Exposition in 1873, made the electric railway possible. From this date until 1887 the development was comparatively rapid, and numerous lines were built at expositions and in other places, which gave them an opportunity of being of more or less commercial value, the culmination of which came with the construction of the Richmond road in 1887.

It is with the succeeding twenty years, during which time the most remarkable development in the history of the world has taken place in the application of a new force to the uses and conveniences of man—it is to this period that the attention of the readers of this article is directed.

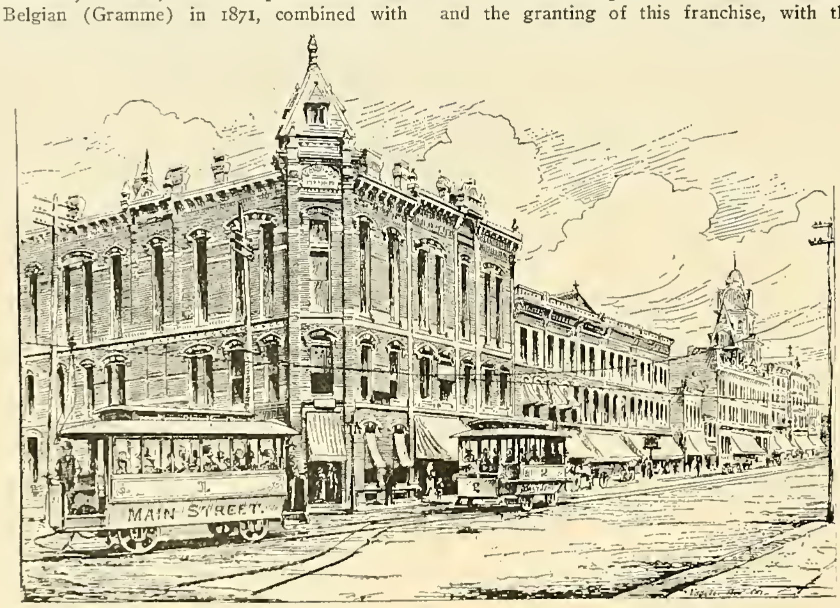
Following the successful operation of the Richmond road came a most rapid conversion from animal power to electric power of street railways of the principal cities of the country, so that by the year 1895 it might be said that almost every city of any magnitude of the United States and many of the principal cities of the world were equipped with electrically propelled cars, requiring for their operation in the United States alone over 8,000 miles of electric railway, using 18,000 cars, and involving an investment of more than eighty millions of dollars.



Reproduced from the Western Electrician of May 19, 1888.
CAR DESIGNED FOR SHORT'S ELECTRIC-RAILWAY SYSTEM.

In 1893, at the World's Columbian Exposition in Chicago, there was put into operation the Columbian Intramural Railway, the first elevated electric railway to be operated in the world, and although the London underground road was placed in operation slightly prior to this date, and the Liverpool overhead road soon after, the opening of the Intramural Railway marked the beginning of the conversion of the elevated railway from steam to electricity. The successful operation of this road caused the announcement by the promoters of a proposed road, since built and known as the Northwestern Elevated Railway of Chicago, to make application for a franchise in 1893, from the Chicago City Council, and to use as one of their main arguments in favor of the granting of this franchise the assurance that the road would be operated by electricity.

The successful operation of the Intramural road and the granting of this franchise, with the distinct understanding that electricity instead of steam would be used as a motive power, not only gave to Chicago and the West the honor of having demonstrated the practicability of electricity for the propulsion of heavy trains, but also marked the doom of the steam locomotive for elevated-railway service. The Northwestern Elevated went into operation in 1900.



Reproduced from the Western Electrician of September 10, 1887.
VAN DEPOELE ELECTRIC STREET CARS IN LIMA, OHIO.

During the construction of the Intramural Railway there was under construction in Chicago an extensive elevated-railway system known as the Metropolitan Elevated Railroad, the work upon which started in 1892. Much of the structure of this road was completed prior to the operation of the Intramural Railway, and its entire structure had been planned for the use of steam locomotives. The success of the Intramural Railway, however, converted the promoters of the Metropolitan to electricity, with the result that contracts for the steam locomotives were countermanded, arrangements made for the propulsion of its trains by electricity, and when it went into operation in 1895 it was an electric road.

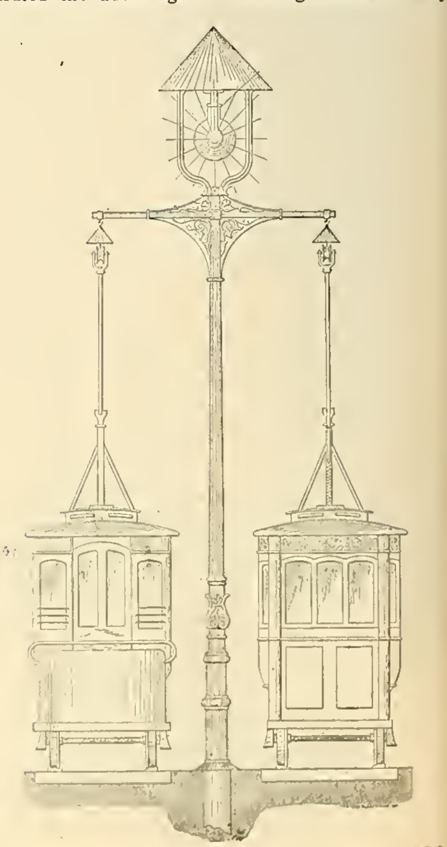
Contemporaneous with the construction of this road and that of the Northwestern Elevated, came the conversion, in 1896, of the Lake Street Elevated Railroad, begun in 1891, and which had been put in operation with steam locomotives in 1893. The electrification of this road and the completion of the Northwestern Elevated was soon followed by the construction of the Chicago Union Elevated Loop in 1897, and the electrification of the South Side Elevated Railroad in 1898, steam locomotives having been in use upon the latter road since its completion in 1892.

Thus within a period of five years all of the elevated railways of Chicago were electrified, and on account of the fact that two of them had been operated by steam for several years, conditions were thus created for the securing of valuable information regarding the relative cost of operation by steam and electricity.

The results of the operation of these roads after electrification, and those of the Liverpool overhead and London underground railways, were so favorable to electricity that it led to the subsequent electrification of all the elevated railways of New York city in 1902 and the construction of additional elevated electric railways in Berlin and Boston in 1901, thus establishing the supremacy of electricity for this class of railway work.

In the electrification of the street railways of cities and for elevated-railway work direct current had been used exclusively, due to the fact that the stops were frequent, the distances to which energy must be transmitted were short, and the special adaptation of the direct-current motor for intermittent work. After the street railways of the cities had been equipped, however, the engineers and others engaged in electrical pursuits sought new fields for their endeavors, with the result that the interurban road came into being, which opened up a field wherein was soon shown some of the disadvantages of the use of direct current for this class of work, due to the great distance over which electrical energy had to be transmitted. To overcome this objection the rotary converter was brought into use and first placed in commercial operation on an extensive scale on the Chicago and Milwaukee Electric Railroad by the writer in 1898, who, following the general practice prior to that time, had used in the construction of the Intramural Railway and other electric railways which he had built, the direct-current system of transmission exclusively.

The successful operation of this road demonstrated the advantages of the high-tension rotary

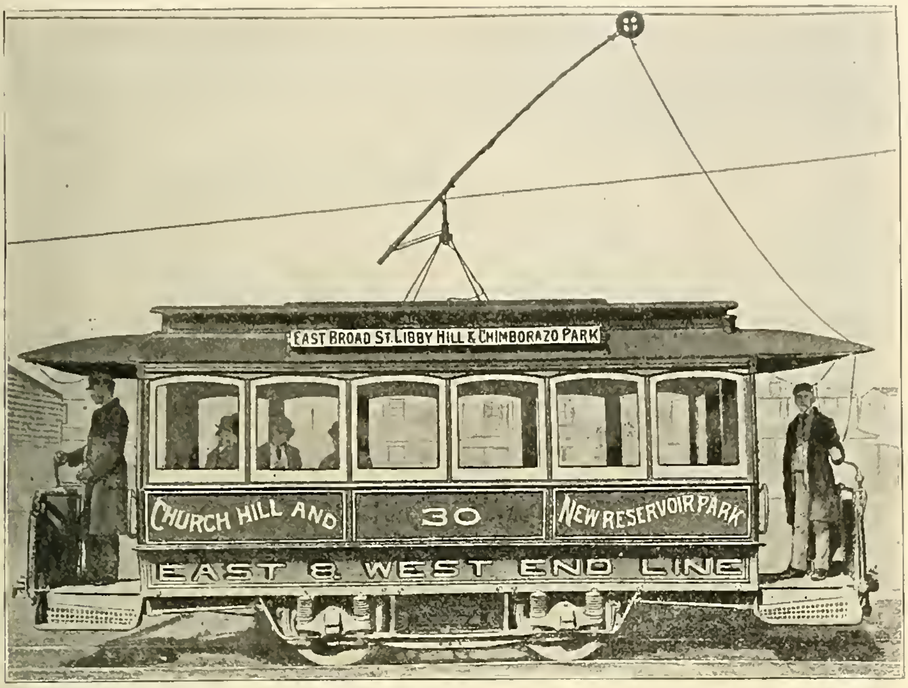


Reproduced from the Western Electrician of January 28, 1888.
VAN DEPOELE DESIGN FOR BRACKET CONSTRUCTION.

converter transmission plan so thoroughly that the practice became standard, with the result that this system has been used in almost all of the interurban roads built since, and by its use rapid transportation has been established between the various cities and towns of the United States as well as between those of other countries, resulting in the great improvement of sociological conditions of those living contiguous to these roads.

An idea of the remarkable development in this field may be obtained from the statement that at the present time there are in operation in the United States alone something over 12,000 miles of interurban electric railway, connecting with urban systems which bring the total electric railway mileage up to something over 30,000 miles, and aggregating in cost probably over $600,000,000.

The electrical engineer and his associated allies having thus devoted their energies to successfully equipping the street-railway systems and the interurban railway systems of the country, have in addition to these accomplishments been devoting their energies toward the electrification of steam railroads, with highly successful results.



Reproduced from the Western Electrician of May 12, 1888.
ONE OF THE CARS ON THE HISTORIC RICHMOND (VA.) LINE.

In 1902 the New York Central Railroad Company, having in view the elimination of the objectionable conditions surrounding the operation of its tunnel through Park Avenue and the improvement of its service within the vicinity of New York, had the question of the feasibility of the electrificaton of its terminal investigated by the writer, with the result that electrification was finally decided upon by its board of directors. A commission was organized in 1903 to prosecute the work, with the result that it was decided to electrify some 300 miles of track and to haul all of the trains of the system by electricity while entering the Grand Central terminus.

Some time subsequent to this, although practically contemporaneous with this work and induced by it, came the electrification of the New York, New Haven and Hartford Railroad from New York city to Stamford, Conn., 30 miles from New York, involving the electrification of something over 80 miles of track, with a fair prospect of the extension of electrical operation toward Boston.

The application of electricity to railway terminals has brought about another condition of far-reaching effect, for it permits the construction of terminal stations in such a manner that trains may enter at different levels and provide equal convenience to the passengers of all, thus making a tunnel entrance to a city equally as desirable as a surface entrance. This advantage is being utilized on a grand scale in the construction of the terminals of the Pennsylvania and the New York Central railroads in the city of New York, and it is not improbable that it will soon be utilized in the city of Chicago.

In the case of the Pennsylvania company, tunnels are now being constructed from the New Jersey side, passing under the Hudson River, across Manhattan Island, then under the East River to Long Island City, through which the passenger service of this road will be carried, thus making possible the construction of a magnificent terminal station in the heart of the city of New York without vitiating the atmosphere or encumbering the streets.

The New York Central terminal will be constructed on a double-deck plan, the suburban service coming in on the lower level, while the upper level will be occupied by express trains.

The result of the labors of those engaged upon these works is worthy of note. Not only will the trains of the Pennsylvania company, which now stop at Jersey City, be brought into the center of New York city, but all of the passenger trains of the New York Central Railroad and practically all of the suburban trains of the New York, New Haven and Hartford entering the New York terminal of these roads are propelled by electricity. Soon all of the trains of the New York, New Haven and Hartford Railroad will be thus operated, thereby eliminating the steam locomotive from the city of New York forever—a condition which has been brought about by the active co-operation of the engineering, financial and executive talent of these roads with the manufacturing companies furnishing the apparatus, and the judicious expenditure of approximately $300,000,000 for electrical apparatus and terminal improvements made possible by the adoption of electricity.

Furthermore, the construction of passenger subways for passenger service in New York, London, Berlin, Budapest and Paris are other notable examples of the application of electricity to the transportation problem. In Chicago there has been constructed something over 50 miles of freight subway underlying the principal streets, through which the freight from the various railway terminals will be delivered into the basements of the principal business houses, thus removing from the streets the obstructions and objections incident to the movement of this freight upon the surface. When Chicago has put into effect plans now contemplated there will be, in addition to the elevated and surface tracks, three levels of subways below the surface, thus making it probably the greatest example of the development of this class of service in the world.

Other cases might be cited, such as the Baltimore tunnel of the Baltimore and Ohio Railroad at Baltimore, which has been in operation since 1895; the St. Clair tunnel of the Grand Trunk Railroad system under the St. Clair River between Port Huron, Mich., and Sarnia, Ont., and the Detroit tunnel of the Michigan Central Railroad at Detroit, under the Detroit River, where electricity will soon supplant steam in the hauling of heavy freight and passenger trains.

In addition to these prominent examples there are now in operation a number of railways built from the start as electric railways, operating under conditions approaching steam-railroad practice, and these, with the examples above mentioned, the Simplon Tunnel line (by which the traveler is conveyed from Switzerland into Italy without the annoyance of obnoxious gases from the steam locomotive), the Erie Railroad, the Lancashire and Yorkshire of England and the Valtellina line of Italy, all of which are in operation, are conspicuous examples of what electricity is now doing in heavy railroad work, and while this list is by no means complete, it indicates what may be expected in the future.

In addition to the conclusive evidence of the successful operation of the roads above mentioned there are now either under contract for construction or under contemplation numerous other important applications of electricity to steam-road conditions, as shown by the contract recently let for the electrification of the Cascade division of the Great Northern Railroad, by means of which it is expected that the capacity of the Cascade division of this road will be greatly increased and its operation made more safe. The Southern Pacific Railroad Company is also contemplating the electrification of one of its heaviest divisions through the Sierra Nevada Mountains for the purpose of eliminating the difficulties due to tunnel operation, and has recently let a contract for the electrification of its entire terminal system at Oakland, Cal.

The writer, although the first to put into extensive use the rotary converter sub-station system for railway work, soon realized its limitations, which caused him to conduct a series of experiments at Lansing, Mich., from 1900 to 1903, with the object of using the single-phase alternating current directly in the car motor, so as to eliminate the sub-station feature of the then standard system and at the same time economize in copper by using a higher working pressure on the working conductors.

These experiments so stimulated the work of others that various single-phase systems were developed and placed upon the market in 1904, so that, although the direct-current system had been adopted by the New York Central commission when it had to make its decision in 1903, by the time the engineers of the New York, New Haven and Hartford were required to act, the single-phase system had been sufficiently developed to be considered a formidable rival of the well-established and well-behaved direct-current motor.

These engineers decided in favor of the single-phase motor, with the result that we now have two of the leading railroads of the world operating their trains into the same terminal and over the same tracks for a considerable distance, but using entirely different systems and methods of applying electricity to the propulsion of their trains, one using the direct-current motor with the third rail for a working conductor, while the other uses the single-phase alternating-current motor and an overhead conductor.

Thus we have a splendid example of a "battle royal" on a grand scale of two formidable rivals for supremacy in the application of electricity to steam-railroad work.

In the meantime the three-phase system as developed in Hungary has been in successful operation on the Valtellina line and the Simplon Tunnel previously mentioned, and has been recently adopted by the engineers of the Great Northern Railroad Company in this country for its Cascade division, while the single-phase system has been adopted by not only the Grand Trunk Railroad Company for its St. Clair Tunnel installation but for a number of other installations involving heavy work. Therefore, we stand a fair chance of soon realizing from the results of actual practice the relative merits of the different systems.

Concluding this brief outline of what has been accomplished in the electric-railway field we may reasonably ask, what of the future?

In writing upon this subject in 1904 the writer then announced that it was his firm opinion that conditions would compel the steam-railroad companies to absorb the principal interurban lines paralleling them and convert them into local feeders for their through-line trains; that the steam-railroad companies would, either for the purpose of producing more economical conditions of the operation of their terminals, or from the force of pressure brought about by the officials of municipalities, which would compel them to equip their terminals electrically on the ground that steam locomotives in our cities are a public nuisance, become not only owners but operators of electrical properties; that with their terminals thus equipped electrically and the interurban roads between these terminals operated electrically the next step would be the electrification of the trunk-line passenger tracks between these electrified terminals. Thus when one road which ran through a territory sufficiently populous to warrant the operation of passenger service by electricity became equipped electrically, other roads competing between the same cities for passenger business would be compelled to do likewise, owing to the advantages afforded to passengers by electrically propelled trains. In this manner the roads would gradually be electrified and ultimately the principal trunk lines of companies operating in populous districts would be operated by electricity.

The first step has already been taken in the absorption by principal steam-railroad companies of many of the competing trolley lines. The second step is being rapidly realized by the electrical equipment of the terminals in the city of New York, the recent awarding of a contract for the electrification of the terminals of Oakland, Cal., and the present agitation for the electrification of the terminals in the city of Chicago. The third step, the connection of the main terminals and the operation of electric trains between them, seems to be but a question of time, although it should not be assumed that the steam locomotive is soon to be banished from its legitimate field, wherein it excels as an economical agent for moving heavy trains at infrequent intervals.

Pacific Gas and Electric Association.

Writing under date of September 18th the San Francisco correspondent of the Western Electrician says: "The annual convention of the Pacific Gas and Electric Association is now in session at the Casino, Santa Cruz, Cal. The convention opened Monday and will close today. About 75 delegates from different parts of the state are in attendance. On the main floor of the Casino is a creditable exhibit of gas and electrical appliances for heating and lighting. Last night the association was banqueted in the Casino grill, and today the delegates are the guests of W. J. Dingee on a trip of inspection to and through the big cement works of Davenport."

Electric Heating and Cooking.

Although it is only within the last half dozen years that electric heating and cooking has really been taken seriously as an important branch of the industry, the art dates back at least 18 years and perhaps farther than that. At the Chicago World's Fair of 1893 there was quite an extensive exhibit of this character, with a colored cook in charge of the demonstrations, and it attracted much popular attention. Development was slow, however, owing partly to defects in earlier types of apparatus and partly to apathy of central-station managers, but mainly to the expense to the user, compared with other methods, due to cost of current. But of late years the business has been pushed energetically; appliances have been improved, simplified and multiplied in number; central-station men have been aroused, owing largely to the success achieved by the humble electric flatiron; and, with the constantly decreasing cost of electric current, electric heating and cooking seem to have a bright future.

In a paper read before the convention of the National Electric Light Association in May, 1904, Mr. James I. Ayer, manager of the Simplex Electric Heating Company, said:

"The earliest work of a substantial character was begun by the Carpenter Electric Heating Company of Minneapolis in 1889, and continued through a checkered career for several years. Other companies were numerous and short-lived, as most of them deserved to be. While the earliest products were not all that could be desired, and much crude experimenting was conducted at the expense of the enterprising public, some of the product justified itself in the way of fair performance. Had there been a more general use of current in residences and industrial establishments to make the market worth while, a different history would have been written.

"Considerably less than ten years ago there were few central stations outside of the largest cities which supplied current in the daytime. In such cities the rates were high, with the use of constant-potential current limited largely to the most important stores, few residences, and fewer industrial enterprises. The isolated plants were small and used entirely for lighting for a few hours a day.

"Six or seven years ago the conditions rapidly changed, but prior to this, because of the early numerous failures of electric-heating companies and the sad experience of the public with much of their product, electric heating had become as much discredited as had the storage battery earlier. Extraordinary efforts were required to place the storage battery where it rightfully belonged, even several years after its revival abroad pointed the way, so strong was the prejudice of our fraternity due to their faith in tradition.

"Electric heating, while not meriting the same consideration, was very seriously retarded in its development by this same prejudice, and after eight years' effort, during which period much improvement had to be made to make possible such success as has obtained, I can say that the present results would have been achieved much earlier had there been no past.

"The future of electric heating is assured, and yet it has in it disappointing elements for its advocates who do not rightly comprehend its limitations. In the early days of electric lighting the salesman confidently asserted that all the speculative dreams of the inventor could be accomplished by anyone who would purchase his particular dynamo and appliances. Electric heating is capable of being misunderstood to a considerable degree. The engineer, without some thought, will wonder how we can successfully heat with electricity the staterooms of an ocean liner, competing with steam, while deriving power from steam, when we cannot heat an office with current from waterpower at $30 a year per horsepower, or by meter at three cents per horsepower; yet it is true. If this is a problem to an engineer, how does it appeal to the layman?

it will be found that many things are possible that are not commercially practical, and many that appear so are not, and because of this I want to appeal to you as central-station men to get a grasp of the elements of electric heating, and a knowledge of working conditions, that you may move rapidly and reap the benefits of intelligent application of this branch of development."

It is interesting to note the steady advance of the business in recent years. For the last four years the Western Electrician's New Year's estimates of the value of electrical heating and cooking apparatus produced in the United States were as follows: 1903, \$325,000; 1904, \$425,000; 1905, \$650,000; 1906, \$850,000. Unless all signs fail, the value of such appliances made and sold in the United States in 1907 will be well over a million dollars.

Electric Street Lighting Twenty Years Ago.

By Albert Scheible.

In street lighting as in many other applications of electricity the early part of 1887 showed that unrest which usually precedes decided advances, and before the year was old four important forward steps had been realized. The first consisted in the introduction of alternators and transformers where only direct-current machines had formerly been used. Profiting by the European work of Gaulard, Gibbs, Zipernowski and others, three American firms developed alternating-current apparatus. Stanley (then electrician of the Westinghouse Electric and Manufacturing Company), Elihu Thomson and Slattery worked with almost feverish haste. The National Electric Light Association received a decidedly favorable report on the practicability of induction systems for electrical distribution, and the foundation was laid for the gradual crowding out of the direct current for street lighting.

A second step of great bearing on street lighting was the development of low-resistance incandescent lamps, suitable for use on series circuits. Up to that time street lighting had simply meant the use of series arc lamps (all direct-current "open" arcs) with crude supporting arrangements, though some few places supplemented the arc lamps with a so-called "series-multiple" system supplied by the Brush Electric Company. This system used incandescent lamps by connecting five (specially selected for practically equal amperage at the same voltage) in multiple and inserting them directly in the series arc circuit. Its use simply reflected the crying need for some means of running incandescents on circuits whose high voltage meant economical distribution, but the difficulty of balancing the resistances of the lamps of each group if separated by more than a few yards limited this plan greatly. A few places did use street incandescents in series but on circuits of very low amperage, as, for instance, Lawrence, Mass., where three-ampere circuits were used with an electromagnet at each lamp to shunt the same when the filament burned out. During 1887 Bernstein (in England) developed a low-resistance incandescent lamp suitable for use singly on series circuits of 6.9 and even 9.6 amperes, and the Thomson-Houston Electric Company also offered lamps for the same purpose.

But while the demand for a more subdivided light led to the making of series incandescents for use as small and widely scattered units, the same period was also marked by warm controversies as to the use of towers for lighting cities by groups of arcs forming units of very high candlepower. A number of American cities had already been lighted in this way, but some were dissatisfied with the plan, as, for instance, New York city, where 23 arc lamps on poles were substituted for the tower lamps in Madison Square and Union Square. In Europe the Eiffel Tower project gave a concrete basis for a lively discussion of the same topic, in which prominent engineers took an active part. This was to be expected, as the stone tower (for which Eiffel's steel design was substituted because of its lower first cost) was originally planned by Bourdais with the prime object of lighting the entire city of Paris electrically. Some held that arc lamps supported 300 meters above the ground would make this an effective "sunlight tower," while others tried to calculate the absorption of light by the air, the possible increase of efficiency by placing a band of mirrors above the lamps, and the size of enclosing globe or lantern needed for diffusing the light so as to avoid dazzling the eye.

The same tendency toward the use of towers led to plans for stringing distribution wires on high towers instead of running them on poles or in conduits. Projects for thus placing the wires on poles 80 to 130 feet high were proposed for cities like New Orleans and St. Louis. But the reaction soon set in, so that most electric-light men of today look upon towers as mere historic relics, although there still may be many places where their use would be both practical and economical.

The fourth turning point came in the introduction of specially designed line material in place of the improvised construction previously permitted. Up to that time crude materials had been gathered from various sources. Thus hay-fork pulleys and ¾-inch manila rope for hoisting the lamps, with the rope run diagonally down from the pulley to a cleat on the pole and a bungling coil of rope there, made up the arc-lamp suspension. For insulation a broomstick with a porcelain knob at each end guided the line wires over each lamp, the wires themselves having the wonderful "underwriters' insulation." Now the art was ready for better construction, and the materials for it came almost simultaneously from the East and the West. Thomas Brady and Harry Cutler, with their mast-arms, and John Fletcher, with his sleet-proof pulleys, paved the way for modern construction. Bell insulators, safety pulleys or hanger cut-outs were still far in the distance; but before the year ended energetic dealers were pushing practical devices which marked the introduction of a higher grade of material.

Thus the epoch of transition and growth during which the Western Electrician saw its birth, and which it undoubtedly speeded, showed four decided effects on electric street lighting:

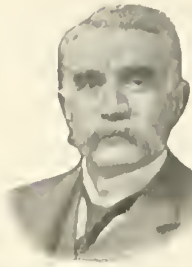
First—It proved the practicability and economy of distribution by alternating currents.

Second—It brought out low-resistance incandescent lamps, thus making series incandescent lighting feasible.

Third—It showed tower lighting to be quite limited in its effectiveness for modern street lighting.

Fourth—It introduced properly made appliances for supporting and insulating street lamps.

Yet with these important transitions no one dreamed of enclosed arc lamps or alternating arcs, 150-light series dynamos, tub transformers, rectifiers, shunt boxes, Nernst lamps, flaming arc lamps or magnetite arcs. All these have come with the last twenty years. Does not that fact in itself show how rapidly we have progressed in electric street lighting?



Charles F. Brush.

Leo Daft.

Elisha Gray (deceased).

S. H. Short (deceased).

Charles J. Van Depoele (deceased).

FIVE DISTINGUISHED ELECTRICAL INVENTORS OF THE WEST.

Progress in Telegraphy.

During the last twenty years telegraphy, which is the oldest of the electrical arts, dating back to 1844, has shown considerable advance, particularly in the introduction of more rapid means of sending by automatic or machine methods, in the substitution of dynamos for batteries as current producers, in the great extension of submarine cables and in the striking increase in the number of code messages.

Robert C. Clowry.

Edward J. Nally.

TWO LEADERS IN TELEGRAPHY IN THE WEST, NOW IN NEW YORK.

The most important question now facing telegraphic administrations is undoubtedly the substitution of automatic for manual sending. The present strike of telegraph operators will no doubt have not a little to do with the expediting of this movement. Three years ago, in a paper read before the International Electrical Congress, Mr. J. C. Barclay, the assistant general manager of the Western Union Telegraph Company, made the following interesting observations on this subject:

"Machine telegraphy is undoubtedly destined to play, if not a dominant, at least a highly conspicuous part in the telegraphy of the future. For the present, and probably for a long time to come, the Morse system will continue to be the standard system employed in this country. It is doubtful indeed if the Morse apparatus—representing as it does the very acme of simplicity—will ever be wholly superseded, but new and improved as well as more economical methods of working will,

Enos M. Barton.

S. A. Barton.

John I. Beggs.

S. M. Hamill (deceased).

H. Ward Leonard.

Anson Stager (deceased).

C. C. Warren (deceased).

Walter H. Whiteside.

SOME OF THE MEN PROMINENT IN THE ELECTRICAL DEVELOPMENT OF THE WEST.

slowly perhaps, but nevertheless surely, limit its field of operations.

"The advances made in recent years in the direction of developing and perfecting a printing telegraph system, adapted to meet all the requirements of a modern telegraph service, have been of such a practical and progressive character as to leave no room for doubt that the successful advent of such systems into the domain of commercial telegraphy will soon be, if it is not indeed already, an accomplished fact."

Another change that has made for greater speed in telegraphing is the great increase in the number of code messages. As shown by Mr. D. McNicol in an article contributed to the Western Electrician three months ago, a cipher telegram was the exception fifteen years ago, while today the plain-language telegram constitutes only about half of the business handled. Other changes are the substitution of the dynamo for the gravity battery and the almost universal requirement that operators shall use the typewriting machine in receiving.

Submarine telegraphs have been greatly extended in all parts of the world, the twentieth century witnessing the spanning of the Pacific, thus supplying the last remaining link in a telegraphic circuit of the globe.

Wireless telegraphy is briefly treated elsewhere.

Electric Power Transmission.

By Chas. F. Scott,

Consulting engineer, Westinghouse Electric and Manufacturing Company.

TWENTY years is in most things a short interval, but in electric transmission of power it is an epoch.

The long-distance transmission of power, as commonly practiced today, was unknown twenty years ago. Some of its fundamental elements had not been discovered, and apparatus and methods which have been in common use for many years were yet to be invented and deevloped.

CHAS. F. SCOTT.

Practically all transmission today is by the alternating-current three-phase system. Twenty years ago the first alternating-current central station in this country had been in operation but a few months. The introduction of the alternating current was encountering the most strenuous opposition, by technical argument, by commercial antagonism and by attempted legal prohibition. There was no commercial alternating-current motor. It was not until May, 1888, that the Tesla patents on polyphase apparatus and transmission were issued and published.

Transformers rarely exceeded two kilowatts in capacity and 1,000 volts in pressure. Insulators and lightning arresters had hardly become clearly differentiated from their telegraphic predecessors, from which they were evolved. Even the direct-current stationary motor was a commercial novelty, and all the electric railway systems in the country aggregated a length of track which could be traversed at present speeds in less than an hour.

Beginning of the Niagara Development.

It is less than twenty years ago that an international technical commission was formed to determine the methods to be adopted by the Niagara Falls Power Company. It was not until 1893, during the World's Fair at Chicago, that final action was taken against the sentiment in favor of direct current by the formal decision to use polyphase alternating current.

At that time commercial frequencies were shifting from 133 cycles to 60 cycles. It was necessary to determine the frequency for the Niagara circuits. It was believed that much of the power would pass through large induction and synchronous motors, or synchronous converters, although such apparatus was more apt to be found in experimental testing rooms or in exhibits than in service. There was very little experience upon which to base the bold recommendation of a low frequency for so large an undertaking. The turbine speed had been fixed at 250 revolutions per minute. The power company's advisers proposed that the generator have eight field poles, giving 16 2-3 cycles (2,000 alternations); the Westinghouse Company recommended 16 poles and 33⅓ cycles (4,000 alternations). The only possible intermediate course was finally chosen—12 poles and 25 cycles (3,000 alternations).

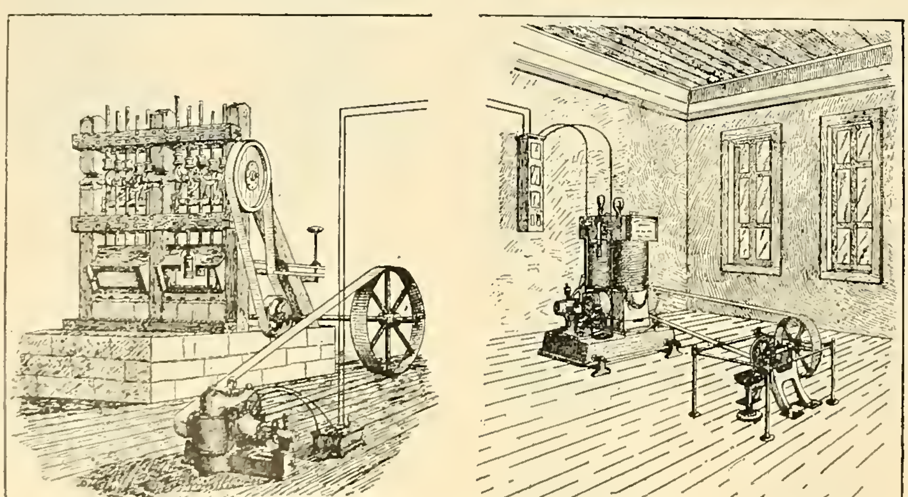
Pomona and Telluride Plants.

In 1892 the first 10,000-volt transmission plant in this country began operation in Southern California, transmitting single-phase current from San Antonio Canon for lighting Pomona and San Bernardino, approximately 14 and 28 miles. There were two banks of transformers, raising the pressure from 1,000 to 10,000 volts. In each bank were 20 six-kilowatt transformers, with primary 1,000-volt windings in multiple and secondary windings (each transformer giving 500 volts) in series. The transformers were oil-insulated, and the cast-iron cases were provided with ribs to increase the cooling surface. The transformers were connected to the line through simple disconnecting switches. The line consisted of No. 7 hard-drawn copper wire supported on specially designed glass insulators which were then considered of quite formidable size. At each sub-station there was a bank of transformers duplicate of those in the power house. There were no lightning arresters—nor was there lightning. The system was about as simple as a typical diagram of a transmission circuit with raising and lowering transformers.

The Telluride single-phase synchronous motor plant was started in 1890. A 100-horsepower motor was operated at 3,000 volts at a distance of several miles. The Redlands plant in southern California, the first 10,000-volt three-phase transmission system in this country, was started about the beginning of 1894.

Then and Now.

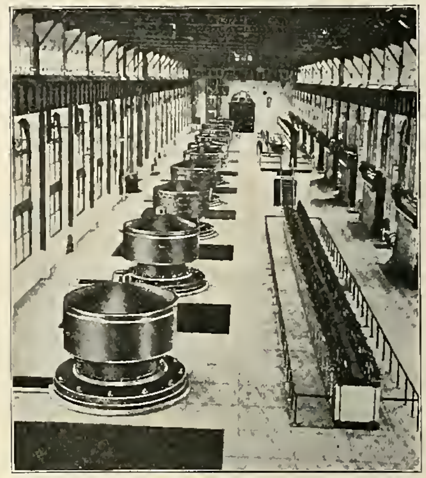
One may look through several volumes of the Transactions of the American Institute of Electrical Engineers in the early '90's and find scarcely a paper on transmission subjects; now the work of the transmission committee is one of the leading features of the Institute publications.



This curious illustration is reproduced from the Western Electrician of June 23, 1888. The text very briefly explains that the power was transmitted four miles, with 25 per cent. loss in transmission, to operate a motor for driving a stamp mill in Idaho.

AN EARLY POWER TRANSMISSION.

At the opening of the International Electrical Congress held at Chicago in 1893, it was found that there were no papers on power transmission among the considerable number which were on the programme. Dr. Louis Duncan came to the writer and asked that he prepare something to help start a proposed discussion on the subject. The outcome was an introductory paper, dealing particularly with the induction motor, by Dr. Duncan, and a description of the Westinghouse exhibit of polyphase apparatus in operation at the World's Fair, by the writer. These papers were followed by an animated discussion, which dealt with general principles rather than particular apparatus or methods. At the similar congress in St. Louis in 1904 there were many papers in the section on Power Transmission, most of them dealing with the results of experience and details of construction and operation.



INTERIOR OF A NIAGARA FALLS POWER HOUSE, SHOWING 10 VERTICAL 5,000-HORSEPOWER GENERATORS.

Such, then, was the early condition of transmission work. A score of years ago it was nil; during the following seven or eight years several sample plants were installed; it was only about ten years ago that operating voltages got much above 10,000 volts, and power transmission assumed commercial importance.

What have been the changes which have taken place in apparatus and methods since the transmission system could be represented by the elementary textbook diagram showing generator, raising transformers, line, lowering transformers and load?

Each element in the system has undergone a remarkable development. Each increase in voltage and in current and in power has called for higher and better quality in design and in construction. Not only has each of a great number of detail parts been individually improved to meet the new requirements upon it, but there has been a general adaptation of parts and elements to form a single great system. In fact, the transmission elements are only a part. The generating plant, the distributing system and the utilization of the power all constitute elements in the system, of which the transmission is but a part. And, further, aside from the engineering and operating features of the system, it in turn has its financial and commercial and economic relations in the general affairs of life. The prices of coal and of copper and the growing uses of power are in a broad sense factors in power transmission just as much as the insulator or the transformer oil.

It will be useful to take a hasty glance at the development which has taken place in the various elements of the transmission system.

Generating the Power.

In the power house the generators have been increased from about 100 kilowatts to sizes varying all the way from 5,000 to 10,000 kilowatts. These generators are alternators usually delivering three-phase current. This is somewhat remarkable, since a general discussion fifteen years ago was apt to treat transmission by direct current or single-phase current with high respect and anticipation.

In connection with the larger generators have come consequent developments in the switches and controlling appliances between the generator terminals, bus bars and raising transformers.

The Transformer.

The transformer has grown from a few kilowatts to a few thousand kilowatts in output and from a few thousand volts to commercial voltages ranging all the way to 100,000 volts. In the transformer questions of general type, the kinds, the quantity, the arrangement and treatment of solid and fluid insulating materials, the methods of arrangement and mechanical support of the coils for withstanding not only the forces of normal operation but those which may occur in a short-circuit on the secondary lines, the construction of the case and terminals, are all features which have required the most careful consideration. Some of these seemingly minor points have received the attention of experts for years. One of the terminal bushings on a large 100,000-volt transformer of today weighs about as much as one of the complete transformers for the Pomona line.

Insulators and Line Construction.

The insulator, upon which rests probably the greatest responsibility in the transmission system, has grown from the sizes now used for telegraph circuits to most formidable proportions. The matter of surface leakage, which was thought by some to be so important that oil cups were proposed in connection with the inner petticoat for increasing the surface resistance, has been found to be of little consequence compared with other features. It has been only ten years since the attempts in the making of large porcelain insulators resulted in a porous construction, so that the material inside of the glazing would absorb a drop of ink as would a lump of sugar.

In its various features of size and geometrical proportions, of materials, mechanical strength and manufacture, the insulator has called for the best efforts of designers and makers. So far, the development has been almost entirely along a single line. The largest insulator is similar to that used for telegraph lines in that it is mounted upon an upright pin, carries the wire near its top, and secures surface distance by means of petticoats. This simple type loses much of its simplicity when large sizes are reached. The conductor is so high above the cross-arm that cross-arm and pin and insulator must be made large and strong to secure mechanical strength. Insulator petticoats are large and fragile. The insulators are heavy and difficult to handle, making the replacement of a broken insulator a serious matter. The ordinary type is such that increase in size makes the mechanical stresses very much greater. Thus the addition of insulating strength brings new difficulties. This time-honored form is now threatened by a radical modification. In one new type the wire is below the insulator and the insulator is in the form of a series of disks linked together to form an insulating flexible suspension.

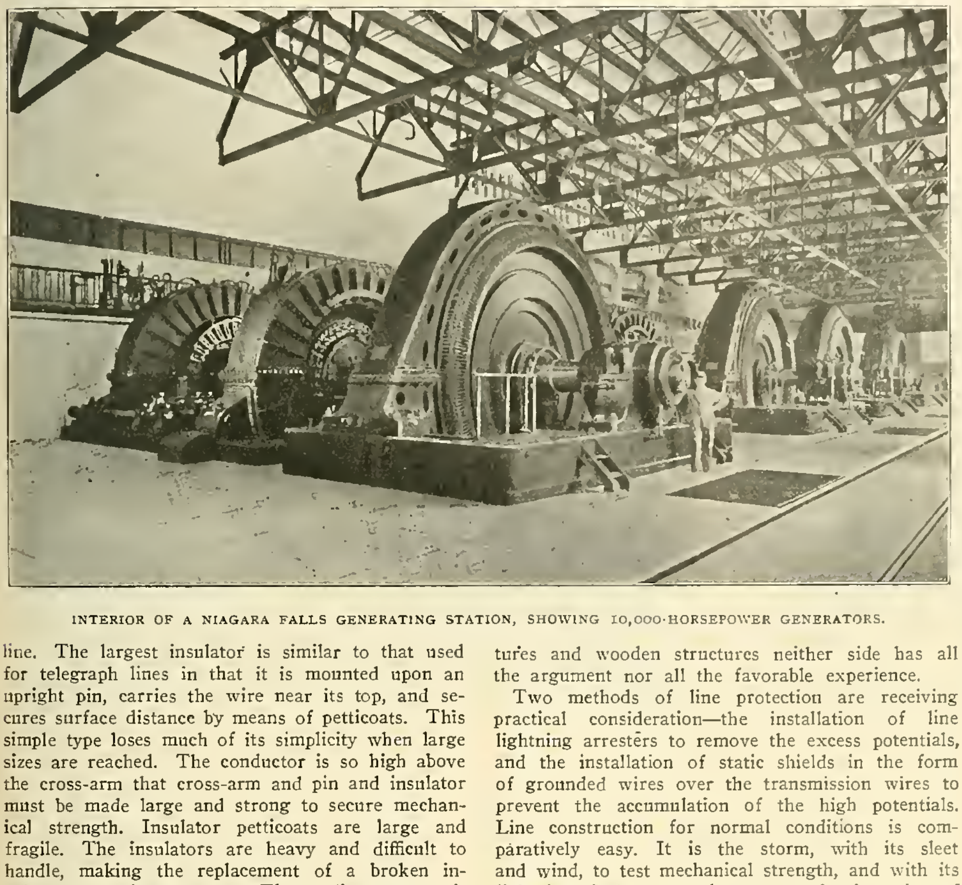
The pole line followed for many years the orthodox method. Wooden poles, 100 to 150 feet apart, with cross-arms, are now giving place to steel towers ranging from a few hundred to a few thousand feet apart. The long spans are made possible by the larger sizes of conductors, made necessary by the transmission of larger quantities of power.

Lightning Protection.

Lightning arresters have taken an important place in transmission development, as a matter of investigation, discussion and observation. The general phenomenon of lightning, both the kind that comes from the heavens and that which comes indirectly from the dynamo in the form of line surges, has made a common field for theoretical investigation, for laboratory research, for design and invention, and for observation and test. Probably no single element has brought together so closely the theoretical and the practical as lightning protection. In the arrester itself the simple spark-gap, with suitable resistances for limiting the current, is now finding a somewhat radical modification in the electrolytic arrester, which realizes in simple form many of the requirements of an ideal arrester, as it is practically impervious to the dynamo current, but responds readily and freely to higher voltages.

It is coming to be generally recognized that lightning protection is not a matter of some simple device to be attached to a system at one or two points, but that the disturbances which are involved are such as require much more general and radical consideration. The design of transformers, of terminals, of switching appliances and of insulators are all involved. The location of the lines, the form and character of the supports for the wires, the protection of the line itself, as distinguished from the apparatus at its terminals, are all elements in the general problem.

In many of the transmission systems the troubles from lightning are not station troubles but line troubles. The apparatus in the station does not suffer, but some part of the line remote from the station. Wooden poles are shattered or burned. Insulators are punctured. Iron pins and iron poles protect the structure, but make the insulator more vulnerable. In the contention between iron structures and wooden structures neither side has all the argument nor all the favorable experience.



INTERIOR OF A NIAGARA FALLS GENERATING STATION, SHOWING 10,000-HORSEPOWER GENERATORS.

Two methods of line protection are receiving practical consideration—the installation of line lightning arresters to remove the excess potentials, and the installation of static shields in the form of grounded wires over the transmission wires to prevent the accumulation of the high potentials. Line construction for normal conditions is comparatively easy. It is the storm, with its sleet and wind, to test mechanical strength, and with its lightning flash or stroke to try the integrity of the insulator, which makes the problem so difficult. The haven of safety for the wires is the earth, and if the wires cannot be put underground, then the ground should be put over the wires.

This problem of line protection from static disturbance is one of the most serious in transmission development, having to do so vitally with continuity of service.

Controlling Devices.

The switching and controlling devices on the high-voltage circuits, which became necessary when the transmission system developed from a line connecting the power house with a single sub-station into a network of many lines and many stations, furnishes in itself material for an extended article. Oil switches; fuses, notably those of the expulsion type; disconnecting switches; station wiring, with compartments for the high-tension bus-bars and wires—all have increased in capacity and efficiency. A radical departure in station arrangement is now proposed by which the bus-bars, high-tension connections and transformers will be located out of doors.

The Development of the Art.

The steps which have marked the progress from the transmission of a hundred kilowatts at 10,000 volts to the systems of today have been little steps. They have not been taken by one man, nor by one company, but by many men in many places. Theoretical study, painstaking experiment, widespread observation and experience, have all contributed. The freedom with which designing and operating engineers have interchanged their knowledge and experience through the reading and discussion of papers has been an effective element in this advance. There are few departments in which engineering co-operation has been more extended and has been fruitful of larger results than in power transmission.

Great as have been the developments which have taken place in the details of the various elements involved in power transmission, they are equaled by the general commercial development, by the amount of money which is invested in transmission systems, by the general confidence in which long-distance power transmission is now held, and the substantial place it is now assuming in modern affairs.

In looking back over the last few years we note the very great development which has taken place. There is no indication now that the limits have been reached. The fact that the principal increases have been made in size, until recently, when new types are being introduced, is significant of the kind of changes which the future may have in store. The introductory sentence of a recent paper by Mr. Frank G. Baum before the American Institute of Electrical Engineers is significant and will bear careful thought: "In designing power-transmission systems it is always well to bear in mind that the ultimate development of the art and of the country has not yet been reached."

Radio-telegraphy.

Radio-telegraphy or wireless telegraphy dates from 1895 and may be fairly said to have been invented by G. Marconi, who, in Italy, in that year, established wireless communication over as long a distance as two kilometers. Early in 1906 Marconi went to England to develop his invention, and in June of that year he obtained his first patent for radio-telegraphic apparatus. The specifications for that patent clearly show, according to Marquis Solari, that up to that date (June 2, 1896) Marconi had not only made the first practical application of Hertzian waves to wireless telegraphy, but had conceived a theory of their action which was broader and more comprehensive than that imagined by Maxwell and contemplated by Hertz, neither of whom had given evidence of their belief that the effect of these waves might not be bounded by the limitations of the electromagnetic theory of light.

Since then great strides have been made in the art, which has engaged the attention of many physicists and inventors, to say nothing of financial promoters. It is said that messages have been sent across the Atlantic, although there seems to be some mystery on this point. At any rate, messages have been sent, received and read, at sea, for distances of more than a thousand miles. Transmission over land has not been so successful, although accomplished for considerable distances.

Among those who have contributed to the technical advancement of the art are Marconi and Solari in Italy, Popoff in Russia, Lodge, Fleming, Preece and Muirhead in England, Branly, Du Cretet and Rochefort in France, Slaby, Braun, Ruhmer, Brandes, Drude and Schloemilch in Germany, and De Forest, Fessenden, Stone, Massie, Squier and others in the United States. Nearly all the important warships and seagoing passenger steamships are equipped for "wireless," while it is believed that there are about 400 land stations in operation throughout the world. Nevertheless, there is little indication that the newer method, now prominently before the public for more than a decade, will supplant electrical communication by wires where the latter can be attained. It is unfortunately true, also, that the financial operations of some of the companies exploiting the various "wireless" systems have not been such as to merit unreserved commendation.

A good review of the art was given in Mr. D. McNicol's recent serial in the Western Electrician on "Wireless or Radio-telegraphy," which was concluded in the issue of February 16, 1907.

Duluth, Minn., and Superior, Wis., are now getting electric power from the large hydro-electric plant of the Great Northern Power Company on the St. Louis River. The first unit was started about two weeks ago. The second will be ready in a few days.

Dynamo-electric Machinery and Its Evolution During the Last Twenty Years.

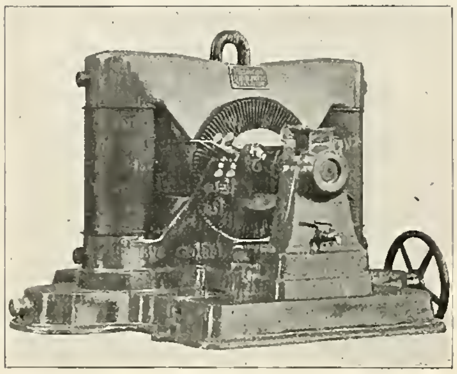
By B. A. Behrend,
Chief Engineer and Chief Designer, Bullock Works, Allis-Chalmers Company.

When the historian-engineer writes upon the evolution of electric machinery during the last twenty years, he must needs write a story in which his own work and the work with which he has been associated form a more prominent part than is desirable in an impartial historical review. But every writer has the defects of his qualities, and the historian-engineer is prone to be either too much of a historian, or too much of an engineer, in relating the story of the growth and development of electric generating machinery and electric motors. No one who has ever carefully read history can deny that the bias of the author lends a peculiar color to his views and statements, and, in writing this article, I cannot plead guiltless of a similar bias.

BERNARD A. BEHREND.

Twenty years ago we find a number of gifted physicists and engineers, the latter mostly of the telegraph type, engaged in fathoming the mysteries of electricity for the purpose of making machines which generate electric energy. Great masters of physical science, as Faraday, William Thomson and Maxwell, understood all about electromagnetic induction, but did not care to build dynamo-electric machinery, or, perhaps, heresy though it may be to say so, could not have done it. Here the engineer stepped in, a little lame, perhaps, in the mastery of theory, but with that creative imagination and poetic vision which form an important quality in the designing engineer.

There were dynamos built by Gramme, by Deprez, by Edison, by Elihu Thomson, by Siemens, and others whose names are beginning to fade from our memory. It must be irreverently stated, however, that our college boys would laugh to scorn these attempts and deem themselves greatly superior designers to the pioneers. The weakness of these early machines was not confined to the electrical design; in point of fact, it has always struck me that these early designers were more deficient in knowledge and experience in mechanical matters than in electrical. And there was much less excuse for this, as the mechanical art was developed and could be utilized without much difficulty. To this condition is to be attributed the deplorable patent situation in the electrical field, which has led to the protection by patent of mechanical features, known for many years, applied to electrical machinery because of the profound ignorance of the mechanical arts displayed by the electrical experts.



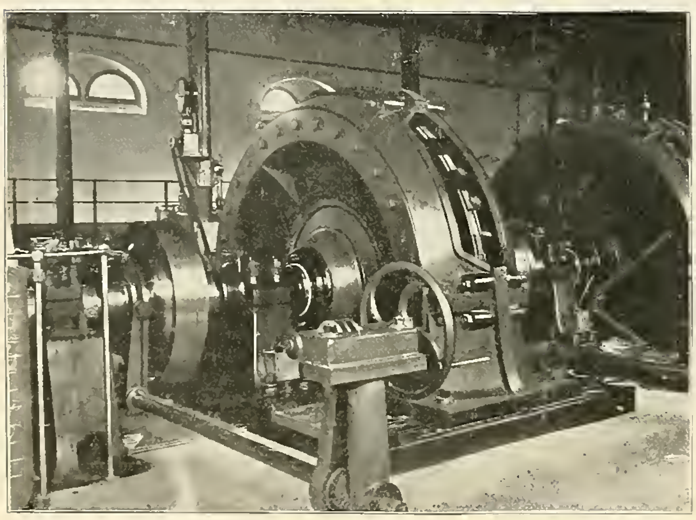
HIGH-VOLTAGE DIRECT-CURRENT DYNAMO OF 1887 (OERLIKON).

I have always contended that electrical designing is but a branch of mechanical engineering, as the design of heat engines is considered but a branch of the same field. That, of course, the electrical engineer should possess a thorough familiarity with the principles of electrical phenomena is as fundamental a requirement as that the steam engineer should know thermo-dynamics. These electrical machines which generated electricity but came to pieces in the process, burning out their bearings and being altogether nothing but toy machines turned over to a millwright, started the procession. And as any glaring faults are often made the starting point for improvements, so the dynamo-electric machine was taken out of the instrument makers' hands and placed with mechanical men in machine shops. In America I believe it was the Westinghouse & Schmidt Company, the precursor of the Westinghouse Electric and Manufacturing Company, which greatly improved the mechanical features of dynamo-electric machinery, while in Europe the Oerlikon Company made machines in which the art of mechanical engineering was utilized to the full.

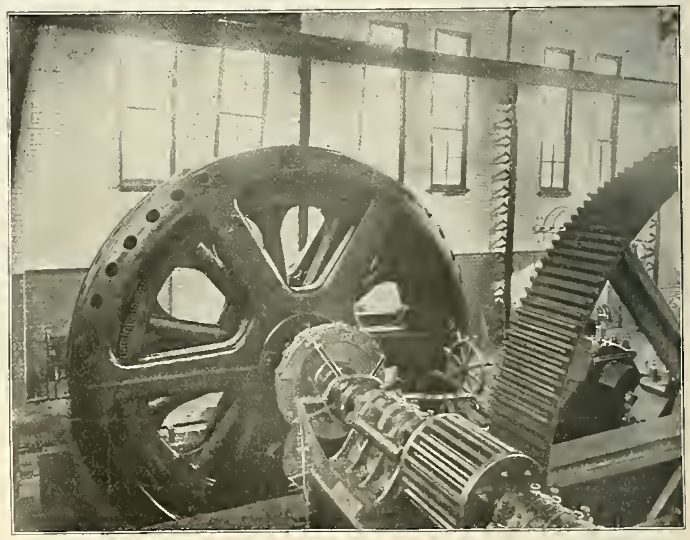
To all those who have followed the recent discussions about the relative merits of single-phase alternating currents and of high-voltage direct current for railway work it must be interesting to be reminded that the first electric generators of any account were direct-current machines of from 50 kilowatts to 150 kilowatts, generating from 1,200 volts to 3,000 volts, and being used for the transmission of power as series-wound machines. These machines were of the Manchester type, credited to Hopkinson, being bipolar and having copper brushes. Both the careful mechanical and electrical work which was put into these forerunners of modern electric machinery is testified to by the fact that a number of these plants are still in operation with commutators whose once cylindrical surfaces have been worn into bodies of revolution with fantastically curved outlines. The series winding of these machines was, of course, an essential condition; but we have in the interpole, which is over twenty years old, and which has recently been unearthed, a means of obtaining equally satisfactory results with shunt-wound generators.

While intent upon the development and improvement of the direct-current machine, there came the startling work of Nikola Tesla, which prevented any further concentration of thought on anything excepting alternating currents and their combinations into polyphase currents. The work of Tesla has never been clearly understood or appreciated according to its intrinsic value by the majority of engineers. Mr. Tesla's early papers are classical contributions to the art of engineering and rank with the best that have been written. This statement is altogether independent of the validity of his patents—a matter which is not here under discussion.

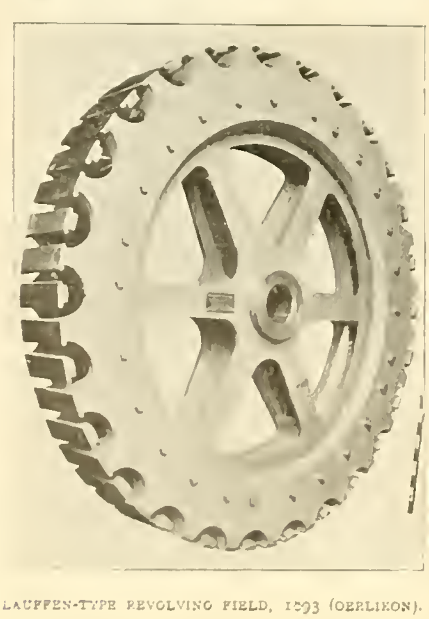
Mr. Tesla is the victim of his friends. It is a peculiar trait of ignorant men to go always from one extreme to another, and those who once were the blind admirers of Mr. Tesla, exalting him to an extent which can be likened only to the infatuated praise bestowed on victims of popular admiration, are now eagerly engaged in his derision. There is something deeply melancholy in the aspect, and I can never think of Nikola Tesla without warming up to



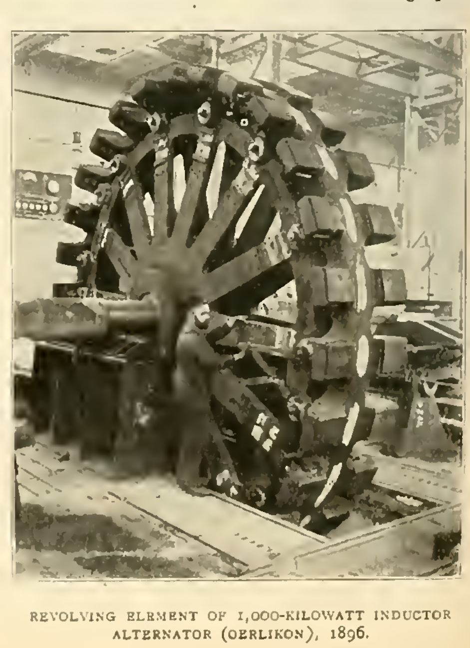
KAPP ALTERNATORS AT ZURICH, SWITZERLAND, 1890.



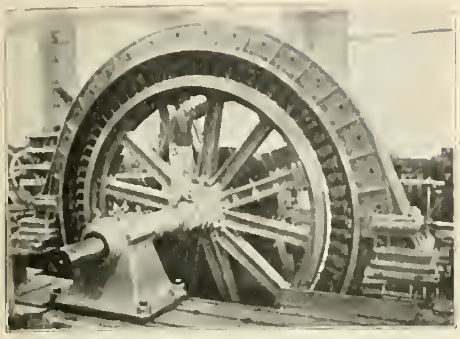
SLOW-SPEED 500-HORSEPOWER INDUCTION MOTOR (BULLOCK) AT MONTREAL WATERWORKS.



LAUFFEN-TYPE REVOLVING FIELD, 1893 (OERLIKON).

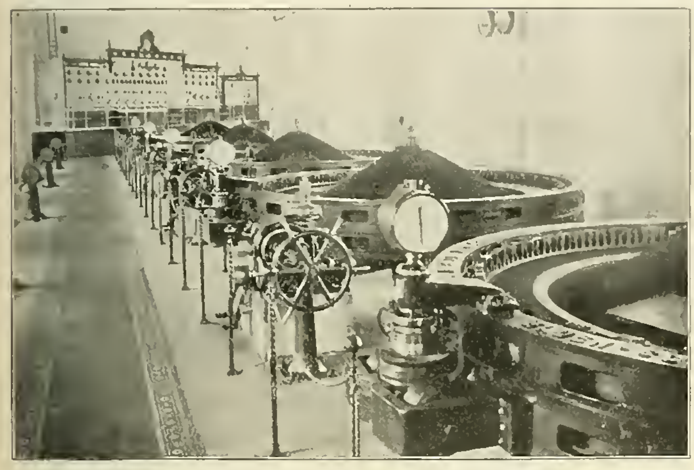


REVOLVING ELEMENT OF 1,000-KILOWATT INDUCTOR ALTERNATOR (OERLIKON), 1896.



LARGE REVOLVING-FIELD ALTERNATOR (OERLIKON), 1898

my subject and condemning the injustice and ingratitude which he has received alike at the hands of the public and of the engineering profession. A child of genius, springing from a race not inured to the poisoning of flattery, he came to this country and did great and imperishable work. His admirers feted and celebrated him, and he took them seriously. It was only natural that his later work did



UMBRELLA-TYPE REVOLVING-FIELD ALTERNATORS (BROWN-BOVERI), 1897.

not show the clearness and originality which characterized his work on polyphase machinery, and which made him famous. The engineering profession, unjustly and ungratefully ignoring his early work, labeled him a charlatan, and the public, always on the lookout for new sensations, dropped Mr. Tesla and forgot him. As my professional work for almost a score of years has had for its object the

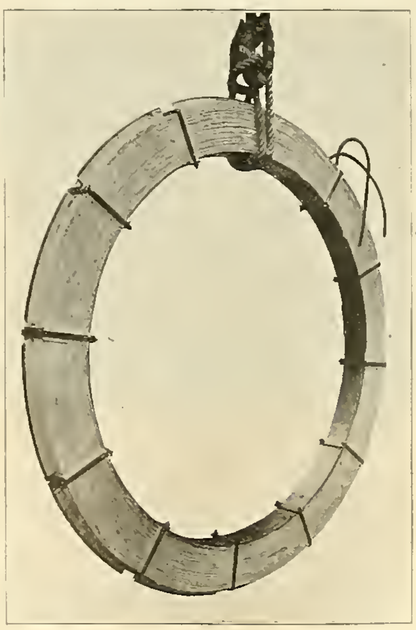
20,000-VOLT TRANSMISSION LINE, OERLIKON WORKS, 1892.

development and improvement of electrical machinery, for which Nikola Tesla has done much, I wish to take this opportunity to pay a tribute to his work done at the opening of the epoch which has culminated in the large industry of electrical engineering.

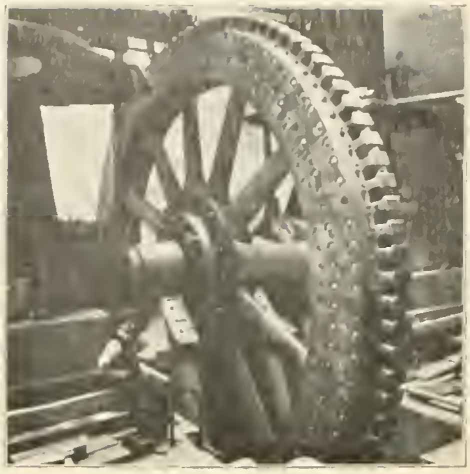
As the early direct-current machines were all wound as Gramme rings, there became established a preference for this construction in alternating-current generators. Besides the ironless types represented by Mordey, Ferranti and Siemens alternators, we notice the iron-core alternators of Kapp and of Schuckert, in which flat rings are wound with coils, in principle like the Gramme ring. The application of mechanical principles soon created reliable mechanical construction by using drum windings, and we record the next step in improvement of dynamo electric machines when we refer to the direct current generators built by the Westinghouse & Schmidt Company and the Thomson-Houston Company in America for railway work. Mr. Sidney H. Short, of the Walker Company, should here receive honorable mention for his pioneer work in this respect.

It has always seemed to me that the designs of electrical machinery in the early '90's lacked a clear recognition of underlying principles until the designing genius of C. E. L. Brown had done for the art what Corliss and Reynolds had been doing for the steam engine. Unity of plan enters into the field, and the present dynamo-electric machines become stereotyped. The direct-current generators have become multiple-wound multipolar units, with cross connectors in the armatures, and with commutators and brush-holders which we are all familiar with in present designs. The alternating-current generators are multipolar machines with internal revolving fields and external stationary armatures with windings arranged similar to those of drum-wound armatures. No more are we tempted from the straight path of engineering by such will-o'-the-wisps as Lauffen types, inductor types and other patent articles. The general design and construction have become established and will remain established until the introduction of entirely new principles which will relegate present dynamos to the past.

In reviewing the evolution of dynamo-electric machinery during the last twenty years, we must needs comment on the careful development of details and upon the adoption of rational processes for the manufacturing of this machinery. Fifteen years ago it was quite customary to manufacture the core plates by using circular shears and to build up the plates without slots, these being milled in the cores after



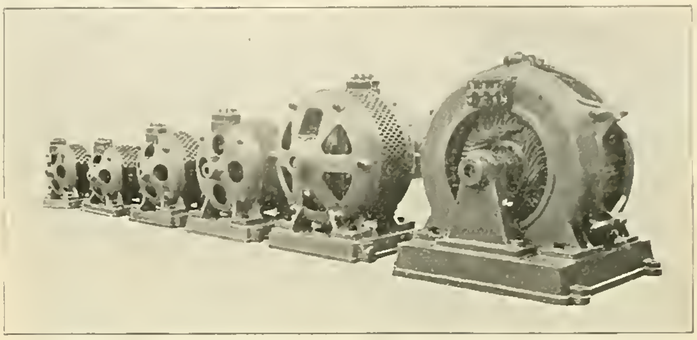
STATIONARY FIELD COIL OF INDUCTOR ALTERNATOR (OERLIKON), 1896.



REVOLVING FIELD OF 3,200-KILOWATT ALTERNATOR (BULLOCK), 1902.

the cores were built up. The manufacture of a large number of machines of the same size has made it possible to use dies and punchings for this operation, so that sectional plates completely slotted and dovetailed for fastening can be turned out with the greatest accuracy.

Field coils which, in the early dynamos, were made

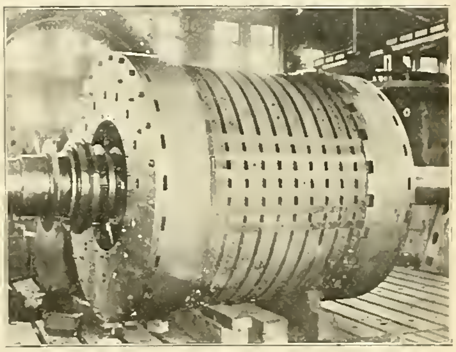


A LINE OF RING-WOUND INDUCTION MOTORS (OERLIKON), 1893.

of insulated wire, are made of copper strip bent on edge, and coils thoroughly mechanical and strong have thus been evolved.

Instead of hand-wound armatures, the winding of which required great skill and patience, form-wound armature coils were introduced, leading to mechanical construction with easy possibility of repair.

The gradual evolution from step to step which is pursued by Nature is also pursued by engineers in



FOUR-POLE REVOLVING FIELD OF 10,000-HORSEPOWER TURBO-GENERATOR (ALLIS-CHALMERS), 1904.

the development of an art. Different steps are evolved by different designers in different parts of the world in almost exactly the same way, because this evolution is the product of the human brain, which is the same the world over. It appears, therefore, most preposterous to any thoughtful man of culture and knowledge to designate these intrinsically small steps as inventions, and to bewilder the mind with claims couched in words of ambiguity and prolixity which apply to the objects they are meant to describe as well as to the process of the creation of the world as related to us in the first chapter of Genesis.

Much yet has to be done to educate the public, and the engineering public in particular, to understand the philosophy of progress and invention and to appreciate a complex situation created by a well-meaning institution like the Patent Department, but here, as elsewhere, human institutions founded with the best of intentions have defeated their own purpose. In an art which has hastily grown and whose principles have been considered mysterious, it may be excusable if certain means for mechanically fastening pole-pieces, for example, are represented to serve certain occult purposes conducting magnetism; but it seems pitiful that experts can be found to give their support to such humbug.

Though the perfection of the present dynamo-electric machines can be traced step by step from a modest beginning, yet there is a vast gulf between the first slow-speed machines and the present 7,500-kilowatt generators operating at 750 revolutions per minute. Yet little or nothing has had to be changed in the principles underlying the design of electric machinery, and the engineers must be filled with pride who, twenty years ago, recognized in the principles of Faraday and Maxwell the leading light of their art.

The Industrial Uses of the Electric Motor.

By E. W. Lloyd,

Contract agent, Commonwealth Edison Company, Chicago.

Extraordinary indeed has been the growth in the use of the electric motor for general power purposes during the last twenty years. The fact is well known to those interested in electrical matters, but the layman, perhaps, is not so well informed.

Before the year 1887 the use of electric motors was confined to small applications, and the motors as a rule were very unreliable.

Although Faraday, in 1831, discovered the principle that the generator could be used on an electric circuit as a motor, the value of the discovery was not appreciated.

Gramme, in 1871, displayed the celebrated ring-wound armature, which marked the advent of the first practical motors and dynamos. Motors, however, were generally considered only as toys at this time, and it was not until in the '80's, when Van Depoele, Edison and Sprague demonstrated the use of the motor in connection with the street car, that the electric motor began to be used more in a practical way.

Some of the first motors put into practical use in this country were the Baxter and Excelsior, and they were used on series arc circuits in sizes usually under ten horsepower. At the present time the very large motors run into thousands of horsepower in the capacity of individual units.

Before 1887 some motors were operated on 500-volt, continuous-current circuits, but not to any great extent. It has really been since that time that the great advances have been made in the use of electric power.

The growth of the power load of the Chicago Edison Company and Commonwealth Electric Company of Chicago since that time is indicative of the development throughout the world. The following figures show this growth:

In 1890 less than 1,000 horsepower in motors was connected.

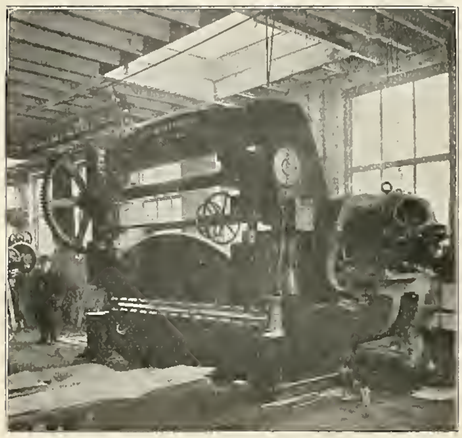
In 1895 about 3,000 horsepower.

In 1900, 19,107 horsepower.

In 1905, 69,053 horsepower.

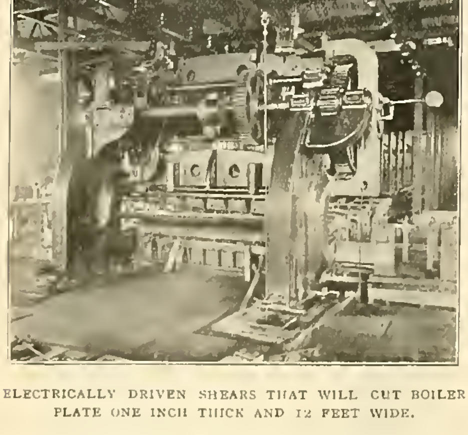
In 1907, 101,267 horsepower

The electrification of the street railway has been accomplished in the last twenty years. The vast network of urban and interurban lines in the populous states throughout the country owes its existence to the electric motor. The growth in this direction has perhaps been the most marvelous of all the progress made in connection with the use of the motor. Hundreds of thousands of horsepower is generated in central stations for use in this way, and it is possible to travel for hundreds of miles between large cities at comparatively low cost by comfortable and even luxurious trains, some of the roads going so far as to use sleepers.



A 15-HORSEPOWER MOTOR DRIVING FORMING PRESS IN SHEET-METAL WORKS.

Further progress has been made in this direction by the New York Central Railroad by installing large power stations in small towns adjacent to New York city by which power is furnished to the company's trains entering New York. This imposing undertaking is nearing completion; it involves the expenditure of millions of dollars. The great high-power electric locomotives used are a revelation to those examining them. The speed attained by these electrically operated trains is in excess of that of the fastest steam passenger trains.



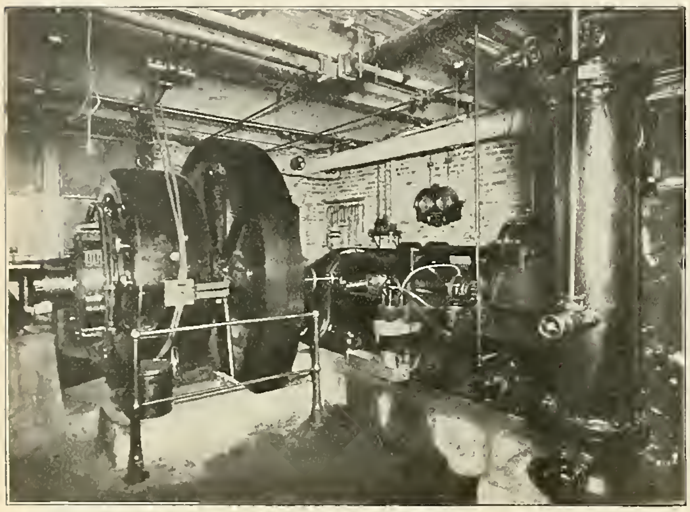
ELECTRICALLY DRIVEN SHEARS THAT WILL CUT BOILER PLATE ONE INCH THICK AND 12 FEET WIDE.

Such industries as mining, smelting, steel and iron mills, shipyards and textile mills owe their economical operation to the electric motor. A modern department store is dependent to a large extent on the use of the motor in connection with its many mechanical devices, such as the cash-carrier system, refrigerating system, package-carrying system, escalators, elevators, ventilating fans and numerous other machinery.

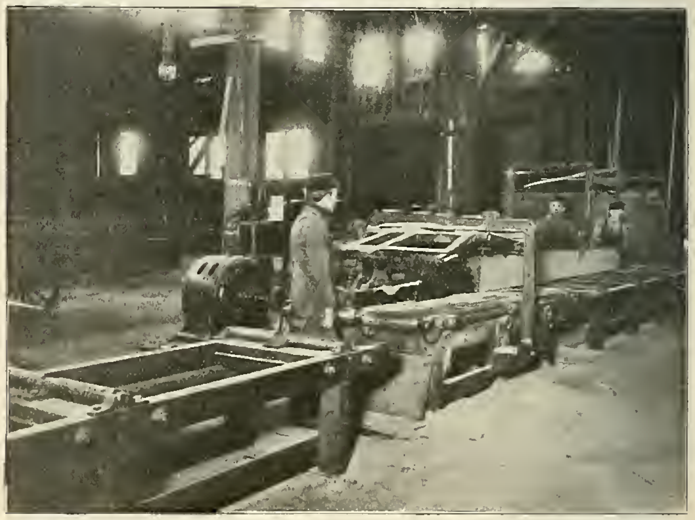
Pneumatic tubes, for carrying mail in large cities, have their air-compressing apparatus operated by electric motors. It would be difficult to operate such systems without their use, as, should electric power be not available, it would be necessary to erect steam-generating stations in various parts of the city where it is necessary to install the compressors for the correct operation of the system.

Clothing manufacturers are dependent to a large extent on electricity for the economical operation of their factories, and in the larger cities these manufacturers are obtaining, in the aggregate, a very large amount of power from the central station—very much larger than is generally appreciated.

In fact, large manufacturers of all descriptions have seen the great advantages in the motor, and there is now scarcely a large enterprise which is building new works of any description where the owners consider anything else for driving their machinery.



DIRECT-CONNECTED ELECTRIC MOTOR AND ICE MACHINE OF 137 HORSEPOWER (LARGEST IN CHICAGO).



This saw will rip a timber 12 inches square and 12 feet long in one minute.
48-INCH SAW DIRECT-CONNECTED TO 40-HORSEPOWER MOTOR.

The modern battleship could not operate without the use of the electric motor, and most of the large engineering works now in course of construction would be immeasurably slower in their progress without the motor. This piece of apparatus has not only been produced in very large numbers, but its efficiency has improved until it it is recognized as the most efficient machine for driving other machinery that is known.

The motor has not only been adapted to tools and machinery used by the different manufacturing interests, but it is made in diversified forms for use in hundreds of ways in every line of industrial and home life; in fact, is indispensable.

Electric power for the home has received great encouragement in the last few years by different inventors designing apparatus to be used for almost every service heretofore done by manual labor, such as washing, meat grinding, refrigeration, buffing and cleaning, the use of air compressors in connection with the removal of dust, to say nothing of elevators and many other domestic power applications.

The central station has been the large factor in the introduction of electricity for power purposes, and to the men who have been identified with these interests is due the credit for the largest share of this immense growth.

As these central stations increased in size toward the end of the '80's, the managers realized the necessity of developing a power load to fill up the valleys in their load curve.

For the first ten years the growth was very slow. The power was used only in the large cities by small consumers where modern methods and city environment had made the use of ventilators and other apparatus necessary.

Small manufacturers renting rooms needed small motors and were glad at any price to get the motor and central-station supply.

After getting that business, which of necessity took central-station service, it was the difficult task of the central-station manager to convince the small user of power to use this service. There were many difficulties in the way of this development. The motor in the early days was not the efficient and reliable machine it now is, and its price was very high. The price of electricity was also high. Furthermore, the cost of apparatus and operating costs were much in excess of what they are at present. As a general rule central-station mains were confined to a comparatively small area, and as manufacturing establishments in cities are usually located outside of the business center, the central station was unable to furnish service to these plants, due to the fact that it was impossible, on account of the low-tension dynamos in use, to install feeders of any great length. Furthermore, the size of generators was limited, and it was impossible to handle large power loads on this account. The central station was, therefore, forced by circumstances to increase its power load in small amounts in the business district, thereby building up gradually a network of mains of sufficient capacity to take care of larger demands.

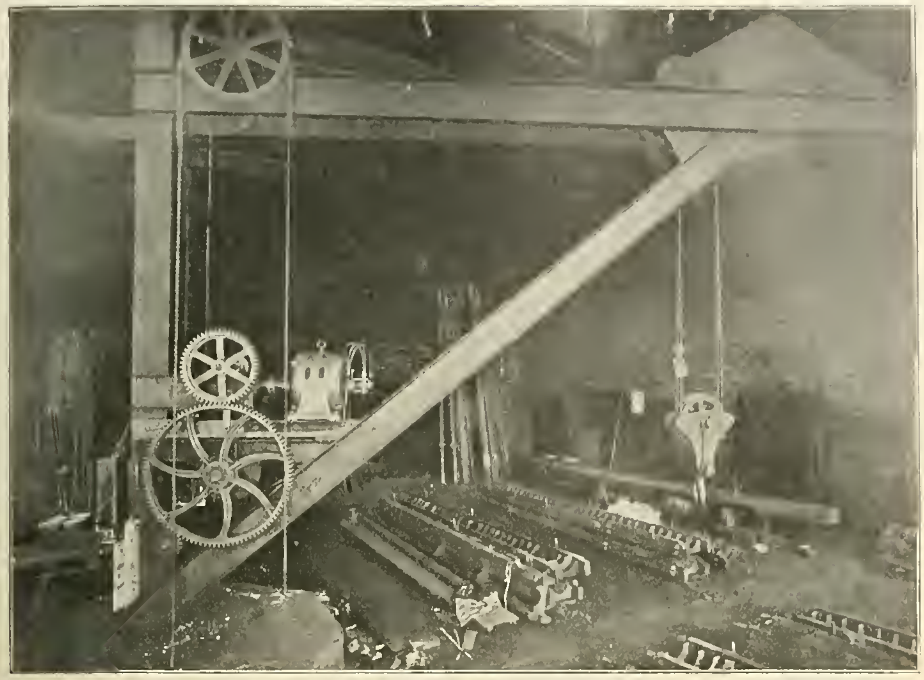
With the advent of the rotary-converter substation, and the perfection of alternating-current generating apparatus, it was possible to spread the network to the outlying districts, first for direct-current service, and within the last few years by polyphase alternating-current circuits serving customers having single-phase, two-phase and three-phase motors.

While the demand for direct-current motors on the low-tension mains has not ceased, and will not for years to come, it seems probable that the growth of the use of alternating-current motors will exceed the direct-current motor in a short time, due primarily to the fact that it is possible to distribute alternating current at high tension over wide areas, and again because the induction motor has been perfected to the point where it is available for almost every kind of service except where variable speed is required.

Even at the present time apparatus is being perfected for use in connection with alternating-current motors which permits of some variation in the speed of the motors. The traveling crane, equipped with alternating-current motors, is giving very satisfactory service. In fact, in some instances the manufacturers using them prefer them to the direct-current crane.

The single-phase alternating-current motor is used quite satisfactorily in small sizes in connection with machinery requiring variable-speed operation, and there are a large number of these motors in use. More recently it has been found possible to start and stop automatically alternating-current motors, driving air compressors and other tools required to be automatically started and stopped.

Another development which has been assisted by the electric motor is the freight and passenger elevator. The direct-current motor has been in use in connection with this service for about twenty years. The growth was extremely slow at first, but has now reached the point where the motor for this class of service is a serious competitor with the well-known hydraulic machines, which have, up to within a short time, been generally used in very large office buildings.



A JIB CRANE DRIVEN BY A 10-HORSEPOWER ALTERNATING-CURRENT MOTOR THAT HANDLES 12 TONS WITH EASE.

The adapting of the motor to this service has been a great aid to the central-station companies, as it is now possible to equip all of the different apparatus in a building with motors, whereas previous to the time when the elevator motor was satisfactory, a great many people preferred to use steam and hydraulic power for all purposes in preference to having a mixed installation of part steam and part electric.

Within the last few years the single and polyphase motors have been designed for use on electric elevators with considerable success. At first such installations were made where it was impossible to get direct current, and where steam was not available at a low price. The development in this class of elevator has been improving rapidly of late, and the promises of manufacturers are that within a short time the alternating-current motor will be in use in connection with elevators, giving satisfactory results both as to continuity of operation and cost.

At the present time, with the large network of both direct-current and alternating current lines in the larger cities and even in the country and smaller towns, it is possible to purchase electric power in almost any quantity from central-station companies.

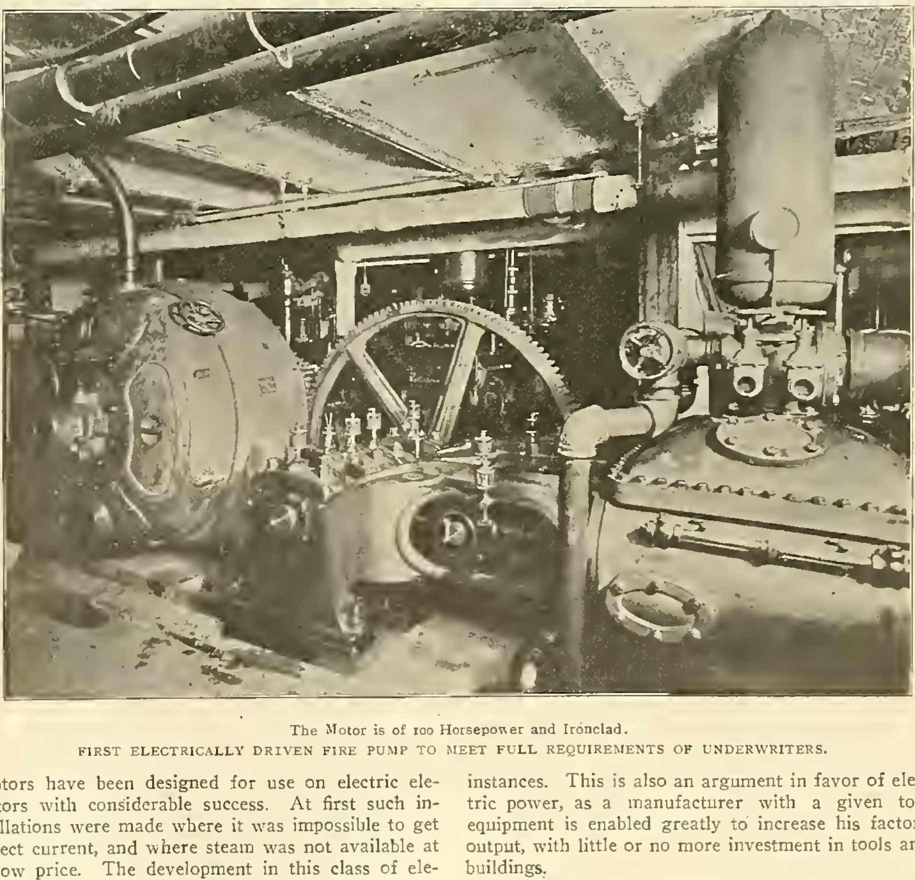
The growth of the use of central-station service has been phenomenal, and while the amount of electric power installed during the last five years has increased to a wonderful extent over previous periods, it seems reasonable to suppose that the increase will be greater in the future, as the cost of production of electricity is reduced, due to improvements in all branches of the service, from the boilers to the distributing system.

From the viewpoint of the manufacturer using a large amount of power the electric motor is the logical motor for his purpose. It allows him to locate his factory wherever he desires. He can lay out his machinery to suit his conditions, without regard to the location of line shafting. Power can be applied directly to any tool in existence in a most economical manner. The output of machinery equipped with motor drive is considerably more than the old fashioned methods, and no one will dispute the sanitary conditions of a shop so equipped.

When motors were first used for industrial purposes very little had been accomplished in the methods of regulating the speed. Motors were principally used to drive line shaft, and machines were driven from these shafts. The possibilities of making motors of any speed, and having a wide range of speed, became familiar to manufacturers, with the result that the manufacturing of the motor received great impetus, and perhaps this improvement in the motor is one of the main reasons wny manufacturers use it to such a large extent.

One of the principal reasons for making motor installations, either individual drive or well-designed group drive, was because such installations materially reduce the power required for a given output in a given factory. The reduction in friction load, due to properly designed installations, is one of the most important points in connection with the use of such apparatus. Thousands of horsepower are being saved every year in factories for a given output where proper motor installations are being made. This in itself is a strong argument in favor of their use.

Where it is possible to equip tools with individual motors it has been found that the increase in the output of such machines has been doubled in many instances. This is also an argument in favor of electric power, as a manufacturer with a given tool equipment is enabled greatly to increase his factory output, with little or no more investment in tools and buildings.



The Motor is of 100 Horsepower and Ironclad.
FIRST ELECTRICALLY DRIVEN FIRE PUMP TO MEET FULL REQUIREMENTS OF UNDERWRITERS.

In addition to this, the cost of labor for a given amount of work is materially reduced, notwithstanding the fact that it has been possible to increase the wages of the men operating motor-driven tools by offering them a premium for the extra output.

While it may seem from all that has been accomplished that a large share of the industrial machinery used throughout the country is driven electrically, as a matter of fact I believe it is safe to say that less than ten per cent. of the power required by the industries of the country is electrically applied.

There are constantly developing uses for electricity that were not known years ago, and it is safe to say that this progress will continue and that within the life of the younger generation the use of electric power will become almost universal.

The electrical distribution system seems to be the logical method by which to deliver power, as this system has many advantages over any other form of power known up to the present time. It is clean, sanitary, flexible, safe and economical, and should be a great factor in the problem of eliminating smoke in large cities. Central stations can be located in the less desirable parts of these cities and the power distributed over the vast network of mains to wherever desired.

The future of the electric motor seems well established, and we have every reason to believe that the growth will be at a great percentage of increase from year to year. In another twenty years we will no doubt look back in the same manner as we are at present, with the idea in mind that in 1907 the amount of electric power used was very small indeed, and that the adaptation of this piece of apparatus to different machines requiring power for their operation was in a very crude state.

Twenty Years of Telephone Development.

By Samuel G. McMeen.

One way of appreciating what progress has been made in commercial telephony in twenty years is to get before us a general picture of the conditions which existed twenty years ago.

No foreign country has made the advance which has been made in the United States, and it may be well to confine our thought to our own country for the present.

S. G. M'MEEN.

Twenty years ago there were distinctly fewer than 200,000 telephones in use in the United States. No city of under 10,000 inhabitants supported a telephone exchange at all adequate for its needs, and most such cities either had supported an exchange which had declined or had none at all.

Practically all towns having postoffices had at least a toll station, but the limit of "long-distance" conversation was about fifty miles, and the service rather unsatisfactory even at that distance.

Rural lines furnishing service to the suburbs of towns and cities did not exist at all.

The wire plant within and between towns was almost wholly made up of iron or steel wire carried on cross-arms and brackets, and those lines entered the exchanges in most cases by way of house-top fixtures.

These fixtures in the larger exchanges were enormous structures, often occupying the entire roof of the central-office building. The number of buildings owned by operating companies was insignificantly small.

The only general use of cables was in carrying the lines from the roof fixtures to the switching apparatus. These cables joined the outdoor iron wires in a "tower" on the roof, and the point of connection between cables and outside wires was made to serve the purpose of a main distributing frame.

The outside lines and the office cables were all of a single wire per line, as all telephone currents used the earth as a return.

Protective mechanism was limited to a sawtooth open-space lightning arrester or its equivalent; such arresters occasionally stopped lightning charges of moderate strength.

Sub-station equipment was more nearly in a standardized condition than today. It is true that the standard was bad and that each set had defects rather clearly recognized at the time, but if there be an advantage in uniformity, it existed at that time. The telephone receiver was of the single-pole type and was associated with a Blake transmitter. The latter utilized a solid carbon button with a polished face, bearing against a rounded platinum stud. A black-walnut box, with a hole in the door for a mouthpiece, contained the transmitter and the induction coil.

The central office was called by a magneto generator, and signals were received, as now, on a polarized ringer, the resistance of which was uniformly about 80 ohms. When a number of stations occupied one line, all the ringers were connected in series. The switch contacts of the magneto-bell outfit were innocent of platinum at any point.

The current for the transmitter was furnished by a single cell of Le Clanche battery.

The amount of maintenance labor to be spent on such lines and such sub-station equipment need not be called to the mind of the older telephonists, as most of them would rather forget than remember. It may be appreciated in a degree by those who have entered telephony in a more fortunate time, when it is said that the life of galvanized-iron wire varied from three to seven years, and that the number of opens, crosses and grounds on a rainy day often reached 20 per cent. of the total number of lines in an exchange admitted to be fairly well managed. To this had to be added the attention necessary to keep local batteries renewed, transmitter buttons cleaned and polished, transmitter tensions adjusted, and switch-hook contacts cleaned. If the latter were not done, and well done, the subscriber would be entertained by a continuous sizzling, frying noise, often great enough to prevent commercial conversation.

Of the central-office equipment, it may be said that it was robust enough to give as little trouble as any equipment that has been devised since. The multiple switchboard with an audible busy test was well established, and all of the larger cities were so equipped.

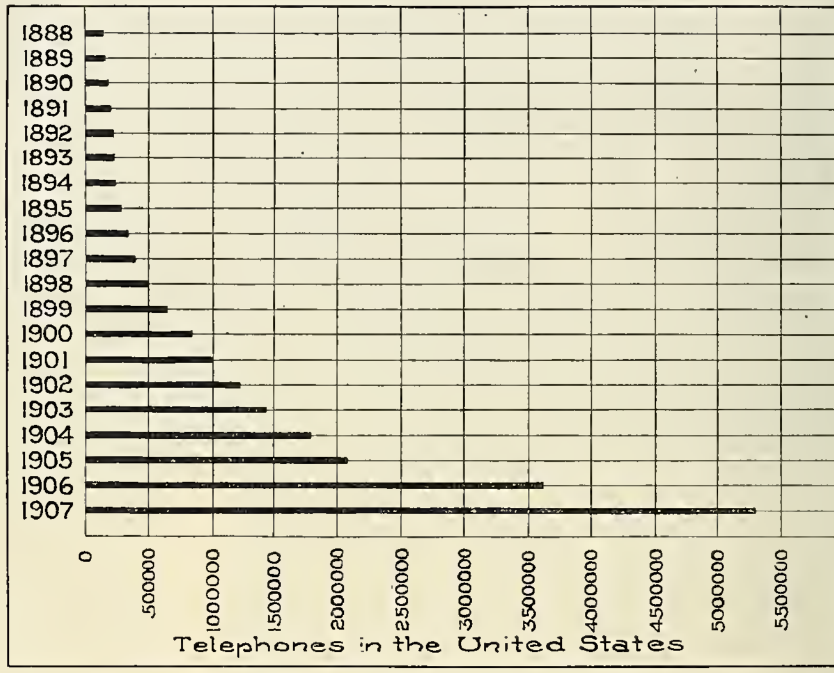
Compared with the simpler transfer switchboard, however, the multiple outfit was costly; and, in addition, a royalty had to be paid on the multiple feature itself. It resulted naturally that there were many fewer multiple boards in the country than good service really was demanding.

The multiple switchboards were varied in type, some having operators' equipments consisting of pairs of cords with listening and ringing keys and others having a single plug and cord per line, each line having its own listening and ringing outfit associated with the cord. These single-cord boards had many advantages assisting speed of operation, and records have been made on them which compare more favorably with what can be done today than would now be imagined. This speed was due, however, not to a convenient and positive system of signals to indicate the state and progress of the call and connection, but to a mechanical arrangement of the keys and cord circuits, which reduced the motion required to make the connection and the disconnection.

The nearest present-day counterpart of a single-cord switchboard is a manual incoming trunk section. If one of the early single-cord boards could have been equipped with automatic signals, such as now are possible, there is no doubt that its performance would have been still more remarkable. But the single-cord type of subscribers' switchboard ceased to be made when metallic circuits succeeded the single-wire line.

In the foregoing I have tried to picture the general aspect of conditions twenty years ago. It is true that metallic circuits were not wholly unknown. The granular carbon (Hunnings type) of transmitter was in sight. It was recognized that platinum contacts must be introduced for hook switches, and that it would be well to improve or abandon the primary local battery. A few traction systems had appeared and the first steps toward curing the difficulties so introduced were being taken.

What has happened since then in the commercial development of the art can well be shown graphically, and I have prepared a diagram stating what probably are the facts as to the number of telephones in the United States year by year. It shows



that the number twenty years ago was smaller for the United States than for Manhattan Island today. It shows the leisurely growth for the first eight years and the remarkabale acceleration since, and it may be that it indicates what we may expect in the future.

If similar diagrams were to be drawn for the growth of long-distance conversations, they would show that the limit of fair commercial transmission has been increased over 2,000 per cent.; that the rate of growth in interurban-wire mileage is as remarkable as the growth of telephones in use, and that the conversation-miles per inhabitant per annum have increased at a rate beyond either.

The causes which have stimulated growth in telephone development since 1895 are more than the expiration of the basic patents and the appearance of competition. Probably this competition has been the most powerful cause, but there are mechanical reasons as well. Principal among these are the rearrangement of things which has reduced the complication of the subscriber's telephone and increased that of the central-office equipment; the changes in methods of line construction, the introduction of automatic switching equipments, and of manual switchboards with automatic signals on line and cord circuits.

I have spoken of the early multiple boards as being robust when of the type first introduced. Somewhat less than twenty years ago, however, as the number of subscribers' jacks required to be placed within a section within the operator's reach began to become very large and the spring pressure per jack to grow small, the presence of series contacts in such jacks introduced a new and serious trouble. A good many ways of reducing or avoiding this trouble were tried, but the solution most successful was the entire elimination of all contacts required to close the line through the jack on the withdrawal of the plug. A rearrangement of circuits was necessary, resulting in the "bridging" or "branch terminal" switchboard, with automatically self-restoring and locking drops.

Many such switchboards were installed, most of them being equipped with the additional refinement of an intermediate distributing board, enabling the

A. S. Hibbard. Henry C. Paine (deceased). John I. Sabin (deceased). H. B. Stone (deceased).

FOUR MANAGERS OF LARGE TELEPHONE PROPERTIES.

traffic of the office to be readjusted from time to time so as to even up the work of the various positions.

In an effort to avoid the large cost and royalty expense of multiple switchboards, there was produced on the Pacific Coast, at about the time of the advent of the bridging multiple board, a local trunking or transfer switchboard, equipped with automatic signals. Its performance aroused sufficient interest to cause its operation to be studied in detail, with the discovery that the important advantage lay not so much in the use of local trunks, or transfer circuits, between parts of the switchboard (as a substitute for a multiple of the lines) as in its use of automatic signals. It was then but a simple step of logic to the conclusion that if automatic signals were to be applied to the multiple switchboard a maximum of advantage would be gained.

At that point the present type of common-battery multiple equipment came into existence, and what has been done since upon it, while of great value, has not been revolutionary in any way.

The conditions required for the operation of automatic line and supervisory signals fitted in so well with the requirements for supplying the subscriber's transmitter with current from the central office that common-battery transmission came into being almost as a matter of course.

The earliest commercial installations of automatic switching equipments were made before the expiration of the basic telephone patents, and the early development of the automatic art was about contemporaneous with that of the branch-terminal magneto board. Viewed in the light of total accomplishment, the development of automatic switching equipment is quite as remarkable as any other phase of the art; and more so in view of the strong prejudices which had to be overcome, the continuous discouragements which were met, and probably the difficulty of prosecuting the development with so little support from the telephone-consuming public.

It is interesting to note that while in manual telephony the present grade of central-office service only has been reached by abandoning the local trunking system and adopting the multiple system, in automatic telephony the opposite is true.

The earlier automatic equipments were all of the multiple type, and the large automatic equipments of to-day only are possible because the multiple feature has been discarded and the complete local trunking arrangement adopted in its stead.

With an equal possibility of a high quality of voice transmission; with the marked advantage of instantaneous disconnection; with the ability to handle the largest groups of subscribers' lines and to care for private-branch-exchange service, an automatic system is to be considered one of the great certainties of future telephone equipment.

The principal changes in sub-station equipment in twenty years have been the provision of platinum contacts; the change of ringers from a low-resistance series type to the high impedance bridging type, and the provision of a granular carbon transmitter free from the tendency to pack and with a great range of resistance-change when spoken into. The adoption of the bipolar type of receiver also has improved the equipment in a small degree.

Just as metallic circuits were a rarity twenty years ago, so grounded circuits are the rarity today. The reasons for this radical change, practically doubling the wire plant for a given number of lines, were three.

One of them was the arrival of electric traction, whose return currents made telephone lines extremely noisy and caused unbearable false signals; another was the limit placed on long-distance speech by the noises in grounded lines from earth currents and atmospheric charges; the third was the cross-talk between neighboring lines when carried as grounded circuits in cables of more than a few hundred feet length.

This rather complicated group of reasons is a fairly good instance of the causes of change in all branches of telephony.

The McCluer system of common wire returns as a substitute for ground returns helped out the electric-traction difficulty very usefully, but was of no advantage in solving the other two problems. The enormous masses of open wires in the streets were causing the operating companies to wish, and the municipalities to demand, some other method of distributing telephone lines. After a short time of denying it to be possible, the inevitable underground system appeared, and there are more telephone wires in the earth today than there were above it a dozen years ago.

But even with a pair of wires shut up in a cable within a lead sheath in a duct in the ground, with all external disturbances excluded, the line problem was not solved. Indeed, a new difficulty had been introduced. This was the substantial increase in the electrostatic capacity of the two wires forming the line, and with the clearly articulating but low power Blake transmitter the short circuiting effect of this capacity amounted to a very hurtful loss. A solution of this new problem came in the paper-insulated, highly aerated telephone cable of present practice. A still further and most admirable solution was contributed by Dr. Pupin, which inserts an inductance in series with each wire of a pair to neutralize the effect of the capacity across it.

The effect of such a series of inductances upon the electrical voice waves is so similar to the effect of a molar loading of a light string upon "string-waves" that the treatment of a telephone line by Pupin inductances has come to be called "loading."

Lines in a given cable can be worked for greater lengths at a given loss when loaded, and the result is a new series of economy factors in laying out the many central offices of a city, and the adoption of underground instead of aerial long-distance trunks between cities many miles apart. As a matter of comparison it may be noted that it is possible to talk farther through an underground cable of small copper wires today than one could talk over an open aerial circuit twenty years ago. It is not apparent why all interurban trunks ultimately may not be placed in the earth.

The advantage of an entire underground system of loaded trunks between cities is not merely a reduction of interruptions and the elimination of pole decay. The principal gain is in the nearly uniform hurtful capacity effect to be cured and the almost absolute certainty of uniform transmission.

Inspired by the success of repeaters in long telegraph trunks, a telephone repeater for a similar assistance has been dreamed of. One inventor seems to have remembered the dream after waking, as the commercial success of the Shreeve repeater has at least shown that a repeater is not impossible. Whether the perfected repeater will co-operate with line loading on long circuits, supplant it, or render it unnecessary, furnishes an interesting field for speculation.

The operation of telegraph and telephone service over the same wires at the same time, in successful operation for many years past, has had the effect of reducing the financial burden which long-distance telephone circuits otherwise would need to carry. It is now possible, under favorable conditions, to work each side of a long-distance pair quadruplex and the pair itself for speech.

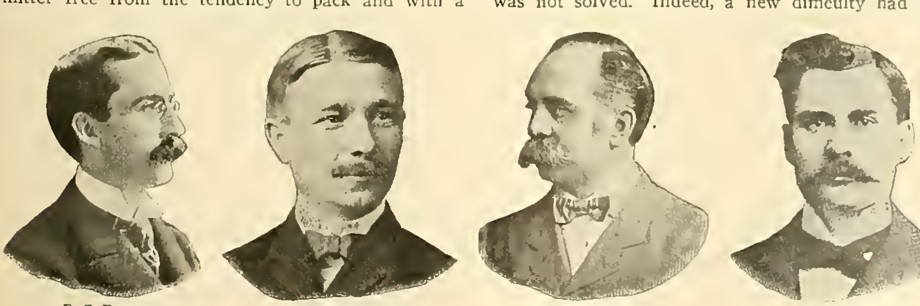
No record of the principal features of the development in telephony should omit to note the opportunity of a switching system combining the best features of manual and automatic equipments; the very valuable investigations in electrical acoustics made possible by the use of the oscillograph, and the recent advance in radiotelephony through the use of energy in the form of Hertzian waves.

I have confined my attention so far to conditions in the United States. Growth in other countries has been less rapid than here, and in the main the methods and appliances less well developed. For some years, however, Sweden led the world in density of development of the larger cities. This

James I. Ayer. H. M. Byllesby. H. L. Doherty. Louis A. Ferguson.

C. E. Flynn. F. S. Gorton. Charles R. Huntley. C. H. Wilmerding.

A FEW OF THE MEN WHO HAVE BEEN IDENTIFIED WITH WESTERN LIGHTING AND RAILWAY COMPANIES.



P. C. Burns. James B. Hoge. Milo G. Kellogg. A. Stromberg.

MEN CONNECTED WITH THE INDEPENDENT TELEPHONE MOVEMENT.

is not now true, as there are a number of American cities with a ratio of telephones to population greater than in any Swedish city.

The literature of telephony is an excellent index of the progress which the art has made in twenty years. The telephone man's library of long ago consisted of a single volume, written by the dean of telephone engineering, Mr. Thomas D. Lockwood. Today a library of telephony occupies several shelves, and one may receive half a dozen periodicals exclusively devoted to the art.

Electrical Engineering Education.

By Henry S. Carhart,
Professor of Physics, University of Michigan.

The history of electrical engineering for the last twenty years reads like a tale from the Arabian Nights. The faculty of the imagination is a useful one in scientific research. It refuses to be confined within the boundaries of the known and searches the future. But no imagination was vivid enough twenty years ago to foresee what would happen in applied electricity by this year of grace, 1907. If, when the Western Electrician was launched, an engineer, intoxicated with his subject, should have predicted that by 1907 electric generators approaching 10,000 horsepower in capacity would be under construction, he would have been heard with a compassionate smile and regarded as a fit subject for a retreat.


HENRY S. CARHART.

Instruction designed to prepare engineers for this giant work has of necessity kept abreast of practice. In fact no insignificant factor in the rapid advances of applied electricity has been the presence of men in the profession who have been trained in the schools. If practice has stimulated advances in electrical education, education has reacted strongly on practice. Hence the present situation that the leading men today among electrical engineers and in the great manufactories devoted to electrical appliances are college trained men. It was not so twenty years ago, and the first graduates in electrical engineering had to break into manufacturing *vi et armis*. High finance and the captains of industry owe a great debt to engineering schools because of the young men who have gone from them in shoals headed for the workshop and the ranks of consulting engineers.

The course in electrical engineering inaugurated scarcely a quarter-century ago by Professor Anthony at Cornell marked an epoch in engineering education. It was introduced in connection with physics, and this practice has been followed in many universities since. The Institute of Technology in Boston repeated Cornell's experiment, and both have been eminently successful.

The course in electrical engineering in the University of Michigan was approved by the Regents in June, 1889. At that time engineering students were included in the Department of Literature, Science and the Arts, and the electrical course was under the wing of physics. It maintained this relation to physics until four years ago. The first graduating class numbered only two men; the last one, 33. The University Calendar for 1890-91 contains in this course the names of F. E. Barnum, G. A. Damon, A. C. Marshall, G. H. Rowe and F. A. Sager, all of whom are now well known in their chosen field. The Calendar for the following year adds to this list such names as C. G. Atkins, M. S. Connor, S. P. Grace, A. M. Haubrich, H. R. King, Walter Robbins, Fay Woodmansee, and the lamented H. W. Wyckoff. At that same period there was in the department as a graduate student and assistant Mr. Louis C. Hill, now superintending engineer of the United States Reclamation Service and third in rank in that branch of the government's activity. It is no small satisfaction to look back fifteen years and then to consider what these men are now.

The University of Michigan was not the first state university to introduce a course of study in electrical engineering. Such a course was established in the University of Kansas by an act of the Legislature in 1887 as a branch of mechanical engineering. In the University of Wisconsin the course was inaugurated as a separate engineering course in 1891 upon the appointment of Professor Jackson. In the University of Nebraska an elective course in applied electricity was authorized in 1890-91. According to the catalogue this course contained at first only five hours of applied electricity in the senior year, but in three or four years it had already become one of the important courses of the university.

Other institutions of learning east and west have added a course in electrical engineering, one after another, until now no engineering school is at all satisfied without it. Even the Rensselaer Polytechnic School, for so many years devoted to civil engineering and the scene of Rowland's first great work in magnetism, has at last succumbed and joined the rest in electrical education.

At the present time the number of students enrolled in electrical engineering is nearly as large as in either civil or mechanical engineering. The curriculum has been enriched from year to year as the subject has enlarged, until the difficulty now is to find room for all the courses within the conventional four-year period.


Thomas Duncan. Dugald C. Jackson. Kempster B. Miller. W. R. Patterson.
Richard H. Pierce. E. P. Roberts. Henry Rustin (deceased). Harris J. Ryan.
Frederick Sargent. E. P. Warner. William L. Waters. James J. Wood.
SOME ELECTRICAL ENGINEERS, EDUCATORS AND DESIGNERS IDENTIFIED WITH THE WEST.

The question has often been debated as to what portion of the entire course should be devoted to practical work in the laboratory and in visiting works. It is not uncommon to hear students express some complaint that too little time is given to so-called practical work. On the other hand, the other extreme has at times been touched in attempting to make the course little more than workshop practice, with some lectures on prevailing applications thrown in for good measure.

The writer has taken pains to learn the views of many graduates after two or three years' experience in practical work. The universal testimony is that engineering courses should be devoted largely to fundamental subjects and to theory, and that more practical experience can be gained in the factory in six months after graduation than it is possible to get in a four years' college course.

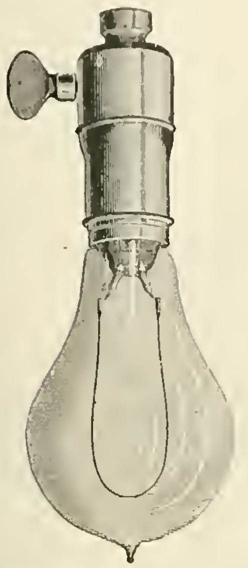
The laboratory is an essential part of engineering training, but it should be subordinate to the main purpose—that of training the mind and the acquisition of those fundamental principles of science and engineering, without which a man is only an artisan and not an engineer. A generous amount of laboratory work is essential to a thorough comprehension of the principles involved in the applications of electricity and to give the graduate some confidence in his knowledge of the manner in which these principles work out in practice. Beyond that he would better repair to the factory and get enlarged experience there, for no schooling can possibly take the place of experience, just as no workshop can be a substitute for the college lecture room and the personal contact between the enthusiastic teacher and the ambitious student.

The laboratory presents a concrete exposition of the principles taught in the lecture room. It is an auxiliary to didactic instruction and the study of text-books. It supports imparted information by an appeal to things one can see and handle for one's self. It puts the young graduate in a condition "to light on his feet" when he enters the big factory and is assigned to duty. Without it his attainments would be unavailable until he had learned to connect his unfruitful knowledge of principles, embodied too frequently in mere language, with their material embodiments in iron, steel and copper. But no amount of laboratory work alone, in the absence of substantial attainments in principles, mathematical theory and general insight, can equip a young man for the work of a successful modern electrical engineer.

After all, in the final analysis, something more must be added to educational attainments to make a successful engineer. Engineers, like poets, are born, not made. To education must be added character; to character, tact in dealing with men; to tact, originality in conception of design; and to originality, a calm judgment that reaches the wisest solution of an engineering problem under given conditions.

It is not inappropriate to refer to one good service which the electrical course has done for engineering in America. I refer to the support it gives to the adoption of the metric system of weights and measures. Electrical engineering and design are strictly scientific, and fundamentally they use the language and ideas of the centimeter-gram-second system. The results are often translated into the English system of measurement, but always as a departure more or less grave from the fundamental concepts. Practically the capacity of all generators is now expressed in kilowatts, and electric motors are commonly rated in terms of the same unit. It would be a great gain if kilowatts could replace horsepowers universally.

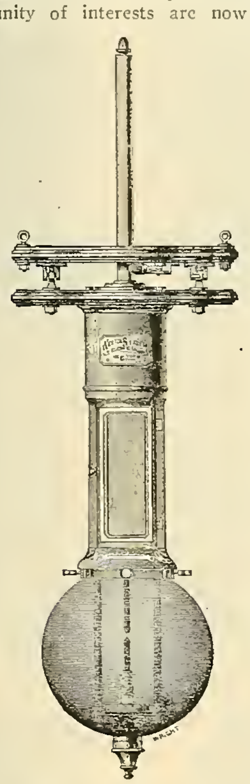
We already have a universal system of electrical units and standards, the details of which will undoubtedly be settled within a year or two on a basis of universal acceptance by all the civilized nations of the world. This universal system furnishes a splendid object lesson for engineering, and calls for a similar universal use of an identical system of weights and measures. Most unaccountable prejudice still stands in the way, even in England and America, which pride themselves on being foremost. No obstacle is harder to overcome than a system, however absurd or illogical, which has become entrenched by long usage, and which has little more to commend it than mere familiarity. But there are some happy signs of relief. Education is slowly introducing the effective leaven. The widest use of the metric system is furnished by the Universal Postal Union, in which the agreement respecting the weights of letters and packages adopted by all the



AN INCANDESCENT LAMP OF TWENTY YEARS AGO.

participating governments is expressed in terms of the metric system. If we translate the agreement into ounces, we do so as a rough-and-ready compliance. The postal convention adopted by the nations of the earth uses only the metric system.

What large question in engineering education is pressing for solution in the near future? It is this: Shall we continue to segregate civils from mechanicals, mechanicals from electricals, etc., or shall we consolidate and extend the course to five years instead of the conventional four? The latter has little more to commend it as a period of educational gestation than that it is divisible by two. Consolidation and community of interests are now the watch-



AN ARC LAMP OF TWENTY YEARS AGO.

words. It is time to undertake the education of engineers without any limiting adjective. The term civil engineering was adopted years ago as the antithesis of military engineering. But the word civil as applied to engineering has lost its early significance. All engineering is essentially civil in type.

The present practice is to separate engineering students into groups with some differentiation of subjects, but distinguished more by the accentuation placed on the same subjects in different groups than by anything else. It would not be a task beyond accomplishment to lay down a universal course in engineering with sufficient degrees of freedom to permit choice of a few subjects for special stress and intensive study. Then we should no longer have the familiar spectacle of an engineer, who has been educated in one group, practicing in another for which he has made no special preparation.

Electric Welding Progress.

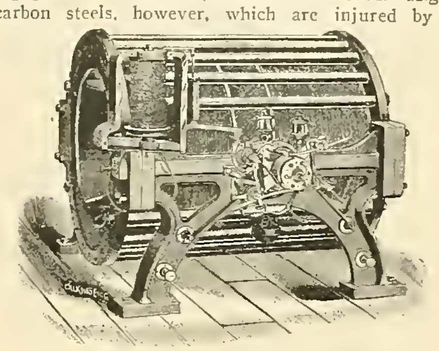
By Elihu Thomson,

Electrician, General Electric Company

IRON has been welded in the forge fire for so long a time that the memory of the first beginnings is lost. In fact, the early production of iron masses depended upon the union by welding of the plastic particles reduced from the ore in the primitive furnaces, which long antedated the blast furnace for iron smelting, now producing in enormous quantities the more fusible cast-iron containing carbon in considerable amount. About twenty years ago the electric-welding art had its origin, and during the period since then it has become an important adjunct to many manufactures, and has, in numerous instances, provided new means of accomplishing results and given rise to new manufactured products.

ELIHU THOMSON.

The fact that by electricity not only iron, but practically all of the metals, may be united piece to piece, and often one metal to another metal, indicates the manageability of the process itself. Many metals which contract a film of oxide in the air demand a flux such as borax to dissolve this film in order that clean metal surfaces may be brought together in a weld. Where, as in the case of iron, the oxide itself melts below the melting point of the metal, no flux is needed. High-carbon steels, however, which are injured by a



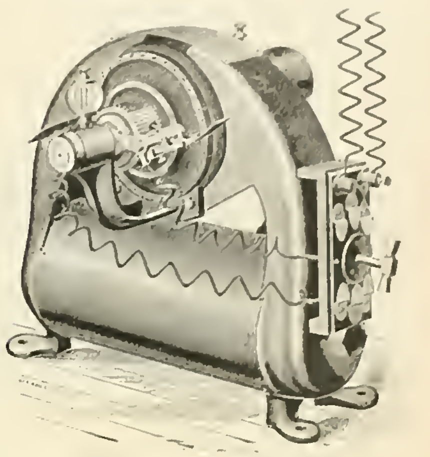
FAMILIAR SQUIRREL-CAGE TYPE DYNAMO OF TWENTY YEARS AGO.

temperature which would melt the oxide or scale, require careful treatment in electric welding, as well as in forge-fire work, and in each case an easily fusible flux allows the work to be done at a comparatively low and safe temperature.

Gradually, the heating effect of the electric current is being made use of more and more extensively to do the work of the forge fire in welding, and the welding transformer is the modern substitute for the forge fire.

Work which was either impracticable with the forge fire or which demanded very high manipulative skill is often accomplished with great facility by electric methods. Each year witnesses the extension of these methods into new fields. It is important to distinguish between arc fusing, wherein the high temperature of an electric arc is used actually to render liquid refractory metals, and cause union with solid masses, as in filling holes in castings, melting edges of plates together, and the like, and the Thomson process, in which the pieces to be united are pressed together by being held in massive conducting clamps or holders and a very heavy current at low voltage is passed across or through the proposed joint, thereby causing heating, softening and union. The important standing which this method of work has won is due to the rapidity, flexibility, cleanliness, neatness, accuracy and economy of the electric process over the older modes. The advantages are such that a continued extension in the application of electric welding is assured. The work of the electric welder is characterized by uniformity, and it is therefore best adapted to repetition work on the large scale. The operation of welding is controlled with exactness, and the localization of the heating to the particular parts being brought into union is often important. The electric welder can be used to unite copper, brass, bronzes, and even fusible metal like lead, and may readily be adapted to brazing or hard soldering.

It is not necessary here to describe the construction of an electric welder or welding transformer. Neither will any attempt be made to enumerate the many applications of electric welding in the arts. It may be, however, interesting to note the character of the work which is now being done



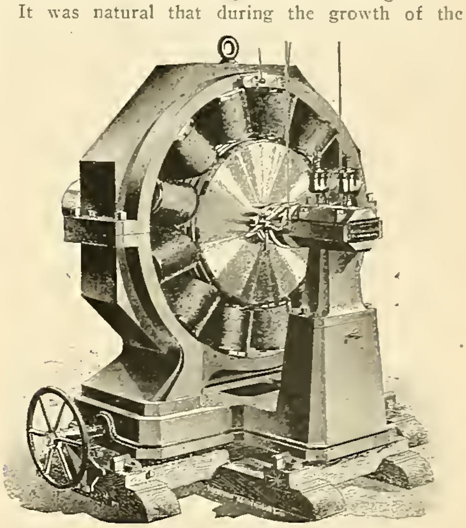
Reproduced from the Western Electrician of August 6, 1887.

AN EARLY TYPE OF ELECTRIC MOTOR.

extensively by the electric-welding process and the direction in which development has been more recently taking place.

Among the earliest applications of electric welding was the production of wheel tires of all sections, also hub bands and vehicle axles, fifth wheels, and more recently shifting rails, steps, shaft irons, etc. Since the advent of the rubber tire the process has been extensively employed for joining the ends of the steel wires running through the tire, for securing them in place in the channel rim, and also for uniting the ends of the channel metal itself. The application to carriage work has been indeed quite extensive, and most of the dash frames used in carriage construction are now made by electric welding, while in agricultural machines the iron and steel wheels are frequently built up or have their parts united by electric welding.

It was natural that during the growth of the



Reproduced from the Western Electrician of February 18, 1888.

SLATTERY'S ALTERNATING-CURRENT DYNAMO.

bicycle industry a great many parts of these useful machines should be united by electric welding and that the welding transformer should be applied for locally heating the parts in electric brazing or hard soldering, as well as for upsetting, bending or shaping. As products in which electric welding had its part may be noted bicycle crank hangers, pedals, seat-posts and fork ends, frames and brake parts, and the like.

More recently, since the automobile has come into existence, electric welding has entered into the construction of wheel rims for pneumatic tires, crank-shafts, cam-shafts and other parts.

One of its early applications which has gradually grown has been in tool manufacture, as in the production of drills, reamers, taps, band saws and circular saws, drawing knives, carpenters' squares, printers' chases, etc., and sometimes for the production of special machine parts. Teeth are inserted into gear wheels and saw bodies are provided with teeth welded on, while special stone saws have been for a long time built up by electric welding. As instances of machine parts may be mentioned inking rolls used in printing machines and fallers for looms, which are now constructed with the aid of the welding transformer.

Similarly, in the wire industry, the value of electric welding has shown itself, and the progress in such work goes on steadily. Beginning with the simple action of producing long lengths of iron, steel and copper wire from shorter pieces, there came the welding of wire or strips into hoops for barrels, tubs, pails and similar vessels, and numerous machines are now in operation resembling electric looms for turning out electrically welded wire fence in continuous rolls. In this case the wire used is usually zinc-covered or galvanized, and the machine is made entirely automatic, placing the wire in position, welding and cutting off the various pieces, while such machines are frequently adjustable to vary the size of mesh in the wire netting which constitutes the product.

Perhaps in few instances of welding has the electric welder shown its special adaptability more strikingly than in the welding of pipe lengths for the production of long lengths of piping from shorter pieces. Such long lengths are frequently wound up into coils and are, therefore, without couplings or screw joints. More recently, machinery has been constructed to weld continuous lengths of pipe to be laid in the ground, where, of course, it is desirable to secure absolutely non-leaking joints, as the joints are hidden out of sight. To this purpose the electric welder lends itself admirably.

Those interested in the development of street railways are, of course, familiar with the fact that hundreds of miles of street-railway rails have been electrically welded into continuous lengths and that long lines of these rails now exist in many cities. In this case the machinery is carried upon car trucks along the line of the rails and the welder suspended at the end of one of the trucks for applying the splicing bars and welding them to the rail ends. In general, the energy is taken from the trolley line by a series of transformations whereby the current is at last reduced in potential to the welding voltage of two or three volts and increased in current volume enormously for heating large sections. This constitutes some of the heaviest work done by electric welding, and on a similar scale with it is the local annealing of armor plates on warships. On the other hand, the delicacy of the operation can be made such that fine wires of one-fiftieth of an inch in diameter may be welded, and such small work as buckles, typewriter bars and umbrella rods is easily dealt with.

Oftentimes electric-welding processes prepare the material for subsequent working, as in the case of the welding of strips into plain bands or cylindrical rings which are afterward rolled into any section desired. A good example of this is the production of automobile-wheel rims, bands for roving cans, stove rings, etc. In a similar manner, yet for a different result, crank-shafts are built up from drop forgings, and the rough shaft so produced requires only light machining and finishing to its correct size.

Somewhat akin to pipe welding, but a somewhat more recent development, is its application to the forming of metal vessels for withstanding high pressures, such as soda-water cylinders, carbonic-acid reservoirs, and steel bottles for nitrous-oxide gas. In this case the cylindrical part of the vessel has the heads welded on, very much as two sections of pipe are welded end to end.

It is a feature of welding application that very frequently the fact of the article having undergone the welding process does not show in the finished article. A good example of this is in its use in the production of table cutlery, such as knives and forks. In such case the handles are formed hollow, of sheet steel, by a kind of drawing process, and welded to the knife or fork portion, after which the articles are finished by grinding, silver-plating and polishing, as usual. The neatness and quickness of the work which can be accomplished by special machines developed for this purpose are worthy of note.

In the development of electric-welding machinery there may be said to be several types. We have, for example, a machine designed to do a variety of work in which, perhaps, the sizes and the forms of the pieces are quite different. In such case the adjustments are usually entirely manual, the pieces being clamped by hand, the electric current being applied by the operator manipulating a switch, while the mechanical pressure is obtained either by a lever or by hydraulic means under the operator's control. In other types of machine, as in the welding of copper, iron or aluminum wire, the machine may be largely automatic. The pieces, it is true, may be placed in position in the machine manually, but the pressure for welding is automatically applied, and an automatic switch cuts off the current when the work is completed.

In still other cases, especially for work upon identical pieces or rapid repetition of the same operation, the entire sequence of actions is definitely determined in advance by the construction. In other words, the machine becomes practically entirely automatic. Such a machine may be driven by a belt or electric motor, and, by means of gears, cams and the like, the clamping of the pieces is accomplished, the current and pressure application following, and, further, the switching off of the current and release of the pieces takes place finally. A machine of this kind may, of course, be fed by manual operation, or, if the pieces allow it, they pass into the machine in sequence without the attention of the operator.

The electric-welding looms which are used in the making of wire fencing, as also chain-welding machines, which produce continuously long lengths of electrically welded chain, are indeed so completely automatic that the operation goes on uninterruptedly so long as the material holds out. This will be in the case in the fence machine alluded to when the reels from which the wire is fed are emptied. In such machines a number of joints are made simultaneously, and the welding is practically instantaneous, the division of energy supplied to the various joints being substantially perfect.

One of the most interesting developments in electric welding has been its application to the production of longitudinal seams in piping or tubing. This work has demanded the development of elaborate machinery, especially adapted to this particular operation. In this case the skelp or long strip of sheet metal is rolled up so that its edges meet, and in this form it enters between the welding rolls, whereby there is a local heating across the meeting edges first produced at one end of the strip, and as it advances this local heating follows the line of the joint, whereby a pipe of which the walls are of even thickness and the diameter uniform is produced. Sometimes this pipe is used in the form as it leaves the machine, but in other cases it is afterward drawn to an exact size. The joint presents itself at first as a delicate bead along the length. Naturally the stock from which the pipe is made can be quite thin if desired, while the localization of the heat to the seam has the result of the preservation of the finish and surfaces of the other parts of the metal not concerned in making the joint, and, therefore, there is no waste of material by scaling. By modification in the operation taper tubes may also be formed. Such a tube-welding machine has been constructed of size sufficient to make tubes or shells up to 16 inches in diameter from sheet steel or iron.

This brief sketch of some of the more important developments of electric welding would not be complete without reference to work which is being undertaken in the line of welding thin sheet-metal pieces flat-wise face to face so as to avoid the necessity for riveting. Methods have been developed within a comparatively recent period whereby this character of welding can be done practically on a large scale without difficulty, and it has a large field of application in the production of sheet-metal ware which is afterward to be enamel-coated, and the outlook for the expansion of these methods is quite extensive.

It is interesting to note, also, that the growth of the use of reinforced concrete has been assisted by the electric welder, which produces a wire mesh which can be embedded in the concrete, and the joints of which mesh are firm and incapable of slipping and of material of high tensile strength. Considerable use of this product has already been made. Other applications of electric welding are in process of development, which, however, cannot be described at this time.

It will be readily understood that electric-welding apparatus is in most cases of the nature of special machinery, and as such has demanded in its development an intimate knowledge, not only of electrical principles, but of a wide range of arts and manufactures. The experience gained in adapting it to any particular use is often of great value in determining how to proceed in making further developments for other uses. In general, it may be said that where the welder is applied on a large scale for continuous work or continuous repetition work the duty of the attendant is now practically limited to seeing that the machine is in order, and in some cases to the mere placing of the pieces in the clamps, while the rapidity and uniformity of the results obtained demonstrate the advantage of working by electricity in these special ways.

The Electrical Upbuilding of the West.

By B. E. Sunny,

Vice-president, General Electric Company.

THE manufacture and distribution of electric current in a successful and satisfactory way is such an everyday affair now that it is difficult to realize the problems of twenty years ago. In the light of twenty years' experience it seems rather ridiculous to consider what were then problems as problems at all.

B. E. SUNNY.

We had then the Edison system, made up of small bipolar generators, driven by belts from high-speed engines. The current was used for arc and incandescent lighting exclusively. Little or nothing had been done in the design and development of the stationary motor. Arc lighting was furnished by arc dynamos generating constant current.

John P. Barrett.

Charles A. Brown.

F. E. Degenhardt. (deceased.)

Truman P. Gaylord.

F. S. Hunting.

E. E. Keller.

Frank B. Rae.

A. H. Reece.

SOME OF THE MEN WHO HAVE BEEN IDENTIFIED

The central station with the largest number of small high-speed engines driving arc and incandescent dynamos—the engines and dynamos installed in a straight line from one end of the station to the other—was generally regarded as the best exhibition of electrical engineering.

Later on, the engineers came to the belief that a more efficient plant included the use of a large Corliss engine at, say, from 500 to 800 horsepower, driving a jack-shaft, the latter in turn operating the belts to the small electrical units. This type of installation was the popular one for perhaps ten years, until the advent of the direct-connected unit.

Twenty years ago we had only the single-phase 125 or 133-cycle alternator of 1,100 volts, and consequently each machine had its own circuit, and there was no such thing as multiple operation. It took perhaps five years to get a successful single-phase alternating-current machine to operate at 2,300 volts, because of the difficulty of insulating for so high a voltage.

One of the greatest problems that had to be solved by the central station was the distribution of high-voltage currents through underground conductors. In Chicago the use of underground conductors was forced on the companies by an ordinance by the city prohibiting the stringing of wire overhead.

The local company, which was made up of the consolidation of many smaller companies, bought a very large quantity of lead-covered cable, with an insulation of three thirty-seconds between the conductor and the lead sheath, which insulation was regarded as ample to carry a current of 9½ amperes at 2,500 volts for arc lighting. The experiment—for it turned out to be an experiment—was a disastrous failure, and the cables frequently burned out under the strain, and the service furnished was very unreliable. The large dry goods stores on State Street were deprived of light when they were filled with a crowd of holiday purchasers, and fires in buildings, caused by arc-light circuits, were of daily occurrence.

The cable problem was entirely beyond any electrician of that day, and, in desperation, it was decided to get cables of twice the insulation, with the hope that they would be able to furnish a reliable service. Cables of six thirty-seconds insulation were then made and installed, and the trouble disappeared. Later on, we scraped up enough courage to reduce the insulation to five thirty-seconds, and this has proven to be the standard for that character of service to this day.

The solving of the problem of underground circuits for arc lighting in Chicago was of the greatest interest to all of the cities, especially in the East. Delegations from New York, Boston and Philadelphia, to look over the work and pass on the service performed, were of weekly occurrence.

The value of the power business was fully recognized, and an effort was made to take care of it by the use of motors operated from arc circuits. The Baxter motor was of a very good type and furnished fairly good service. It was noisy, however, and it also flashed wickedly at the commutator, which had a terrorizing effect, so that it was rather uphill work to get any large number in service. Of course, the arc-circuit type of motor has almost entirely disappeared, and its place has been taken by the more satisfactory direct-current and alternating-current motors.

The advent of the direct-connected unit was rather interesting. Mr. D. G. Hamilton and Captain Robert McCulloch of the Cass Avenue Railway, St. Louis, wanted to make an important addition to their power house, and insisted on a 750-kilowatt generator and a 500-kilowatt generator being supplied them, direct-connected to Corliss engines. An effort was made by the electric companies as well as the engine builders to dissuade them from their purpose, but they were firm in their demand, and finally the contract was closed, not without the greatest possible hesitation, for the two units.

Both of the manufacturing companies were in a condition of fear and dread for months, while the designing and construction was going on, because of the boldness of the undertaking, but when the units were installed, the results were gratifying beyond all expectations.

This was probably the beginning of the manufacture and installation of direct-connected machines of considerable size.

The history of the business during twenty years is full of incidents of the above type. It is rather difficult to credit them, in the light of the situation of today, when the steam turbine, the multiphase generator of very large capacity, the long-distance transmission of current, the electrical equipment of steam-railroad terminals and interurban lines, have become accepted accessories of our everyday business.

While we seem to be in rather a finished condition with respect to present manufactures, it goes without saying that in the next twenty years there will be important developments, but it is not possible that they will be of as great importance as the developments of the twenty years just passed.


Francis B. Badt.


Foree Bain.


F. W. Cushing.


George Cutter.


Chas. E. Gregory.


W. S. Heger.


W. A. Layman.


W. W. Low.


Chas. D. Shain.


B. Frank Stewart.

WITH THE ACTIVITIES OF THE "ELECTRICAL WEST."

Early Underground Electrical Construction in Chicago.

What is believed to be the first example of underground electrical construction in Chicago was carried out in 1877 by Mr. J. P. Barrett, then superintendent of the city fire alarm telegraph, who laid a short distance of fire-alarm circuits underground on the North Side, to serve the district known as "The Sands," at the request of some nearby residents who objected to overhead wires. As far as known, these underground wires are still in use.

The first electric-light cable to be laid underground in Chicago was put down in 1883, and a portion of it is illustrated by the accompanying picture.

Underground telephone cables in this city date back to 1885, when about ten miles of cable was put down in the central part of the city under the supervision of Mr. B. E. Sunny, then connected with the Chicago Telephone Company. The joints in these cables were about 500 feet apart, and the construction excited much attention at the time.


A PIECE OF THE FIRST UNDERGROUND ELECTRIC-LIGHT CABLE (NATURAL SIZE) LAID IN CHICAGO.

The electric-light cable illustrated consisted of two half-round copper rods embedded in insulating compound and enclosed in an iron pipe 1¼ inches in diameter. Each copper conductor measures one-half inch along the chord and is three-sixteenths inch in thickness. The whole constituted perhaps the earliest type of "Edison tube" and was laid in lengths of 20½ feet. The interesting relic shown in the picture was put down, as stated, in 1883, and when dug up, many years later, was presented to R. C. P. Holmes, purchasing agent of the Commonwealth Edison Company, who laid it originally when connected with the Western Edison Light Company. The tube was used to convey current at 110 volts from an isolated plant in a barn in the rear of J. W. Doane's residence on Prairie Avenue, near Eighteenth Street, to three other houses in the same block.

Colorado Electric Light, Power and Railway Association.

On September 18th, 19th and 20th there was held the annual convention of the Colorado Electric Light, Power and Railway Association at the Savoy Hotel, Denver, Colo. There was a good attendance at both the social and business meetings. The entertainment features consisted of a theater party at the Broadway Wednesday evening; a visit to the Northern Colorado Power Company's plant at La Fayette Thursday afternoon; visits to the plants of the Denver Gas and Electric Company and of the Denver City Tramway Company Friday afternoon; banquet and meeting of the "Sons of Jove" Friday evening, besides special automobile rides for the visiting ladies.

Among the papers read at the business meetings were the following: "Incandescent Lamp Outlook," by Francis W. Willcox of Harrison, N. J.; "High-tension Porcelain Insulators," by Frank E. Johnson of Denver, Colo.; "Lightning Protection in Colorado," by Leonard Wilson of Denver, Colo.; "Central-station Power Problems," by Charles Robbins of Pittsburg, Pa.; "Notes on Modern Boilers," by B. E. Buttles of Denver, Colo.; "Business Building by Commercial Departments," by George E. Putnam of Denver, Colo. Each of these subjects was discussed as well as the power-transmission situation in Colorado and the technical problems met with.

At the final meeting the association voted to include Montana, North and South Dakota in its territory, and elected the following-named officers for the coming year: President, W. G. Matthews of the Denver City Tramway Company; vice-president, C. R. Durbin, United States Light and Traction Company; secretary and treasurer, J. Frank Dostal, Denver Gas and Electric Company.

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CORRESPONDENCE relating to electricity or any of its practical applications is cordially invited, and the co-operation of all electrical thinkers and workers earnestly desired. Clear, concise, well written articles are especially welcome; and communications, views, news items, local newspaper clippings, or any information likely to interest electricians, will be thankfully received and cheerfully acknowledged.

ADVERTISING.—THE WESTERN ELECTRICIAN—**the only general electrical paper published in the West**—thoroughly covers a territory *exclusively its own*. THIS IS A CLAIM WHICH CAN BE MADE BY NO OTHER ELECTRICAL JOURNAL IN THE UNITED STATES. Electrical merchants and manufacturers *desiring western trade* will appreciate the UNEQUALED VALUE of this journal as an advertising medium in its special field. Advertising rates are moderate, and will be furnished on application.

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CONTENTS OF THIS NUMBER.

DEPARTMENTS.

IN GLANCING BACK through the vista of twenty years of electrical development, as is done in this Twentieth Anniversary Number of the Western Electrician, it will be interesting to reprint the very first editorial utterance of this journal, not only to see what were the aims of the new enterprise, but also to gain some idea of the state of the art of applied electricity at that time. Here, then, is the introductory editorial of Volume I., Number 1, dated July 2, 1887:

"In presenting the Western Electrician and explaining its mission it is unnecessary to dwell on the marvelous achievements in the electrical field during the last few years. The telegraph, the telephone and the electric light have followed in quick succession. The electric motor is at hand, and its promise of commercial success is as great as that of its predecessors. But these four great electrical accomplishments are not all by any means. Apace with them has been the development of a host of minor electrical appliances, many of which have become distinct branches of industry. Today the development and manufacture of electrical appliances command more thought, more labor, more capital than almost any other department of trade. Yet we stand only at the edge of a comparatively unknown field, the exploration of which is going on more rapidly than ever before.

"While keen minds and skillful hands the world over have contributed to the researches and inventions which have placed applied electricity in its present position, it is in the United States that these applications have reached their greatest commercial success, and no part has shown greater activity than the West. It is a question if any other portion of the country has equaled the West during the last eighteen months. Certain it is that in this section electric-light manufacturers have found the most extensive market for their products. Certain it is that the promoters of the telephone have found it easier to acquire paying subscription lists in small western towns than in similar towns in the East. If we mistake not, a western city enjoys the distinction of being the first in America to adopt and practically operate an electric street-railway system of more than one or two cars. It is in the West that telegraph companies make their heaviest earnings. Today the West is the great electrical market of America. Its advancement to this position has been rapid and sure. Many eastern manufacturers discovered the tendency of trade long ago, and, realizing the impossibility of handling their western business from remote distances, have either moved west or established important agencies in our larger cities. In every case the wisdom of the move has been proven, and in many instances it has been found that a larger and more profitable business has been done in the western department than at the home office. The West, too, is the home of a number of the largest electrical concerns in the world. They have realized the benefits of proximity to a good market.

"No local pride dictates these words. They have not been written with the intention of disparaging any other section. The facts, however, cannot be controverted; and we are but reflecting the experience of the past in stating that the West is worthy of the closest cultivation by manufacturers and dealers in electrical appliances.

"Notwithstanding the remarkable activity in matters electrical in the West, western electricians and manufacturers have been dependent on eastern publications for their literature, and for channels through which inventions and manufactures could be brought to public notice. The need of a representative western electrical paper has been apparent for some time. The subject of establishing such a journal has been urged by western electrical men, and their assurances of hearty co-operation and substantial support have not been wanting.

"The warmth of the welcome with which the project of issuing the Western Electrician has been received is strongly evinced by the extent of our advertising columns. Our reading columns give a foretaste only of what is to be provided in that department. We believe we are well equipped for the work. With the auspices of the undertaking, and the incentives before us, we hope to place the Western Electrician not only in the foremost rank of papers of its class, but in the lead. To accomplish this end no thought, labor or money will be spared.

"At the outset we wish to define our position. No man connected with the Western Electrician is bound to any other electrical enterprise; we are therefore in a position to publish an independent, unbiased and honest journal. No newspaper is worthy of the name unless it provides the news. It will be our endeavor to place before our readers the thoughts, experiences and accomplishments of those interested in the department of electrical investigation. Not only is our editorial staff composed of practical electricians and writers of experience, but our correspondence will be from among the leading electricians and scientists of this country and the old world. We have planted our standard high, and we confidently look forward to the time when the weekly receipt of the Western Electrician will be more warmly welcomed than this, our first number."

So far as the Western Electrician itself is concerned, we believe that our readers will agree with us that it has striven worthily to maintain the high standard it set for itself. It has been an "independent, unbiased and honest journal" and a leader in technical journalism, while at all times, we believe, of real interest, value and help to its readers. A retrospective glance at the career of the paper, such as we indulge in on the opposite page, shows that the record is one in which we may take an honest pride. Mr. McKinlock kindly says, in his article given elsewhere, that the Western Electrician has been "a guide and friend to all western electrical interests," and we shall endeavor to warrant a continuance of this praise in the future.

The present issue speaks for itself. It gives some idea of the extent of the electrical application of today in the principal avenues in which it is directed, and this particularly in the West. It may be compared with the beginnings of the great expansion of the electrical industry, as referred to in the editorial of twenty years ago, which has been quoted.

Marvelous indeed have been the changes, the growth and the number of new developments in the electrical arts and industries during these twenty years. The authors of the articles presented in this issue tell the story, and it reads like a fairy tale. And yet the account is given soberly and without exaggeration by men who are undisputed authorities on the subjects on which they have been induced to take time to write for this anniversary issue of the Western Electrician. Indeed, we are especially proud of our contributors; they are men who stand high in the electrical community, East or West; and we now take occasion to thank them, individually and collectively, for their kind co-operation in making this number what it is.

Aside from the historical value of the many excellent articles in the Twentieth Anniversary Number, the careful reader will find many suggestions that loom large toward the future. Thus, Mr. Insull lays stress on the importance of wholesaling current to large users, such as the street-railway companies, and he seems to think it not unlikely that the "larger transportation companies," meaning perhaps the present steam-railroad companies, may be buyers of central-station current in the future. This is a most interesting suggestion, and one which will give more than one plant manager food for thought. It inevitably leads to the consideration of the great question, "Will the trunk-line railroads be electrified?" In his electric-railway article Mr. Arnold does not hesitate to give it as his opinion that the answer to this question is in the affirmative. It is only a question of time, he thinks. Thus it seems probable that the principal steam railroads will be electrified. If so, will the central station benefit by the change?

One of the most interesting articles in this number is by Elihu Thomson, who shows the amazing extent to which the electric-welding process has been developed. Few, even among electrical men, we imagine, realize the great diversity of processes in which electric welding plays a part, and this article is of wide educational value. Professor Carhart proposes an important change in the engineering curriculum. But we must not go on dipping into these various articles. Here they are—a storehouse. Many are for profit, some not without entertainment. All may partake and be content.

The Western Electrician Twenty Years in Retrospect.

Dated July 2, 1887, the first issue of the Western Electrician marked the beginning of electrical journalism in the West. The paper was issued from the start as a weekly, and it appeared in the familiar blue cover which has been distinctive ever since. The size of the page was practically the same as at present, and the first number consisted of 24 pages, of which 13 were devoted to advertisements. Since then the number of pages issued weekly has greatly increased. The present Twentieth Anniversary Number is made up of 96 pages, of which 60 are advertising pages.

The paper was founded by Mr. W. A. Kreidler, the first editor and manager, and Mr. Kreidler has continued to be the guiding spirit of the enterprise from that day to this.

From the start the paper gave evidence of the excellent illustrations and handsome typography which have remained characteristic. A prominent feature of the first issue was the beginning of an illustrated serial on "The Elements of Electric Lighting," by Dr. Philip Atkinson, while another serial was begun on "Theory of Telephone Cables," by Dr. V. Wietlisbach, translated from the Elektrotechnische Rundschau. Other articles were "Millimetrical Measurement of Wire," by F. R. Welles; "Telephone System for Large Buildings," illustrated; "New Series Incandescent Lamp" (Thomson-Houston), illustrated; "A New High-speed Engine," illustrated; "A Corner on Electric-light Carbons;" "Chicago Electric Club" (an account of the organization); "Electricity as a Mode of Motion," by Dr. Atkinson, and "Electricity Applied to Air Brakes." An interesting feature was the introductory editorial, which is quoted in full on another page. There was a department of "Personal Paragraphs" and others relating to "Electric Lighting," "The Electric Motor," "The Telephone," "The Telegraph," "New Enterprises," "Miscellaneous Notes" and "Business Mention."

In the third issue was begun a description of the electrical patents issued by the United States Patent Office during the preceding week, and this valuable feature of the publication has been preserved ever since. In passing it is interesting to observe that of the 28 electrical patents issued on July 5, 1887, one was to Thomas A. Edison for a system of electrical distribution. It was thus described: "Two or more dynamo-electric machines are connected in series, and a circuit from these machines extends to sub-stations, at each of which feeding circuits are taken off to supply that particular district." So the sub-station idea is not a particularly modern feature of electric-light distribution. Other patents were granted to John Kruesi of Brooklyn for a junction box and an electrical conductor, while J. J. O'Connell of Chicago was granted a patent for an annunciator, William H. Eckert and John A. Seely of New York one for a police telephone system, and Stephen D. Field of New York another for a printing-telegraph transmitter.

In a technical journal the advertising pages are no less interesting, perhaps, than the "reading matter." The first issue of the Western Electrician was patronized by 24 advertisers—a creditable number when it is considered that they accepted the publisher's representations entirely on faith. Here is a list of the names of these original advertisers:

E. P. Allis & Co., Milwaukee.
Brush Electric Co., Cleveland.
Central Electric Co., Chicago.
Cleveland Electric Motor Co., Cleveland.
Edison United Manufacturing Co., New York.
Electrical Supply Co., Chicago.
Forest City Electric Works, Cleveland.
Fort Wayne-Jenney Electric Light Co., Fort Wayne, Ind.
Giles Bros. & Co., Chicago.
A. L. Ide & Sons, Springfield, Ill.
Jarvis Engineering Co., New York.
Jenney Electric Co., Indianapolis, Ind.
Leonard & Izard, Chicago.
Midland Electric Co., Omaha.
New York Safety Steam Power Co., New York.
B. W. Payne & Son, Elmira, N. Y.
Pond Engineering Co., St. Louis.
Railway Telegraph Supply Co., Chicago.
Standard Electrical Works, Cincinnati.
Thomson-Houston Electric Co., Boston.
United Carbon Companies, Cleveland.
United States Electric Lighting Co., New York.
Van Depoele Electric Manufacturing Co., Chicago.
Western Electric Co., Chicago.

In the present issue, by way of contrast, it may be mentioned that there are 204 distinct advertisements. But more than that—significant as showing the standing and character of the paper—it is pleasing to note that practically every one of the first-issue advertisers that is now seeking electrical trade is still represented in the pages of the Western Electrician, twenty years after, by itself or its successor.

With succeeding issues the paper was improved and broadened. In the second number Forée Bain gave "An Electrician's Views on Belting," for belting was an important subject in those days. It was also noted at that time that the American Institute of Electrical Engineers had nearly two hundred members. Ralph W. Pope, then as now the secretary of the Institute, was hustling to get together an electrical library. The first electric lighting plant described and illustrated was an isolated one—that at the Cook County Hospital. An illustrated article in the third issue was on "The Silver Voltameter and Its Use," by Prof. H. S. Carhart, who is also an esteemed contributor to the present issue.

With its third issue the Western Electrician began the practice of printing the papers and discussions of the Chicago Electric Club, of which Mr. Kreidler was secretary for several years. This feature was of real value, for important technical questions were threshed out before the club, and its deliberations attracted wide attention at home and abroad. A history of this unique organization—a technical society and a social club combined—is given on another page.

From the beginning the Western Electrician was warmly received, not only by its western friends but by its older electrical contemporaries in the East, and it may be said to have been successful from the start. It showed enterprise in chronicling the progress of the art; it used the telegraph freely; it was liberal with illustrations when cuts cost more money than they do now; it presented the electrical news of the day with intelligence and fidelity; it rose to important occasions, as in "covering" conventions and the like.

One early example of enterprise that attracted wide attention was the issuing of a Daily Western Electrician every morning at seven o'clock during the sessions of the National Electric Light Association in Chicago in February, 1889. Each issue contained from 20 to 28 pages, well illustrated, giving a complete report of the preceding day's proceedings. This was undoubtedly the most ambitious undertaking in the history of electrical journalism up to that time.

The World's Fair of 1893 in Chicago was of particular importance to the electrical interests in many ways. As early as 1890 the Western Electrician recorded the first movement for electrical representation, and from that time until the close of the exhibition the electrical interests at the Fair found in this journal their warmest champion. The plans of the Electricity Building were first made public by drawings published in the Western Electrician, and the first perspective view was drawn in the office of the paper from the architect's plans and afterward adopted by the World's Fair authorities as an official picture. It was the Western Electrician, also, which led the opposition to the evening-closing rule, which was eventually repealed. In the week ended May 6, 1893, a distinctive World's Fair issue was published, and it was highly complimented. Eleven years later, dated April 16, 1904, another handsomely illustrated World's Fair issue appeared from the office of the Western Electrician, this time relating to the electrical features of the Louisiana Purchase Exposition at St. Louis.

The Twentieth Century Souvenir Number of January 5, 1901, was another issue that attracted wide attention, and it is proper to remark, also, that the Western Electrician was the first electrical journal to prepare its own estimates of electrical manufactures for the New Year's number. And so other important events in the career of the paper might be enumerated if time and space permitted. But, after all, the more essential thing is the value of the service that a technical journal performs for its patrons week by week; and no doubt it is the character of this service, rendered 52 times a year, that has brought about a continuance of favor through twenty years, through good times and bad, and which induces a confident outlook toward the future. It may be added that the paper's total business for 1906 was the largest in its history, and its business for the first six months of 1907 was the largest six months' business it ever had.

A company is being formed for the purpose of building a trolley line from Superior to Ashland, Wis. It is proposed to have the road financed by people along the line, which will be about 100 miles long.

In the Good Old Days.

By F. S. Terry,
First Vice-president, National Electric Lamp Company.

It was in November, 1884, that John Wallace, then manager of Wallace & Sons, the large copper rolling mill concern, sent me out from Ansonia, a small town in Connecticut, to open up an electrical supply store in Chicago. I was given a draft for a thousand dollars and some good advice, and the trip was made by the West Shore Railroad, which had just been completed.

F. S. TERRY.

Chicago was then a city of 500,000 inhabitants. It had wooden sidewalks on all excepting the principal downtown streets, and with a different elevation in front of almost every house, so as one passed along he was continually going up and down steps, to reach the different levels. Within easy walking distance from the center of the city one could gaze out on the prairie with hardly a house to obstruct his view.

Why I was selected to start an electrical supply house is more than I can understand. I had had no business experience, and did not know a push-button from a binding-post. Forée Bain, who was then, as now, in Chicago, was engaged to teach me the science of electricity, and my first lesson was in setting up an electric battery.

The concern with which I was connected was called the Electrical Supply Company, and John Reid and myself were made joint managers of the new branch. We secured a room in the second story of a building on Lake Street, and soon a few bells and batteries, the first goods for our stock, arrived, and with these we opened up the store. Fortunately, most of our customers knew little more of the electrical business than ourselves, so we got along fairly well.

John Reid had had a little experience in the electrical business, and was therefore our electrical expert, but soon he and I disagreed and parted company, and the management of the business remained with me.

The Western Electric Company had been doing all of the electrical business in this part of the country, and at first seemed to resent our breaking in, but I presume after they had looked us over, their enmity turned to pity, and we became good friends. E. M. Barton was then, as now, president of the Western Electric Company, and Charles A. Brown, the patent attorney, was its manager.

The volume of the business done by the Electrical Supply Company each year increased, until, in 1893, the year of the panic, when the business was closed, owing to the failure of Wallace & Sons, it was doing a business of nearly a million dollars a year, which in those days was a large electrical supply business.

One of the closest friends I had during my first year in Chicago was Myron A. Knapp, who was then making telegraph instruments; we were both having a hard time with business, and would meet every noon at luncheon for mutual sympathy.

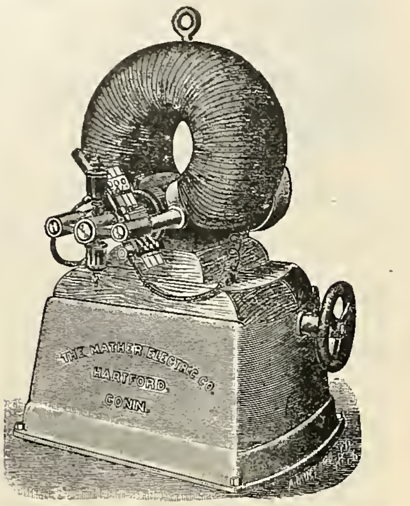
One of the first ones to call upon me at the electrical supply store was W. A. Kreidler, the western representative of the Electrical World, and he soon convinced me that an advertisement in the Electrical World would result in my obtaining all the business that I could take care of. He had prepared the copy for my first advertisement, and he had a contract all filled out for the space he thought I should take, and the deal was closed.

About this time Charles W. Price came to Chicago from the West, and was the Chicago representative of the Electrical Review. There was Fred Degenhardt, who was the most genial and perhaps the finest fellow that I have ever known. There was a young fellow who was selling engines, who was full of life, energy and push; I think his name was W. A. Hammett. Everyone in the electrical business or who sold anything to electrical people would at once become well acquainted, because there were so few of us.

A. K. Stiles was running the Van Depoele Electric Manufacturing Company, and E. A. Sperry was the electrician of the Sperry Electric Motor and Car Brake Company. R. T. McDonald was the whole thing in the Fort Wayne-Jenney Electric Light Company. F. B. Badt and Henry Hine were with the United States Electric Light Company; C. C. Warren was its western manager.

One day B. E. Sunny, who was then with the Chicago Telephone Company, came into the supply store for prices on cross-arms, insulators, etc.

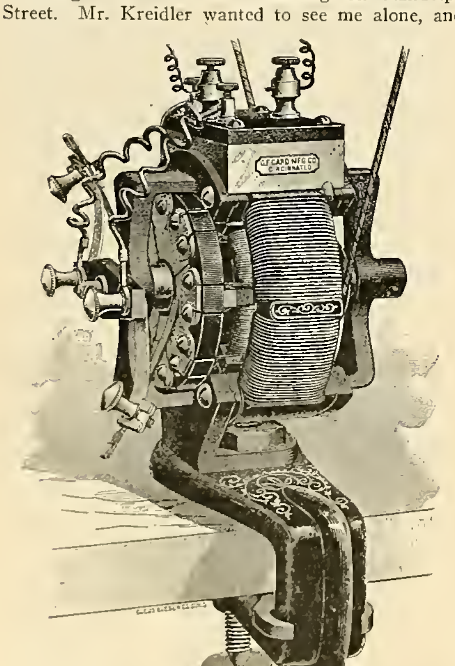
George S. Bowen was the proprietor of the Elgin Electric Light Company, and one day about the end of 1884 he expressed the opinion that the electric-lighting companies throughout the country should have an association similar to the one the gas companies had, and he suggested that we get together at the Grand Pacific Hotel and discuss the matter. This we did a few evenings later, and it was decided that the meeting should be called, and Mr. Sperry and myself were made a committee on invitations. Mr. Price had an announcement inserted in the Electrical



Reproduced from the Western Electrician of October 15, 1887.
A DYNAMO WITH HORSESHOE FIELD MAGNET, ONCE FAMILIAR BUT NOW RARELY SEEN.

Review, and we all awaited with much interest the arrival of the delegates, who came from all parts of the country, and the meeting was held in February, 1885, at the Grand Pacific Hotel, Chicago. This was the beginning and the first meeting of the National Electric Light Association.

A year or two later, I think it was one day in the summer of 1887, W. A. Kreidler came into my office, which had then been moved to larger quarters on the ground floor in a building on Randolph Street. Mr. Kreidler wanted to see me alone, and



Reproduced from the Western Electrician of November 5, 1887.
AN EARLY MOTOR FOR ARC CIRCUITS.

told me he had something to tell me which to him was of very great interest; he told me he had resigned from his position with the Electrical World, and he then brought out a dummy of the Western Electrician, which he said was to be a new electrical publication to be owned and operated by himself.

Mr. Kreidler had a personality which was irresistible, and it did not take him long to persuade me that the proper thing for me to do was to take a choice page in the new paper on a year's contract. The subject of circulation was not even mentioned. The Western Electrician gave evidences of progress and prosperity from the very beginning, which was due to the energetic work of Mr. Kreidler, as there was never a moment that he was not doing something for its advancement, and he had a host of friends who seemed to be equally anxious for its success.

An account of these times would not be complete without referring to the Chicago Electric Club. This was organized in about 1887, and was the scene of many pleasant times, some of them being of a lively character. We used to meet at the club for luncheon, and besides those I have mentioned, were H. Ward Leonard, who was then connected with the western branch of the Edison Electric Light Company, and S. A. Barton who was the western manager of the Thomson-Houston Company. Those of us who were the most active in the club will easily remember the dinners that were given, when the word would be passed to keep the champagne glasses full, and with the songs, speeches and good fellowship we probably never had more enjoyable times. The Electric Club continued so long as a few of us were willing to make good its deficits, but in 1893, the year of the panic, we had other uses for our money, and the club went with our other luxuries.

The Evolution of the Supply Business.

By Geo. A. McKinlock,

President, Central Electric Company, Chicago.

One of the world's most entertaining, analytical and greatest writers took for the title of one of the most important books of his most interesting series "Twenty Years After." From the advanced period of twenty years, looking backward, there passes before the reader's mind a sequence of incidents and events which appeared during the transitory time as incoherent and irrevelant; and so in looking backward in the electrical supply business twenty years, one sees a sequence of advances in the business, although during the period what appeared to be violent changes seemed to have no reference to the progress of the business.

GEO A. M'KINLOCK.

It seems only a few days ago that Mr. Kreidler climbed the stairs at 38-40 La Salle Street, second floor, to make a call on the youngest, but now oldest, electrical supply house in the country. There was but one other in existence at that date. Mr. Kreidler came to herald the approaching birth of the Western Electrician, which he said might be looked for almost any time.

It would be hard to describe a "Western Electrician" of that date, so that the reader who never met the genii would find it difficult to construct from a description, however complete, the living and breathing personality.

That he was "practical"—we took his word for it. He rarely if ever made any claims to being theoretical, leaving that field to the "E. E.'s," who furiously contended with each other in the columns of the electrical journals of that date, much to the profit and edification of the laity.

The name chosen seemed to be at least practical, therefore, but as events and the high character of the paper have since shown, it has been a guide and friend to all western electrical interests, practical, technical, theoretical, and commercial, and I have every confidence that in the files of the Western Electrician for the past twenty years will be found a more interesting and instructive story of the progress and evolution of the electrical business in this great Central Market than is possible to be prepared at this time. Its advertising pages will be found lively reading and will show forth better than tongue can now tell the energy, enthusiasm and zeal of the "boys" of those days.

The electrical supply house twenty years ago was established to supply electrical merchandise in a field which was very much restricted, due to the fact that the manufacture of the machinery which produced the electric current was in the hands of a very few manufacturers, who laid claims to control patents on the machinery as well as on the method and process of distributing the electric current.

The manufacturers of electric-lighting machinery (the electric-railway and power business came later), as is well known, offered to buyers complete equipments, and controlled, or claimed to control, the manufacture and sale of the detailed parts that went to make up their installation systems. The only field that was, therefore, open to the supply dealer was the sale of construction material, telegraph supplies, electric bells, fire-alarm and experimental apparatus and such other detail construction and wiring supplies as were not controlled by the manufacturers. It would have been a serious offense in those days for a supply dealer to offer an incandescent or arc lamp for sale.

The rapid development of the business taxed the manufacturers' capacity to its utmost, as well as the promoters', with the result that there was attracted to the electrical field all kinds of talent. Inventors with divers inventions, devices and schemes thronged the market place, and every small machine shop had its Edison.

During this period the process of sifting went on, and the centralizing tendencies which appeared in the commercial world were quickly at work in the electrical field, and then came consolidations, in groups, of the manufacturers of devices and inventions of merit.

Improvements in the manufacturer's art and the appliances widened the scope of the supply dealer's business. As the business broadened, in the absence of any manufacturer's ability to carry a full stock and distribute to the buyers according to their needs, the supply business came into its own.

During all this time an element of every successful business became more and more prominent, until now it is recognized as one of the most important elements to the success of the supply business. This element is the question of credit. During the early days of the period of the last twenty years this question was of little, if any, importance, as it was always assumed that anyone that wanted to buy electrical goods must of necessity be in good credit, and the talent of the supply man was exhibited in his ability to get from the manufacturer merchandise to fill the demands of his customers. Of course, there were some losses, but profits were so large that losses were taken lightly.

Today the business of buying and selling electrical merchandise is on a firm and permanent foundation, and is subject to all the vicissitudes and experiences of any merchandising business, and if conducted successfully must be carried on according to the recognized rules of the best business practice.

The business today offers attractions and opportunities for ambitious, active, intelligent young men of character and education. I have always regarded the educational work done by the Western Electrician as being of great value in assisting in the training and education of young men without school or college experience and advantages, who felt drawn to and adopted the electrical business as their life work.

Surely the electrical journal that has contributed to the building of the electrical West is to be congratulated.

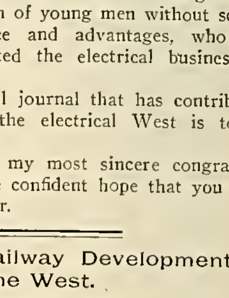
I therefore extend my most sincere congratulations and express the confident hope that you may live long and prosper.

Early Electric-railway Development in the West.

By Aaron K. Stiles.

In accordance with request, I submit a short article relative to the early days of the electric-railway industry in Chicago and the West.

Much that has been said regarding the pioneer days of the electrical industry has been quite misleading, emanating probably from persons who are anxious to sell stock in schemes for the promotion of so-called electric railways. The public in general has but little idea of the real facts in regard to the work that was done in early days.



AARON K. STILES.

The Van Depoele Electric Manufacturing Company, whose factory was at 15 to 21 North Clinton Street, Chicago, was the company that did the work in introducing electric motors and electric railways in the United States. The majority of the capital stock of this company was owned by me.

Charles J. Van Depoele, electrician and inventor of electric motors and electric railways, was a native of Holland and came to Chicago from Detroit, Mich., about the year 1882, when the Van Depoele Electric Manufacturing Company was organized. Mr. W. A. Kreidler of the Western Electrician knows that Mr. Van Depoele was an original inventor of electric railways and that the Van Depoele Electric Manufacturing Company worked to introduce this system up to the year 1887, when the company sold out its rights to the Thomson-Houston Company.

During the time the Van Depoele Electric Manufacturing Company was doing business the principal difficulty encountered was in getting the right to put up the electric wires as they are used today. The prejudice of the public was so strong against the use of electricity that the people had to be educated in its use. It was difficult to convince the public that persons riding upon the cars would not be killed by the electric current.

Mr. Van Depoele was born in 1840 and commenced the study of electricity at a very early age at Poperinghe. While at college in 1861 he produced his first light of 40 Bunsen cells. He afterward moved to Lille, France, where he attended regularly the lectures and experiments of the Imperial Lyceum from 1864 to 1869. When he came to this country he exhibited his first lights and electrical appliances at Detroit, Mich., where he had established his home. As early as 1874, when he was engaged in Detroit experimenting with electrical generators, motors and other electrical apparatus, it occurred to him that trains of cars and ordinary street cars could be run by electricity. On many occasions the belt of his 10-horsepower engine was disconnected from his main shaft driving the shop machinery and the engine was made to operate a large dynamo which drove another dynamo. In 1882 the Van Depoele Electric Manufacturing Company made its first exhibit of a small electric railway in Chicago. About the first week in February, 1883, a plant was put in real operation, and commencing September 10, 1883, a small installation was put in operation at the Chicago Interstate Fair.

In 1884 the Van Depoele company ran an electric railway in Toronto, Canada, carrying passengers from the street railway into the grounds of the Toronto Exposition. The company at this time used an underground conduit, owing to the prejudice of the people against an overhead electric wire. In the fall of 1885, on the same track, the Van Depoele company carried all of the passengers into the Toronto Exposition grounds, a distance of about a mile. An overhead wire was used the same as those now used by electric companies. The number of people carried in five days was over 50,000. To my knowledge, this was the first electric railway where the contact was made with the overhead wire by means of a pole and trolley running under the wire.

The several roads that we had equipped in different parts of the country previous to this time had used a trolley running on top of the wire, the wire being suspended on a hook which allowed the trolley to pass over.

In 1886 we equipped a temporary road running from Minneapolis to Lake Minnetonka, and on one occasion ran ten cars, loaded with all the people that could be piled in, from Minneapolis to the lake. This was to show what could be done, an agreement having been made with the Van Depoele company that the road would adopt the system if it were successful. The Van Depoele company did all that it agreed and more, but the contrct was not consummated, as the president of the railway company had been offered one-half of the capital stock in a soda motor which at that time had come into existence. The railroad company not being responsible, we withdrew for other fields.

In 1886 a railroad was equipped in Montgomery, Ala., where the road did good service, and I suppose is in use to this day. During that year we also equipped a road at Lima, Ohio, and another at Windsor, Ont., and a short road at Detroit, Mich. During the same year we equipped a road at Appleton, Wis., and another at Scranton, Pa., running from Scranton to Nayog, which was called the Scranton and Suburban Railroad. The Lima street railway was put in operation July 4, 1887. In the month of June, 1887, we equipped the Washington Street and State Asylum Railway at Binghamton, N. Y. Here the length of track was five miles and the single overhead wire system was used. In 1887 we also constructed a double-track railway from Brooklyn to Jamaica on Long Island, a distance of six miles, and it was a perfect success. Other roads electrically operated were at Ansonia, Conn., Dayton, Ohio, and Port Huron, Mich. In all, 14 electric railways were equipped. For all of these roads we built power stations and equipped the stations with dynamos from our shop in Chicago.

It was difficult to get car companies to build cars for us, as the general impression was that the electric-railway business would not be a success. The Pullman company built the cars for the Scranton Railway, Brooklyn and Jamaica road, and the Ansonia Railroad; also, I think, the cars for Appleton, Wis. John Stevenson of New York, who was the principal, in fact the first car builder in the United States, refused to build any cars for us without the money being deposited for payment in advance. Outside of those built by the Pullman company, the Brill company of Philadelphia was the first whom we could induce to build cars for us. During this time, in all of our literature, of which I have some specimens, our aim was to convince the people that not only would the cars operate, but that people would not be killed while riding.

It seems at this time very foolish to obtain certificates as to what an electric railway will do, but it was a serious necessity in early days.

During the seven years we worked at this business I spent about 18 hours a day, on the average, to make the electric-railway business a success, but no one would be convinced at that time that cars could be run by electricity except by actual observation.

The Van Depoele Electric Manufacturing Company used motors for power in its shop as early as 1884, doing away with shafts belted from engines.

We had the first cases of electrolysis, so far as I know. There were hundreds of circumstances during the time that we were equipping these roads with electricity which were perfectly ridiculous, and viewed from this long distance are laughable. But at the time they appeared serious enough.

During all of this time I was the general manager of the Van Depoele company, holding most of the stock of the company, which had been unloaded upon me by the other stockholders who had lost faith in the enterprise.

We installed the first electric arc lights in Chicago, and were the second company to make such installations in the United States, the first company being the Brush of Cleveland, Ohio, which had previously put electric arc lights in Detroit and several other places.

It seems now, since electric railways have proved a success, that all kinds of fakes are foisted upon the public; some of these schemes appear to me absolutely ridiculous, but they seem to gather in money.

Such schemes as the one which is to run cars to New York in ten hours are, I think, absurd; also the electric railways that are advertised to run at the rate of 200 miles an hour.

Electric railways have done all that was predicted for them, have built up the suburbs of the large cities and are at present carrying the largest share of the suburban passengers, but I doubt that for extreme long-distance service they will be made to pay. Large amounts of stock and bonds have been disposed of on the interurban electric lines in the United States, most of which are not listed on the stock board in New York, and from which cash on short notice cannot be realized. A large number of interurban roads are undoubtedly making money; but there are others that have been built and are being built to make long-distance connections, which, in my opinion, will not pay for many years. They have done a great deal of good and are entitled to credit for what they have done as interurban roads, but I do not believe that for long distances and for freight business they can yet compete with steam roads.

Some Municipal Lighting Plant Failures.

The City Council of Princeton, Ill., has advertised for bids for the sale of the municipal electric-lighting plant. If the bids are unsatisfactory, it reserves the right to reject them and adopt the alternative plan of expending from $8,000 to $10,000 to put the plant into good condition. It was never a popular venture.

The Galena (Ill.) lighting plant, which has been operated by that city for a number of years, has been sold to a western syndicate at a price much lower than the original cost. The plant never paid expenses and was such an unprofitable investment that the citizens were glad to dispose of it. A contract for furnishing light has been closed with the syndicate for 25 years.

The business men of Washington, Ind., have just refused to advance any money to keep the municipal electric plant there in running condition. It has been estimated that it would cost $85,000 to make requisite repairs. The people have from time to time spent large sums of money upon the plant without seeing any improvement in service or reduction in operating expenses. A majority are demanding the sale of the plant and the execution of a lighting contract with a private company.

The city electric-lighting plant of Topeka, Kan., is said to still show a steadily increasing deficit. The public is asking for better service and a reduction of taxes required for running the plant. Unless a much better showing is soon made, tbe sale of the outfit may be demanded.

A Backward Glance in Kansas City.

By Edwin R. Weeks.

Reminiscence of the early days of electric light and power recall the phenomenal development of this industry in Kansas City, where many of the initial trials of its various devices were made. It is but 26 years since the first central station in the world employing Thomson-Houston apparatus was installed in Kansas City. Yet in that brief period not only the practice but the very nomenclature has so changed that many of the old terms need explanation to the younger generation of electrical engineers, and the development of the industry has been so great that its exposition has exhausted the vocabulary of miraculous achievement.

EDWIN R. WEEKS.

Twenty years ago I served as court appraiser on the remains of what had been one of the world's first attempts at commercial operation of street cars by electricity. The apparatus employed was assembled and in part invented by J. C. Henry of this city, and consisted of single 7½-horsepower motor equipments for two cars, together with a double overhead trolley, and a power house containing one small boiler and a Ball engine belted to a 250-volt direct-current generator. The trolley wires were run ten inches apart, and two pairs of trolley wheels were tentatively held by springs in lateral contact with each wire. The four pairs of wheels were mounted on a single carriage and were connected with the motors by flexible duplex cables. The motors were bipolar, shunt-wound, were in continuous operation, and were equipped with friction clutches for starting and stopping the cars. The motorman, who, to be ready for emergencies, wore overalls, stood in a pit in the center of the car. Even under ordinary conditions he was kept busy shifting the brushes as the load changed or the direction of the car reversed; while the passengers had plenty of exercise dodging the oil which flew in every direction. The troubles of operation through a populous street over adverse grades and track conditions resulted in an assignment for the benefit of the creditors.

But crude and brief as this trial was it was a demonstration, and in the twenty years which make the life of the Western Electrician, the electric railways of Kansas City have been built and rebuilt and now comprise 280 miles of track and 600 cars, requiring a power house capacity of more than 30,000 horsepower, with an annual output of over 80,000,000 kilowatt-hours.

Twenty years ago the oldest Thomson-Houston central station served 500 T-H "drop-and-lift" open series 9.6-ampere arc lamps, 300 "hook-and-eye-contact" Sawyer-Man incandescent lamps, and several constant-current motors, chiefly of the Baxter type. The station was equipped with common tubular boilers and Corliss engines belted to counter shafting, from which were belted T-H dynamos ranging in capacities from 10 to 30 arc lamps. The oldest of these dynamos were made in the "basket factory" at New Britain, Conn., before the T-H factory at Lynn, Mass., was ready for business, and all T-H constant-current dynamos were fitted with the T-H automatic regulator, the most valuable feature of the T-H machines.

In order to save copper these dynamos were run two or more, sometimes six, in series, and the circuits being all overhead, the "underwriter's insulation" with which they were generally covered was put to its test and found wanting. We had, however, already begun to substitute other kinds of insulation which to a greater or less degree insulated under operating conditions. Some of those employed were "P. & B.," "Grimshaw," "Simplex" and "Okonite."

The incandescent lamps on this station were run from a compound-wound, constant-potential dynamo, or by means of "distributor boxes" on the arc-lighting circuits, or, in the case of the first residence lighting, from a 70-volt generator, which was located in the house of the writer and which was driven by a two-horsepower constant-current motor on a street-lighting circuit.

As the T-H "system" of this period had no service meter, contracts were made on the basis of tbe average gas bills, substituting a 16-candle incandescent lamp for each five-foot gas jet. From the beginning the writer protested against the unbusinesslike character of such a basis of service, and we soon found we were getting pay for only 32 per cent. of our output, as consumers whose bills did not depend upon their own economy allowed their lamps to burn even in the full glare of a noonday sun. The prime need of a meter was so apparent that I made a renewed and continued demand upon my good friend, Prof. Elihu Thomson of the T-H Company, for a measuring instrument, with the result that after scrapping a few meters, among which was one that we called "the Thomson teeter meter," he finally brought out the Thomson recording wattmeter, which has since been generally accepted as the standard for all kinds of service.

Twenty years ago the Edison Electric Light and Power Company's Kansas City station had been in operation only a few months and consisted of a 200-horsepower B. & W. boiler and a New York Safety engine, to which were belted two No. 16 bipolar Edison dynamos. The connected load was then 2,600 16-candlepower lamps and 27 horsepower in Sprague, C. & C. and Eddy motors. Distribution was by the well-known Edison 110-220-volt three-wire system, with uninsulated overhead feeders, and all services were measured by Edison electrolytic meters. During the late '80's there was also built in Kansas City a Westinghouse alternating-current plant with all lighting services equipped with Shallenberger meters.

That the Western Electrician has lived in stirring times is shown by the fact that in the Kansas City of today the connected lighting and motor load is 11,788 horsepower in motors, 1,974 series arc lamps and 355,157 16-candlepower incandescent lamps or their equivalent, and the station capacity is over 10,000 kilowatts.

This springing up almost over night of an industry which brought forth each day some untried device of factory or plant made of manufacturer and central-station superintendent experimentalists mutually dependent and each deeply and interrogatively interested in the other's work. There resulted a *camaraderie* between them which showed itself in ways unknown to enterprises of slower and more certain growth.

Between the shareholders' demands for dividends and the consumers' demands for lower rates and extensions to plant the central-station man of pioneer times was frequently sore beset, especially for money with which to enlarge the plant, and the manufacturer had sometimes to fill the breach. I remember a successful negotiation at one such critical period with the Babcock & Wilcox Company for an indeterminate (!) loan of a new 200-horsepower boiler. Freedom from fixed charges for over a decade on so considerable a portion of the plant was a source of great satisfaction to me, and I still have a soft spot in my heart for the world's greatest boiler company for helping me keep up dividends, which had aggregated over 200 per cent. for ten years, while weathering our worst financial panic in multiple-arc, with cut-throat competition from two gas and two electric-lighting companies.

Comparatively little information on electrical practice was available in books 25 years ago, and station managers were obliged to learn from their own experience and that of others in the same line of work. Exchange of experiences had to take the place of systematized knowledge, for even the textbooks could not keep pace with discovery. Each of the pioneer manufacturing companies also was possessed with a religious zeal for converts to its own peculiar "system"—Brush, Edison, Weston, Hockhausen, Thomson-Houston, etc., which made each promoter deny that any virtue was to be found in the camps of his rivals. To afford opportunity to thrash out the problems of applied electricity the National Electric Light Association was therefore organized. Its programmes show the meager elementary knowledge available in the early '80's, and its records attest how eager was every central-station man and employe to know how the other fellow met this and that emergency. Very frequently there were signs that some feared losing the value of their experience by imparting it to others.

Master workmen and electrical trade schools were unknown in these recent pioneer days, yet the instant need for both was great. To fill this gap the writer organized what I think was the world's first mutual improvement society of electrical artisans. This organization, called the Gramme Society, was of value to both employer and employe. It established a most friendly relation between them and compensated in great measure for the lack of master workmen and trade schools, as well as for the absence of theoretical knowledge regarding this wholly new industry—knowledge now so abundantly furnished by books, the technical press, trade and correspondence schools and colleges.

From the slow spread of accurate information as to the results of the more or less chaotic experiments in actual practice with the numerous "systems" of the '80's has come the comparatively stable standardization of today. It is generally difficult to see the end from the beginning, and the applied electricity of 1882 formed no exception. It is therefore no small satisfaction to know that the three systems adopted and first installed by the Kansas City management formed the basis of the phenomenal success of the world's two greatest electrical manufacturing companies, and to reflect that the experience of Kansas City in applied electricity embodies so much of what has proved of lasting value in the development of this, the world's most pregnant industry.

The Chicago Electric Club.

No survey of the "Electrical West" for the last twenty years would be complete without an account of the old Chicago Electric Club, which came into existence in 1887, the year of the birth of the Western Electrician, and was disbanded late in 1893, after the World's Fair of that year and during the financial depression then prevailing. The club was noted alike for its high technical standing and for its pleasant social features.

In the spring of 1887 a number of well-known Chicago gentlemen held several conferences for considering the advisability of organizing an electric club "for the promotion of social intercourse, the diffusion of knowledge among those interested in electrical matters, and to provide members with the conveniences of a clubhouse." As a result of these gatherings a charter was applied for and on May 20, 1887, the Chicago Electric Club was formally incorporated with the following-named incorporators: Charles J. Van Depoele, Franklin S. Terry, Charles A. Brown, William J. Buckley, Aaron K. Stiles, W. J. Armstrong, W. A. Kreidler, F. G. Beach, John P. Barrett, Charles D. Shain, B. E. Sunny and Jos. Uhrig. Several meetings were held in the Lakeside Building to perfect the organization, and there the following-named were elected as the first officers of the club:

President, Gen. A. K. Stiles; vice-presidents, John P. Barrett, F. G. Beach, Charles A. Brown and B. E. Sunny; secretary, W. A. Kreidler; treasurer, Franklin S. Terry.

After a few meetings in the parlors of the Grand Pacific Hotel, the club established itself in its first home in an undecorated room at 225 Dearborn Street. These quarters being far from what a clubhouse should be, arrangements were soon made for removal to 122 Clark Street, and on October 17, 1887, the second home was occupied. A kitchen was established and the serving of the midday meal did much toward bringing the members together and creating the sociability so necessary to the life of the club. Billiard rooms and a library also helped in this line.

From the start the club filled an important place in the electrical field in Chicago as a gathering place for the fraternity, where all interests had a common ground for the discussion of technical and industrial subjects. Electrical men being quick to see the need and value of such a club, flocked to it with great enthusiasm, so that in the six months, to November 21, 1887, the membership had grown to 177, and by December 19, 1887, there were 201 names on the roll.

The first paper was read before the club on July 11, 1887, by the late C. C. Haskins, on "Unworked Territory." During the next month a paper was presented by F. B. Badt on the subject "The Danger to Human Life from Electricity." Each of these papers was followed by a liberal discussion. Other topics were taken up and their discussions began to create much attention outside of Chicago. By the end of the year 1887 the club had held 13 regular meetings and one banquet, and ten papers had been read.

In the early part of 1888 there was held a series of discussions on the "Relative Merits of Alternating and Direct Currents for the Commercial Distribution of Electricity." Papers on this subject were read by Messrs. H. Ward Leonard, F. B. Badt, M. M. M. Slattery, E. P. Warner, E. A. Sperry and George Cutter. That of the last-named gentleman was entitled "The Continuous Current, Limited, vs. The Alternating Current, Unlimited." In April the secretary reported "that the prophecy that the discussion of the subject would make valuable additions to the electrical literature of the day, is already fulfilled. The papers and discussions by members of the club have awakened widespread interest both in America and Europe."

In the latter part of 1888 there was a falling off in attendance and only three regular meetings were held. A deficit of $200 existed in the funds. By striking off the names of delinquent members the membership roll was reduced to 120. The falling off was also due to the dissatisfaction of many over the inadequate quarters of the club.

Mainly through the hard work of President S. A. Barton (who was elected early in 1888) a revival of interest was brought about and the club rented two floors of the High Block at 103 Adams Street, adjoining Kinsley's famous old restaurant and almost exactly where the offices of the Western Electrician are now located. These rooms included lecture, reading and billiard rooms and were handsomely furnished. They were connected with Kinsley's, so the members could enjoy good dining facilities without the trouble of operating a kitchen of their own. The formal dedication of this third home of the club took place on August 1, 1889, and was the occasion of a banquet and reception attended by a great many distinguished guests as well as a large percentage of members.

In the fall of 1889 President Barton decided to return to the East, and tendered his resignation on October 28th. The members were reluctant to see him leave, as he had done so much to increase the prestige of the club. A farewell reception was tendered him. Mr. F. G. Beach was elected on November 18th to fill the unexpired term and was re-elected the following year, 1890.

Among the papers read during the winter of 1889-90 were "The Use of High-tension Currents in Electric Lighting," by B. E. Sunny; "Theory of Compounding Dynamos for Constant Potential" and "Electric Motors in General Railway Work," by Dr. Louis Bell; "A Theory of Accumulators," by Dr. Paul Schoop of Zurich, Switzerland, who was then visiting America. The papers and discussions of the club continued to excite most favorable comment in all directions and were reprinted in the technical journals both here and abroad. Along about this time electrical men in Chicago began to appreciate more than ever that a membership in the club gave a technical man a standing not to be obtained on the outside.

During the next season discussions on underground conduits, rating and regulation of generators, incandescent lamps and electric railways created the most interest, and the substitution of electricity for steam on railroads was broached. Early in 1891 the club was complimented by the request of Chief Barrett of the Department of Electricity at the Chicago World's Fair that the club recommend to him the names of three members from whom he could choose one as the special electrical engineer for the exposition. At this time, also, a committee on World's Fair was appointed that from time to time conferred with the exposition officials and had much to say in the adoption of plans for the electrical features. It was this committee, headed by the president, B. E. Sunny (elected in 1891), that also aided in securing the International Electrical Congress at Chicago in 1893.

In the winter of 1891-92 the club was the scene of many spirited discussions on fuses, power transmission and allied subjects, and a particularly long series of debates on electric-railway topics. In February, 1892, the club started an agitation for the establishment in Chicago of a school of technology, which aided in the foundation of Armour Institute the next year. Mr. Sunny, who had done so much to make the club a potent factor in technical matters, was re-elected president for the ensuing year.

It became apparent to the members that it would be imperative to secure even better facilities than those afforded by the Adams Street rooms in order to be able to entertain properly the large numbers of electrical engineers, scientists and others interested in the electrical arts that were expected to attend the World's Fair in 1893. To secure these adequate quarters the club moved to the second floor of the northeast corner of Monroe and Clark streets and occupied the new rooms on May 1, 1892. These were fitted up as elaborately as any downtown business men's club ought to be and were the center of many pleasant social gatherings and receptions to distinguished guests during the continuance of the Fair. During this time the literary meetings became less frequent and entertainment was the order of the day. The president of the club in 1893 was John P. Barrett, chief of the Department of Electricity at the World's Fair.

The expenses of entertainment of visitors had been so great, however, that after the exposition closed the treasurer reported a deficit of about $3,000. Attempts were made to collect unpaid dues and assessments with incomplete success, and the club was therefore forced to close its doors. The last regularly recorded meeting was held on November 10, 1893.

Following is a list of the names of men who were active members of the club or who took part in its discussions:

Thos. Addison	C. J. Field	F. W. Parker
T. Ahearn	J. H. Gates	W. B. Pearson
W. H. Applegate	J. F. Gilchrist	D. P. Perry
C. G. Armstrong	C. K. Giles	F. L. Perry
W. J. Armstrong	E. R. Gilman	G. M. Phelps
Bion J. Arnold	H. K. Gilman	R. H. Pierce
Lieut. F. B. Badt	H. A. Glasier	H. R. Post
E. Baggot	J. H. Goehst	J. K. Pumpelly
Geo. C. Bailey	F. S. Gorton	Frank B. Rae
Theo. P. Bailey	Prof. Elisha Gray	J. H. Reid
Foree Bain	S. D. Greene	B. Rorison
W. E. Baker	Chas. E. Gregory	C. H. Rudd
C. M. Barclay	Thos. G. Grier	C. E. Sargent
J. L. Barclay	W. G. Hahn	Fred Sargent
John P. Barrett	C. J. Hamlin	A. Schillinglaw
Silas A. Barton	C. C. Haskins	C. D. Shain
R. N. Baylies	W. I. Hitt	Geo. B. Shaw
F. G. Beach	N. F. Hodson	J. H. Shay
W. L. Beckwith	F. W. Horne	M. W. Simons
G. A. Beedle	A. L. Ide	M. M. M. Slattery
Geo. L. Beetle	Samuel Insull	R. I. Sloan
Geo. H. Bliss	E. M. Izard	G. M. Smith
F. Bourne	C. H. Jackson	F. H. Soden
A. H. Brown	D. C. Jackson	E. A. Sperry
Chas. A. Brown	S. B. Jenkins	Wm. Stanley, Jr.
Wm. J. Buckley	Jas. W. Johnson	J. Steadman

Frank Butterworth
W. L. Candee
Prof. H. S. Carhart
W. A. Carroll
W. J. Chalmers
E. B. Chandler
J. W. Clark
Col. R. C. Clowry
Seymour Coleman
Prof. C. S. Cook
E. J. Cook
F. W. Cushing
Geo. Cutter
C. A. Daigh
St. John V. Day
Dr. A. De Baussett
F. E. Degenhardt
Fred De Land
J. W. Dickerson
G. E. Dorman
D. H. Dorsett
S. A. Douglas
Alex Dow
W. H. Dyrenforth
W. S. Elliott
Thos. A. Edison
Geo. O. Fairbanks
E. C. Ferguson
Louis A. Ferguson
C. Kammeyer
E. E. Keller
Alex. Kempt
F. King
M. A. Knapp
G. A. E. Kohler
Wm. A. Kreidler
W. M. Lenhart
H. W. Leonard
Wm. J. Lloyd
Thos. D. Lockwood
A. H. McClure
R. T. McDonald
D. G. McDougall
C. K. McFaddon
P. J. McFaddon
G. A. McKinlock
W. H. McKinlock
H. S. Manning
J. L. Martin
Geo. H. Mayo
E. P. Meany
Geo. H. Meeker
Chas. Munson
J. J. Nate
G. P. Nichols
W. W. Nichols
J. B. O'Hara
C. T. Page
B. Frank Stewart
Gen. A. K. Stiles
W. A. Stiles
E. Stockwell
B. E. Sunny
Wm. Taylor
A. S. Terry
F. S. Terry
Alex. Thompson
S. A. Treat
Jos. Uhrig
H. H. Wait
H. S. Walker
J. B. Wallace
E. P. Warner
C. C. Warren
E. R. Weeks
A. G. Wheeler
Geo. K. Wheeler
Dr. G. W. Whitefield
Ben Williams
E. F. Williams
C. H. Wilmerding
C. H. Wilson
Chas. Wirt
M. M. Wood
Frank Wunder
Wm. Zimmermann

Of the technical work of the club no one, perhaps, is better fitted to judge than Mr. George Cutter, long a Chicagoan but now of South Bend, Ind. Mr. Cutter says:

"I returned from Europe 20 years ago this fall. My position as chief engineer of the Thomson-Houston Company in Europe for two and a half years had brought me in contact with European engineers and their methods. This experience, I believe, caused me to appreciate very highly the value of work done in a technical way by the Chicago Electric Club.

"We had a pretty good coterie of technical men to steer this work. Amongst them I might mention offhand Mr. Van Depoele, who was then connected with his own company on the West Side, this being previous to his selling to the Thomson-Houston Company; Mr. Warner, the dynamo designer of the Western Electric Company; H. Ward Leonard of Leonard & Izard; E. A. Sperry of the Sperry Electric; W. S. Andrews, connected with Leonard & Izard, and Professor Badt. These men had considerable influence in the days of the Chicago Electric Club and have maintained important positions and influence in our loved profession ever since.

"We had before us at that time some interesting questions both as to their bearing upon the future of the business and their importance for the time being to the competing companies interested. It looks a little queer now when running back in the memory of those days that the question of "The Relative Merit of the High-potential Small-ampere or Low-potential Large-ampere Arc Lamp" should be considered a question of great importance. It seems to me right, however, to consider that these were important questions in a technical way, especially when taken in connection with another much more important and absorbing question before us at that time, namely, the relative merits of the constant-potential direct-current three-wire distribution system and the alternating-current system then just crowding its way upon the American market.

"The special value of papers and discussions upon these matters before an organization like our Chicago Electric Club was to be found in the happy mixing of technical and business men. This particular phase of these discussions is what impressed me so very favorably at that time, and the impression remains with me now as a correct one, especially when compared with the methods in Europe, where the technical men felt themselves to be in a class separate and distinct from the business end, and that is why so much work has been done in Europe in a technical way not in best relations to the business end of our industry.

"The technical men mentioned as leaders in this work for the Chicago Electric Club were well able to bring forth the possibilities of their own particular types of apparatus and systems, and the business men who took such active part in our discussions brought out in a forceful way the limitations in the business end of the undertakings. These discussions were considered important and indicative by the head men of the large manufacturing companies, because I well remember requests from Mr. E. W. Rice, Jr., and other leading spirits of the Thomson-Houston Company, with whose engineering staff I was connected, that certain phases of the business be brought before the Chicago Electric Club for consideration. Full reports of the papers and discussions thereon in the technical papers also evidenced the importance in which they were held, and very largely increased the value of the work done.

"On the whole, therefore, I feel that the opinion is justified that the technical work done by the Chicago Electric Club about 20 years ago was important and valuable to our profession."

Of the social features of the club Mr. Charles E. Gregory writes entertainingly as follows:

"My recollections of my associates in the Chicago Electric Club are as dear to me as those of my chums at school. It was organized at a time when Chicago's total investment in electrical apparatus did not total half a million dollars, when the industry was indeed a weakling, when underwriters' wire laid behind awnings and signs was considered a fine arc circuit, when shunt-wound arc generators were considered by many an economical means of producing current, when men representing the different lighting systems who disagreed with each other as to the merit of their respective systems found the need of social intercourse sufficient reason for the organization of a club where they could meet to apologize for the harsh criticism of each other in business competition—great days those.

"While not a charter member of the club, it is my recollection that early in 1888 I negotiated a loan of ten dollars and got on the waiting list, prepared to make good if elected to membership. I was elected, and I well recall the first meeting which I attended; I sat next to Mr. Aaron Stiles, who persisted in calling me 'sonny.' A paper was read by Mr. George Cutter on the 'Residual Magnetism in an Iron Dollar Spent Foolishly' was the event of the evening, and as I wended my way home I wondered if it would ever be my good fortune to become as proficient in the mystic as our chief entertainer of the evening.

"We enjoyed a hundred other delightful evenings during the life of the club, and among those that I remember best was a little social gathering of the friends of Mr. Kreidler to present to him a hall clock as a wedding gift. Congressman George Shaw of the National Electric Company of Eau Claire, Wis., was the toastmaster, and Mr. Fred Degenhardt made the presentation speech. Shaw was at his very best on this occasion, and we each told 'Bill' how much joy and happiness would be his if we could have our way. Fred, when called upon to make his speech, found us all in swaying humor, and we wept and laughed in turn, as he cared to sway us. Mr. Myron Knapp was the joyful surprise of the evening. He and his bosom friend, Mr. Harry Lucas, sat together at the table. Degenhardt by his eloquence had made them blue unto weeping, and as the toastmaster introduced Knapp as 'our handsomest, bighearted member,' and he arose in all his 'glad garments,' looking for all the world like a born orator, and, gazing steadily at the ceiling in an effort to recall the pleasant words he had thought of earlier in the day, we were warranted in expecting from him a fine oration. Well, he did not orate; he slid back into his seat, saying, 'Oh, pshaw! I can't talk.' Nothing could possibly have been funnier.

"Another pleasant evening was the one on which we tried Professor Badt for stealing some megohms from Fred Horne or some other fellow's field. Alexander Kempt was the judge, wearing the robes of a cardinal; W. J. Buckley was the prosecutor, I was clerk of the court, and the jury was made up of other members. After hearing all of the evidence, most of which was given in dialect, the court took the case from the jury, and fined each juror two dollars.

"At one of our meetings I recall that Mr. Grier put through a motion that all manufacturers of electrical machinery be requested to mark all generators with their kilowatt capacity, and all motors with their horsepower capacity, and we considered that if our request was complied with we had indeed spent a profitable hour in formulating, discussing and passing the motion.

"When the club gave a farewell dinner to S. A. Barton in 1889, nearly every member was present and each member exchanged photographs with Mr. Barton, and many pleasant inscriptions were written on them. Again, when Mr. H. Ward Leonard took his departure, to engage in business in New York, it was the occasion of another very pleasant evening spent in wishing him godspeed, and in singing many of the dear old songs that sound best when sung around the festive board.

"Our billiard and card rooms were the scenes of many contests for supremacy, and furnished much entertainment. Mr. A. L. Ide once told me that he preferred our little club because of the good billiard games we had. W. J. Buckley and George Cummings were our best players, and I have seen them play a great many match games that were really good. Our membership was not a cumbersome one, and an air of good fellowship seemed to prevail at all times.

"Our effort to provide club facilities for electrical men visiting the World's Fair was the beginning of the end of our little organization, and when the end came I was chosen to sell our personal property at an auction held in the club rooms. The proceeds of the sale and an assessment of $136 per member enabled Mr. James W. Johnson, acting as trustee, to pay all of our club debts, and we surrendered our charter to the state. Few technical clubs have had a longer life than ours, and I doubt if any produced more lasting friendships.

"Many of the members are still residents of Chicago, and without exception all have prospered."

Death of J. N. C. Shumway.

J. N. C. Shumway of Taylorville, Ill., died suddenly of paralysis at his home on September 22d. He was 57 years old. Mr. Shumway was a former state senator and, among other activities, was one of the best known and best liked central station men in the state of Illinois. Active in the affairs of the Illinois State Electric Association, he was elected president at the seventh annual convention in Springfield on September 20, 1906. His administration was a successful one, terminating in the recent pleasant annual meeting and outing at Peoria, at which he presided. At this meeting the association expressed its love and esteem for Mr. Shumway by presenting him a handsome gold-headed cane.

J. N. C. SHUMWAY.

For about twenty years Mr. Shumway has been identified with electrical interests. Never of very robust health, he abandoned a profitable law practice to engage in more active outdoor work. Since 1889 he has been secretary and manager of the Taylorville Electric Company, and at the time of his death was also interested in the electric plants at Pana, Jerseyville, Robinson and Mattoon. He was also active in many other business enterprises, having been at the time of his death secretary of the Taylorville Savings, Loan and Building Association and president of the national organization of building and loan associations.

Mr. Shumway was born in Illinois, and except for a few years spent in college and travel lived in Taylorville all his life. He was state senator and was a member of the Illinois commission to the Louisiana Purchase Exposition. Mr. Shumway was progressive and public spirited. He had a pleasing disposition and was a ready speaker and raconteur. He leaves a wife and two daughters and a large circle of sorrowing friends.

Chicago Electrical Show Officers Re-elected.

The annual meeting of the stockholders of the Electrical Trades Exposition Company of Chicago has been held and officers and directors elected. Mr. Homer E. Niesz, who so successfully managed the show at the Coliseum last January, has again been selected to manage the 1908 show, which will be held in the Coliseum on January 13th to 25th. Most of the exhibit space has already been applied for, and a larger and better show than ever is assured.

The officers and directors of the company were re-elected as follows: President, Samuel Insull; vice-president, E. B. Overshiner; secretary and treasurer, Stewart Spalding; executive committee, E. B. Overshiner (chairman), Louis A. Ferguson, Stewart Spalding; directors, Samuel Insull, G. H. Atkin, Stewart Spalding, E. B. Overshiner, George B. Foster, T. P. Gaylord, Louis A. Ferguson, H. B. McMeel, H. V. Bennis.

Arbitration Demanded in Telegraph Strike.

The strike of commercial telegraphers is still unsettled, to the detriment of business in some quarters. There are rumors of possible arbitration as the result of government solicitation. The Chicago City Council this week adopted a resolution calling upon President Roosevelt to use his influence toward an equitable settlement. The resolution says that for nearly seven weeks the telegraph companies have been so hampered that they have had to send messages by mail, and that the companies have expressed a determination to "starve the strikers into submission." It sets forth that the City of Chicago solemnly declares that it is the "duty of these great employers to meet representatives of the striking employes" in order that normal service may be restored.

The City Council of Portland, Ore., has appointed a special committee, with power to retain an expert consulting engineer, to consider the advisability of constructing a system of subways for holding all underground wires and pipes.

FALL TRADE PROSPECTS.

While business men in some branches of the electrical industry do not look for as much activity, possibly, this fall as last, others can see nothing ahead but continued heavy demand, so that the outlook for fall trade may be considered as satisfactory on the whole. Inquiry among the various interests reveals that nearly everyone is doing as much business just now as at this time last year. There are some, however, who feel that the close of this year and the beginning of 1908 will see some decline in the number of new enterprises to be launched and in the extension of present properties, bringing with it some falling off in the electrical business generally.

Several Chicago manufacturers, engineers and dealers when interviewed on the subject pointed to the recent unsettled condition of the copper market and the tendency of the banks to increase money rates as factors which are bringing on a more conservative spirit. Although the price of copper has fallen considerably recently, they say that many contemplated projects have been postponed to await developments in financial circles as well as a possible still further reduction in the price of the metal. One prominent dealer in electrical machinery could see some uneasiness in financial circles which might affect the electrical as well as other industries. The fall in the price of copper, he thought, was due to a lessened demand, brought on by the decision to wait in the construction of many new projects for which there is a good demand.

Public-utility properties, as indicated by the remarks of Mr. O. E. Osthoff and others, are producing more revenue at present than ever before, and there is a demand for bonds of going concerns. Nevertheless the properties of the H. M. Byllesby Company, as an example, will not be extended much for the present, and new construction contemplated will not be undertaken just now. The engineering end of this company's business, as also of other companies, is very active, due largely to the numerous waterpower projects which are being carried out and others in contemplation.

Following are some brief interviews and letters from men in various branches of the electrical industry bearing on the subject of fall trade prospects:

John W. Brooks, general sales manager, Pass & Seymour, Solvay, N. Y.: "We are looking forward to a very brisk and satisfactory business for fall, and while the percentage of increase may not be as heavy as last year, yet we believe it will be a more normal and healthier business."

W. W. Mumma, sales manager, the Robbins & Myers Company, Springfield, Ohio: "Prospects for fall trade in our line are good. The last fiscal year, which closed with us on September 1st, was very satisfactory, and we see no reason now why the trade should not keep up its progress."

A. H. Patterson, vice-president, the Phœnix Glass Company, New York: "Based upon the records of our business for the last eight months of this year and trade conditions at the present time, it is our belief that the closing months of this year will show good business conditions, and a volume exceeding that of last year."

H. G. Pratt, treasurer, Samson Cordage Works, Boston, Mass.: "We think our line is hardly a large enough one to be a very good index on the prospects of fall trade. We are glad to state, however, that we have never had so much business on arc-lamp and trolley cord as in the last few weeks, and we are not as pessimistic as some seem to be in regard to the future."

F. S. Hunting, sales manager, Fort Wayne Electric Works, Fort Wayne, Ind.: "The outlook for trade this fall seems very good in all electrical lines except new enterprises or extensive extensions to existing enterprises which require financing. We look for the business in the way of new enterprises to be rather dull until the financial situation in the country at large is considerably improved."

C. B. Humphrey, acting general manager, Westinghouse Lamp Company, New York, N. Y.: "We anticipate a very prosperous incandescent lamp business during the coming fall months, and, in fact, during the entire year. Our experience indicates that the lamp business is not seriously affected by the ordinary business depressions which apparently are being felt in certain other lines at the present time."

J. G. Ihmsen, general manager, American Electric Telephone Company, Chicago: "The telephone trade during the spring of 1907, both in magneto and common-battery equipment, has been the largest in the history of the Independent business. The spring trade opened in large volume over a month earlier than formerly and continued practically unabated until about July, which was three weeks or more longer than usual. In the months of July, August and September there has been the usual midsummer dull period in the magneto and farm-line departments, but the common-battery branch of the business has been exceptionally good. There are a large number of inquiries now for fall and winter delivery, and if 50 per cent. of the contemplated additions and improvements are consummated it will afford a very brisk demand during the next six months."

Walter Ramsey, manager, American Arc Lamp Company, Kalamazoo, Mich.: "The outlook for fall trade is exceptionally fine. Our August sales exceed the sales of corresponding months during the last nine years. September so far has exceeded by seven times the sales during the corresponding period of September last year. Every indication points to our doing a splendid business this fall and winter."

Charles E. Brown, president, American Electrical Supply Company, Chicago: "Our business, covering as it does both electrical machinery and all kinds of electrical appliances and supplies, should give a good indication of trade prospects. Never before have we done so large a business as at present, and the indications are that it will continue, resulting, of course, in a good fall trade. Our supply business is good and our factory is working to its full capacity."

Willard W. Low, president, Electric Appliance Company, Chicago: "From our viewpoint we cannot see anything but a good, healthy business for the coming fall season. Buyers of all classes of electrical material have been buying for the last six months from hand to mouth, the crops of the country are in elegant condition, and the metal and copper conditions, it seems, are adjusting themselves to a proper level, all of which, in my opinion, point to prospects satisfactory for business."

H. B. Vanzwoll, secretary, Sunbeam Incandescent Lamp Company, Chicago: "It is our opinion that the business in electric incandescent lamps this fall will show an increase of 20 to 25 per cent. as compared with 1906. Possibly the electrical business, as a whole, will not show the same increase as will be the case with incandescent lamps, but we believe there will be a substantial growth, due to several influences, notably the work of the Co-operative Electrical Development Association."

L. L. Brastow, the Trumbull Electric Manufacturing Company, Plainville, Conn.: "We take pleasure in saying that we can see only the best indications for a big fall trade. The volume of business has steadily held up to a month-by-month increase, and we expect 1907 to be by far the best year we have ever had. If the conditions in the money market hold good, as we believe they will, we can see no reason why next year should not be even better. In fact, we have included this expectation in our plans."

Thomas Duncan, manager, Duncan Electric Manufacturing Company, Lafayette, Ind.: "We take pleasure in advising that the outlook has never been better in the history of this company. If the indications of the last four weeks are to be taken as an omen for the coming fall and winter business, we will have to treble our output in order to cope with the demand for our apparatus. Our recent orders for meters call for more than we have been able to turn out; so we have every reason to believe that business is still on the boom."

H. Kimball Loud, H. M. Loud's Sons Company, Au Sable, Mich.: "We sell poles to the trade, and our view of the situation is that there will be a brisk demand for short poles during the closing months of this year. We base this partly on the fact that the summer trade has been very quiet, while now there is quite a demand and an increasing one. We also base this on our former experience in such cases. Cedar, outside of poles, has been in very great demand, our stock of cedar ties and posts being practically exhausted, although we generally have a large stock on hand at this time."

Julian Roe, Chicago manager, Crocker-Wheeler Company, Ampere, N. J.: "Judging from our own business, the electrical industry may look for good fall and winter trade. The month of September, as is always the case, has been rather quiet as regards the booking of orders, but the number of inquiries on hand is unusually large and gives promise of excellent business beginning with the first of October. Last year we did a very large business, but since June each month this year has surpassed the corresponding month in 1906. We would almost wish for a period of quiet so that we could catch up and readjust our forces so as better to meet the growing demand."

J. H. Clapperton, advertising manager, Minneapolis Steel and Machinery Company, Minneapolis, Minn.: "In our estimation, notwithstanding the Wall Street scare, the fall business looks very bright, and indications so far point to a good supply of orders for the fall months. The first eight months of 1907 have shown a substantial increase in our business over the corresponding months of 1906, and we see no indications of its letting up. We generally expect a slack period on the eve of a presidential campaign, but interviews with our trade in general indicate that the coming presidential campaign will not materially affect our line of business. Our different departments are at present well filled with orders for future delivery, and we have been obliged to turn down several orders on account of the crowded condition of our shops. Taking the general conditions all in all, would state that the condition of the western trade looks bright for the fall and winter months."

B. E. Sunny, vice-president, General Electric Company, Chicago: "The outlook for business in the electrical and allied interests for the closing months of 1907 is reasonably satisfactory, particularly when the financial situation is taken into account. There has been a slight falling off in the business during the past few months, and this may continue for several months until there is a market for bonds and other forms of securities. The public-utilities companies are all doing a satisfactory business and a large number of them are in need of additional facilities, orders for which are being withheld until the financial situation improves."

J. H. Parish, advertising manager, Kellogg Switchboard and Supply Company, Chicago: "There appears to be no disposition at present from any quarter to produce an unrest in business circles, except, perhaps, an occasional temporary financial agitation in Wall Street. Prosperity seems to reign supreme throughout the whole country. Collections are passably good, and the general money market, while a little unsettled at times, is firm and easy for all legitimate trade purposes. This favorable condition will, no doubt, continue for a long time, and the Kellogg Switchboard and Supply Company anticipates, as heretofore, a good strong fall business."

Joseph W. Marsh, vice-president and general manager, Standard Underground Cable Company, Pittsburg, Pa.: "Since copper and copper products have dropped in price to approximately the figures at which consumers (whether going concerns or new enterprises) can afford to make capital investment in extensions or wholly new constructions, we consider the outlook for the fall trade in our line at least, fair; and if the financial situation becomes easy we anticipate a very good fall trade. Much, however, depends upon the ability of new enterprises to market their securities at a fair price, and it is very difficult to forecast the future, for even three or four months, in this respect."

E. L. Clark, president, the Valentine-Clark Company, Chicago: "The writer is of the opinion that business is in a much healthier condition at the present time than it was six months ago. Copper is now getting to a point where construction will proceed provided we can get a little easier money market, which, in the writer's opinion, will exist some time about the first of November. There is any quantity of new work that should be done and will be done with an easier money market and copper at a price which will warrant the construction. In our particular line—cedar poles—prices are firm, the long poles holding well to last season's prices; the only instances of decreasing prices are in poles 25 foot and shorter. We are looking forward to considerable business yet this fall."

F. S. Terry, first vice-president, National Electric Lamp Company, Cleveland, Ohio: "If there are no large failures or new trust investigations started business will probably continue good up to spring or summer of next year, when there will perhaps be something of a depression in business, although probably not an actual panic. I believe, however, we are nearing hard times, which will probably be preceded by something of a panic, perhaps not as severe a one as 1893. We may reach it in two years, or it may be delayed four years. If I were to guess I should say that it would come in 1910. However, this is all a guess and may depend a good deal upon chance conditions. If an actual panic is avoided, I believe it will be due largely to the government investigations of railroads and large corporations, which are perhaps a little severe on those investigated and regulated, but such things really make for good, as they cause everyone to do business on more careful lines."

G. H. Rettew, general manager, Helios Manufacturing Company, Bridesburg, Philadelphia: "In general we find the volume of business to be good, but collections are unusually slow. Our opinion is that with some aid from the banks in the way of restrictions of loans the general financial conditions will be improved, and that, while this may restrict purchases somewhat, it will no doubt have a wholesome effect on the general business conditions. Our principal lines are arc lamps and storage batteries, and we find that the volume of trade in both is growing rapidly. We anticipate that the sales of lamps during the next three or four months will be very brisk. The arc-lamp business is growing rapidly, and we look for an increase of 20 per cent. in the value of lamps manufactured during the year 1907, that is, considering all of the lamps manufactured in the country. Of this increase we anticipate securing our share. The growth of the storage-battery business is probably due to the growth of the use of electric vehicles, and particularly vehicles used for pleasure purposes. The manufacture of batteries for this service has become one of our largest items and the department is still increasing in business, although the most active time is during the spring and summer."

ELEMENTS OF ELECTRICAL ENGINEERING.

By Geo. R. Metcalfe.

XXXV. Electric Railways.

Controllers.

In order to operate a street car, controllers are used which have three functions, namely, to connect the motors into the circuit, to regulate the amount of current which passes through the motor and to govern the direction in which the car travels. Three different methods of control have been in use at different times for street cars, but two of these are now entirely obsolete, and what is known as the series-multiple method of control is now universally employed.

Of the two obsolete methods, one consisted in connecting car motors permanently in series with a special style of resistance box. With this method the speed of the car was varied by simply increasing or decreasing the amount of resistance in series with the motor. The other obsolete method consisted in winding the motor fields with a number of separate coils, which, by means of a controller, could be connected in various combinations from all in series, to all in multiple. This method was quite economical, as no external resistance was used in the circuit except on the starting notch of the controller; but the number of small wires and numerous connections required made this method subject to numerous derangements under the rough usage commonly accorded to street-railway cars.

The series-parallel control, which is now universally used, consists in connecting the motors on a car first in series and next in parallel. In the series position each motor receives half of the line voltage, and in this position the car runs at approximately half speed. In the multiple position each of the motors receives the whole voltage of the line, which therefore operates the car at full speed. The series and the parallel positions of the controller are called the running notches, or, in other words, these two positions of the controller are the ones on which the car can run for an indefinite length of time.

In addition to the running notches, there are seven or eight other notches on which the car should only be run for a few moments until it attains a speed corresponding to the notch in use. These intermediate notches are simply for regulating the amount of external resistance in the circuit. On the starting notch the full external resistance and all of the motors are connected in series. The next two or three notches simply cut out successive portions of resistance until all of the resistance is cut out and the motors are running in series without external resistance.

The resistances used are not of sufficient capacity to be used continuously, and therefore if they are used more than a few moments while the car is accelerating, they are liable to be burned out. Moreover, the continuous use of resistances in the main circuit of the motor is a very uneconomical method of regulation, as a large proportion of the energy consumed on a car would be wasted in heating up the resistances.

After passing the series notch on the controller the motors on the car are then connected in multiple, and all of the resistance is again connected in the motor circuit. During the next few steps of the controller, resistances are again successively cut out until the motors are in parallel without any external resistances in the circuit. This position gives the highest running speed of the car.

Street-railway controllers are made in a large variety of sizes to be used with various sizes of motors, and they may all be divided into four general types. Type R controllers are of the rheostatic type and are used on cars equipped with only one motor, as the series-parallel control is obviously possible only where two or four motors are used. The R controllers simply cut out the resistance gradually until the motor operates on the full line voltage. This controller is also supplied with a device whose function is to change the direction of the car travel. This reversing switch is provided with a separate handle, and its principle of operation will be explained later.

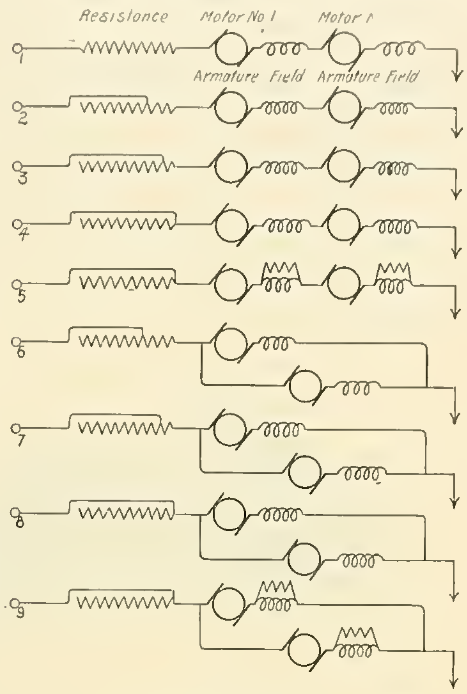
Type K controllers are of the series-parallel type and are the kind used on the great majority of electric cars. A distinctive feature of the type K controllers is shunting or short-circuiting of one of the motors, when changing from the series to the parallel connection, so that the power circuit through the car is not broken.

Note.—This series of articles, intended to survey, briefly, the whole field of applied electricity for light, power and heat, was begun in the Western Electrician of February 2, 1907.

Type L controllers are of the series-parallel type, but differ from the type K controllers by completely opening the power circuit of the car when the change from series to parallel position of the motor is made.

The fourth type of controller is known as type B, which, in addition to its function of controlling the motors, has a number of additional contacts which operate an electric brake. The electric braking is sometimes accomplished by means of the ordinary brake-shoes electrically operated and in other cases by connecting the car motors so that they operate as short-circuited generators.

All of the series-parallel controllers are very similar in their general design, and consist of a vertical spindle which is revolved by means of the controller handle. Upon this spindle are mounted contact pieces in the shape of segments of circles. At one side of the controller is a row of contact



TYPICAL DIAGRAM OF CONNECTIONS OF A SERIES-PARALLEL CONTROLLER.

fingers to which the wires from the armature, field and resistances are connected. These fingers are connected in various combinations by means of the contact pieces upon which they bear.

Also contained in the controller is a second vertical spindle provided with contact pieces upon which another set of fingers bear, the object of which is to govern the direction of motion of the car. This is known as the reverser, and its function is to change the direction in which the current flows through the motor armatures. The reverser is operated by means of a small handle upon the top of the controller, which has three positions. When it is pushed forward the car runs in a forward direction. When it is pulled to its extreme backward position the car runs backward, and when it is in a position midway between these two, it opens the circuit of the car so that the motors cannot be operated at all. The main controller handle can only be removed when the reverser handle is in the "off" position, and an interlocking device is arranged so that the reversing handle cannot be moved except when the main controller handle is in the "off" position. The same interlocking device also prevents the main controller handle from being moved except when the reverser handle is fully thrown to either the forward or backward running position.

Cut-out switches are located in the lower part of the controller, so that in case of accident to either motor on the car the defective motor may be cut out of circuit and the car operated with the remaining motor. When operating with a single motor the car will reach its full speed on the full series position of the controller, and the cut-out is provided with an interlock which prevents the controller handle being moved past the series position when either motor is cut out.

The accompanying diagram shows the connections of the motors and resistance on each step of a series parallel controller having five series and four parallel running points.

In the first position the current passes through all of the resistance and through motors No. 1 and No. 2, all connected in series.

On the second notch the connections are nearly the same except that two thirds of the resistance is cut out.

On the third notch still more of the resistance is cut out, and on the fourth notch the resistance is entirely cut out, and the two motors are still connected in series.

As no current is being wasted in resistance on the fourth notch, the car may be economically run on this speed as long as desired, and it will run at a little less than half of its maximum speed.

On the fifth notch a connection is made which shunts part of the current around the field coils. This has the effect of weakening the field and increasing the speed of the motors, and in this position of the controller the car will operate at just half speed.

In passing from the fifth to the sixth notch the motors are changed from series to multiple connection, so that each motor receives the full trolley voltage, but in order that the change of speed may not be too abrupt, part of the resistance is introduced into the circuit with the two motors in parallel.

On the seventh notch most of the resistance is cut out of the circuit, and on the eighth notch the resistance is entirely cut out of the circuit, so that the motors receive the full line voltage and operate at nearly full speed.

On the ninth notch a connection is made similar to that on the fifth notch, that is, part of the current is shunted around the field of each motor and the car is operated on this notch at its highest speed.

This diagram is characteristic of all the series-parallel controllers, although some of them have two or three notches which cut out the resistance in smaller steps. In all of these controllers, however, the only points of the controller which should be used for continuous running are those points in which the resistance is entirely cut out of circuit.

The L type of controller is somewhat similar in appearance to the K type, but is considerably larger, and its handle operates in a counter-clockwise direction, which is just opposite to that of the K type. During the first half revolution the controller passes through the series points up to the full series position of the motors, and in order to throw the motors into multiple position the motion of the handle is continued in the same direction around past the "off" position, and again passes over what were the series notches on the first revolution. During the second revolution, however, the motors are connected in multiple, and after the handle has passed through one revolution and a half the motors are in full multiple connection and the car operates on its highest speed. An indicator on top of the controller shows whether the motors are in series or in multiple.

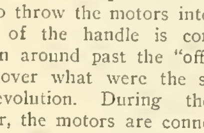
The B type controllers are those which are used in connection with electric brakes. Some of these controllers have two handles, one for operating the power and the other for the brake, while in others only one handle is used, which is moved to one side of the "off" position for operating the power and to the other side of the "off" position for operating the brake.

A feature of all of these controllers which has not been mentioned is the magnetic blow outs which are used to prevent the destruction of the contact by arcing. Arc shields are used, which extend between each row of contacts to prevent an arc from jumping from one row of contacts to the next. The action of the blowout coils was explained in the chapter on lightning arresters.

[*To be continued.*]

The "Chicago" Grip.

Mathias Klein & Sons, 81 West Van Buren Street, Chicago, have just placed on the market their new "Chicago" Grip, which is illustrated here-



"CHICAGO" GRIP.

with. This tool is made of steel throughout and is nickel plated. It is said to be just the right shape to handle quickly, is light, and when placed on the wire will hold itself in place. It can be pushed out on the wire so as to take up as much slack as necessary. It pulls strongly, leaving no kinks in the wire. It is said to cover all the essential points required of the grip to do good work on either iron or copper wire. This grip, as well as all the other well-known Klein products, is carried in stock by prominent supply houses.

Suction Producer Gas as a Means of Generating Power.

By J. H. Clapperton.

In 1881, at the York meeting of the British Association for the Advancement of Science, the late Sir Frederick Bramwell, a prominent member, made the prophecy that in 50 years the steam engine would have been replaced by the gas engine. This prophecy was based on the performance of a small three-horsepower gas engine exhibited at the meeting in connection with the first Dowson power gas producer.

Since that time, and particularly in the last few years, many important changes and improvements have been made in the gas engine as well as in the gas producer, bringing producer gas forward to become an important factor in the modern industrial life. Yet it would be venturesome to subscribe today to the memorable prophecy of 26 years ago, even in full view of the fact that the gas engine is speedily gaining ground on its more wasteful competitor.

What is likely to prove to be the saving factor in the future career of the steam engine is, curiously enough, its very wastefulness, because just as long as conditions prevail in which the waste during transformation of heat energy into power—the latent heat in the exhaust steam—can be continuously and fully utilized to advantage, just so long is the steam engine likely to find its peculiar field of usefulness. But whenever the main or exclusive object is the generation of power from available fuels, then the gas engine may be depended on to be the more efficient motor. To be sure, the heat in the exhaust gases from the gas engine can also be utilized for heating purposes, to a limited extent, either by heating from the gases directly or indirectly, by absorbing the heat value into hot water or steam. However, as the gases contain very much less heat value than the exhaust steam from a steam engine of the same power, they can of course not be counted upon to give but a small percentage of that obtained from the steam engine.

That in principle the transformation of heat into power is more efficient in the gas engine than in the steam engine is recognized and readily proved by the established absolute efficiency of a perfect heat engine expressed by the formula:

$$\frac{T_1 - T_2}{T_1}$$

T_1 and T_2 being the absolute initial and final temperatures of the working charge.

By inserting in the above formula the available extreme temperature limits, the numerical value of the absolute thermal efficiency becomes:

$$\text{For the gas engine } \frac{2{,}160 - 560}{2{,}160} = 74 \text{ per cent.}$$

$$\text{For the steam engine } \frac{872 - 560}{872} = 36 \text{ per cent.}$$

That is, assuming that the temperature of the working charge would be raised in the gas engine cylinder, as it normally is, through compression and combustion, from a temperature of 100° F. to an initial temperature of 1,700° and expanded in the cylinder until its temperature again becomes 100°, then the total efficiency of the heat transformation would be 74 per cent. Similarly, assuming that steam is raised in the boiler from water of a temperature of 100° F. to the initial temperature 412° (corresponding to a pressure of 250 pounds), and that it is expanded in the engine cylinder the entire range down to the temperature at which the cycle started, 100°, then the total efficiency of the engine becomes 36 per cent.

However, these ideal efficiencies of respectively 74 per cent. and 36 per cent., based on the assumption of a perfect heat transformation, can in reality never be obtained, and the object of their citation here is simply to show the comparative ultimate limit for the economy of the gas engine and of the steam engine, due to the difference in the range of temperatures between which they operate. But, should we reduce the above percentages to about one-half of their ideal value, then they will represent fairly the maximum thermal efficiencies that have been obtained in reality, or for the gas engine 37 per cent. and for the steam engine 18 per cent.

The combined efficiencies of the producer gas engine and producer and of the steam engine and boiler will, of course, be somewhat less than the percentages just quoted, which apply for the engines alone, and, as the process of gasifying the fuel in a good type of producer returns readily 80 per cent. of the heat value of the fuel, while an efficient boiler returns only a maximum of 70 per cent., the total useful effect obtainable from the coals consumed will be, for the gas engine 29 per cent. and for the steam plant 13 per cent. That is, the total returns in power from the heat value of the fuel are in the gas plant fully twice that of the most efficient steam plant, such a one we may say as includes in its equipment a compound or triple-expansion condensing engine. Furthermore, the efficiency of the gas engine varies very little with the power, size or type of the engine, whereas the efficiency of the steam engine varies considerably. On this account it will be found that the actual coal consumption per horsepower is in the gas plant often materially less than one-quarter of that of the average well-equipped steam plant.

The chemical reactions on which the operation of the gas producer is based are very simple and should be carefully considered by anyone wishing to obtain efficient results in its manipulation. The first reaction taking place in the lower part of the fuel bed is the combustion of carbon, C, into carbon dioxide gas, CO_2; the second is the reduction of this gas into carbon monoxide gas, CO, as it passes up through the incandescent fuel bed, and the third is the decomposition of steam in contact with carbon of high temperature, resulting in the formation of hydrogen, H, and carbon monoxide, CO.

The first reaction is expressed chemically by the formula:

$$C + 2O = CO_2.$$

The information conveyed by this formula may be expressed by stating that for the complete combustion of one pound of carbon there is required $2\frac{2}{3}$ pounds of oxygen, and the resulting carbon dioxide gas will weigh $3\frac{2}{3}$ pounds. During the complete combustion of each pound of carbon there is generated heat to the entire heat value of the fuel, or about 14,500 heat units.

The second reaction taking place in the producer is expressed by the formula:

$$CO_2 + C = 2CO.$$

That is, the previously formed $3\frac{2}{3}$ pounds of carbon dioxide takes up one pound more of carbon, forming $4\frac{2}{3}$ pounds of carbon monoxide, or per pound of carbon consumed we obtain $2\frac{1}{3}$ pounds of carbon monoxide gas.

The first two reactions in the gas generator, in combination commonly called incomplete combustion, result in the combustion of carbon to carbon monoxide gas, and during the process there is developed heat to the total amount of about 4,500 heat units, or less than one-third of the heat value of the fuel. This heat will appear as sensible heat of the gases and of the fuel bed. The carbon monoxide gas formed can at any time after it has left the furnace be made to again combine with oxygen to the same amount as that which it already contains, in doing which it will generate more than twice the heat developed at its formation in the furnace, or about 10,000 heat units.

The proportion of oxygen, O, to nitrogen, N, in the air being in the ratio of one pound of oxygen to 3.35 pounds of nitrogen, and as for each pound of carbon consumed there has been introduced in the furnace $2\frac{2}{3}$ pounds of oxygen, the $2\frac{1}{3}$ pounds carbon monoxide gas obtained from each pound of carbon must therefore be diluted by 4.46 pounds of nitrogen. But, nitrogen being an inert gas and carbon monoxide of low calorific value, it is evident that the gas mixture resulting from the first two reactions of the process in the generator and which is the main constituent of producer gas must be a lean fuel gas.

In the power gas producer the object is to generate combustible gas of as high heat value as possible, but any sensible heat is not required for the process, excepting to the amount necessary to maintain the temperature of the furnace at such a degree that the formation of gas takes place readily. All that is required, therefore, for the formation of combustible gas in the producer is to supply it with the amount of air only that is necessary for the combustion of carbon to carbon monoxide gas. As, however, during this gasification sensible heat is generated to the amount of 4,500 heat units per pound of coal, and as only part of this heat, about 2,000 heat units, is carried off with the gases, or dissipated through radiation, there will be a surplus of heat, about 2,500 heat units per pound of coal consumed, that must be carried off from the furnace in order not to overheat the same as the process of gasification proceeds. This surplus of heat can be utilized in a most effective and desirable manner simply by introducing steam in the furnace.

The circumstance that steam is subject to decomposition in its constituent elements, oxygen and hydrogen, when in contact with incandescent carbon of sufficiently high temperature, gives cause to the third reaction in the gas generator, which is expressed by the formula:

$$H_2O + C = 2H + CO.$$

That is, each pound of steam, when heated to a high temperature in presence of carbon, will liberate 1-9 pound of hydrogen, and the 8-9 pound of oxygen which it contains will combine with ⅔ of a pound of carbon to 1 5-9 pounds of carbon monoxide gas. It will be seen by the formula for this reaction that in the gasification of carbon by means of steam no inert nitrogen is introduced in the furnace, contrary to the occurrence in case that air is employed, and as the nitrogen, which dilutes the resulting gas, if of no value as far as the heat value of the gas is concerned, it is evident that the more oxygen that can be obtained for the combustion of carbon by decomposition of steam the richer in heat value will the generated gas be. However, as for the decomposition of each pound of steam there is required to be supplied heat to the amount of 6,800 heat units, which is absorbed into hydrogen liberated, and, as for each pound of carbon burned into carbon monoxide gas only a limited amount, about 2,500 heat units is available, it is evident that not more than about 0.36 pound of steam can be decomposed per pound of carbon without cooling the furnace unduly.

Now with 0.36 pound of steam yielding at its decomposition 0.32 pound of oxygen, which combines with 0.24 pound of carbon to carbon monoxide, we may say that somewhat less than one-quarter of the total carbon can be gasified by steam, using for the decomposition the surplus heat from the incomplete combustion only. The weight of hydrogen realized will be one-eighth of the weight of steam decomposed, or 0.05 pound per pound of coal gasified.

If a certain percentage of the carbon dioxide gas, at first formed in the generator, is not reduced by the incandescent fuel bed to carbon monoxide, but is allowed to escape with the fuel gases, then a greater amount of heat will be available for gasification of steam and for the formation of hydrogen, resulting in a gas in the same proportion richer in heat value. It is generally the case that some carbon dioxide will be found in the producer gas. In fact, it has, through experiments, been found impossible to reduce the last four to six per cent. of the carbon dioxide, excepting at extremely high temperatures and slow rate of gasification. A suitable amount of moisture must therefore always be supplied for decomposition and for the absorption of the surplus heat in the liberated hydrogen, as otherwise there will be a loss incurred on the account that the gases will pass off hot and the sensible heat be dissipated at the subsequent cooling of the gas. Too much steam must, however, not be admitted, as this will cool the fuel bed unduly and superheat, instead of decompose, the steam which will subsequently be condensed in the cooling process.

The percentage of fixed carbon, moisture, volatile matter and ash in coals varying considerably, it is evident that the amount of steam required to be supplied for different fuels must also vary to the same extent. In practice it is generally found that an anthracite suction producer requires 0.3 to 0.4 pound of steam per pound of coal gasified and that it gives a gas normally of a heat value of about 135 heat units per cubic foot of the average composition as follows:

	Per cent. volume.	Heat value per cubic foot in heat units at atmospheric pressure and 60 deg. Fahr.
Carbon dioxide CO_2	2.5	0
Carbon monoxine CO	28.0	96
Hydrogen H	9.0	31
Marsh gas CH_4	1.0	10
Nitrogen N	59.5	0
		137

The heat value obtained per pound of fuel gasified will be:

	Heat Units.
In the carbon monoxide gas	10,000
In the hydrogen reclaimed from the heat of gasification	2,500
Additional heat obtained if 1% of hydrocarbons are present in the fuel	100
Total heat value	12,600

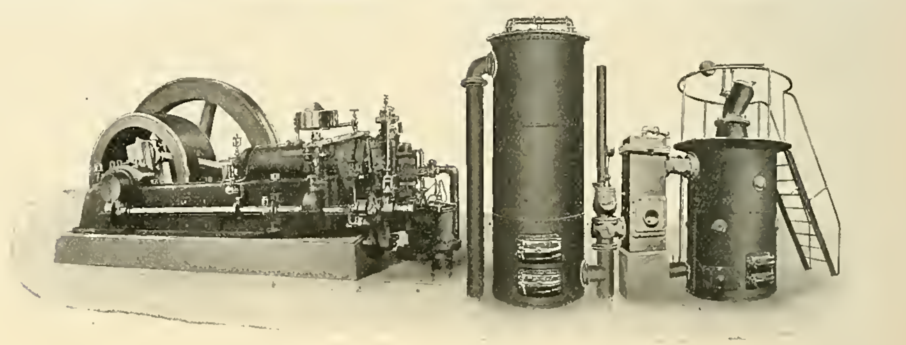


FIG. 1. MUENZEL SUCTION GAS PRODUCER AND GAS-ENGINE PLANT.

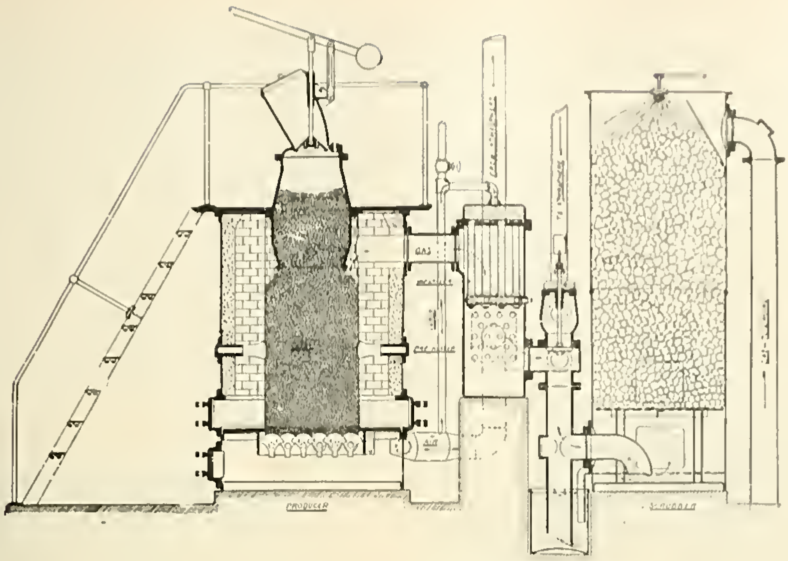


FIG. 2. SECTIONAL VIEW OF MUENZEL SUCTION GAS PRODUCER.

The actual heat value obtained in the gas is thus 87 per cent. of the heat value of the fuel, or if some waste of fuel through the grates and other minor losses are taken into account we may say that the actual efficiency of the producer is 80 to 85 per cent.

From the preceding detailed account of the processes taking place in the gas producer it may appear a rather difficult matter to control the various conditions that are required for an even and continuous formation of gas. This is, however, not so. A moderate amount of intelligent attention to the fire will keep it in a condition to permit the products of combustion to flow freely over the entire area of the incandescent fuel bed, which is one of the essential requirements for obtaining good gas. As to the adjustment of the proper amount of steam to be admitted to the fuel, this readily takes care of itself in a well-constructed apparatus, because the simple requirement that the vapor supply be increased as the sensible heat of the fuel bed increases is automatically filled by the tendency of the greater heat of the gases passing through the vaporizer to generate and supply a more plentiful allowance of vapor to the ash pit.

The construction of the suction gas producer, the type most frequently used at present for power purposes, may be seen by referring to Figs. 1 and 2, which represent the Muenzel suction gas producer, built by the Minneapolis Steel and Machinery Company. The producer is shown in a detailed sectional view in Fig. 2. The producer consists of a cylindrical air-tight steel shell, provided at the proper height with a rocking grate, and is lined above the grate level with a substantial fire-brick lining. At the top is the cast-iron feeding hopper and charging bell and below this the magazine in which the fuel is preheated by the gases before it descends upon the incandescent fuel bed.

The gases generated in the producer are discharged through a change valve into the scrubber, in the smaller sizes, and into the separate vaporizer in the larger sizes. The vaporizer in the smaller sizes consists of a steel pan forming the upper part of the producer body, but in the larger sizes it is found preferable to use the form shown in Fig. 1. This vaporizer consists of a proper number of water tubes connecting a steam heater and a waterlog placed in a suitable gas flue, which conducts the hot gases from the producer through the change valve into the coke scrubber. In this gas flue are also arranged heating tubes for preheating the air supply which is drawn from outdoors to be supplied to the ash pit. The change valve affords an outlet for the poor gases that are formed in the producer when blowing up and starting the fire. The scrubber, which has for its object the cooling and cleaning of the gases on their way to the engine cylinder, consists of a large cylindrical steel vessel filled with coke, over which water flows from the strainer nozzle above, while the gases ascend slowly from below and are, due to the large contact surface between them and the water, effectively freed from any dust or tar that they may carry over from the producer. After the gases have passed the coke scrubber they are sometimes, when generated from certain tarry and less suitable fuels, carried through a sawdust purifier for abstracting the last traces of tar. This is, however, not necessary when running on fuel of ordinary quality, but the gases are generally carried from the coke scrubber direct to the expansion tank and engine.

The expansion tank is simply a gas-tight vessel placed close to the engine for storing some volume of gas, thereby counteracting the pulsations in the gas line that in other cases would be noticeable, due to the periodical suction of the engine piston. The expansion tank serves also the purpose of effectively draining off any water that, in the form of vapor, may be carried with the gas.

The two-cycle engine, in the beginning of the gas-engine era, promising much, has more and more given way for the greater simplicity and compactness of the four-cycle engine. Even disregarding the greater complications of the former type of engine, and considering only the fact that in it the fluid velocity of the admission and exhaust gases are about eight times as great as in the four-cycle type, with consequently greatly increased fluid friction losses, it can readily be expected that the mechanical efficiency of the two-cycle type of engine should be considerably lower than that of the four-cycle type. That actually such is the case has also been satisfactorily proven by numerous records from gas-engine tests.

The Muenzel producer gas engine is of the single-acting four-cycle type for smaller or medium power and of the double-acting four-cycle type for large power.

The single-acting type is particularly suitable for engines of 25 to 160 horsepower in single units and for twice these powers for two engines connected in parallel to one shaft. The four-cycle double-acting type, in single or double units, is recommended for power requirements above those mentioned.

Fig. 3, representing a longitudinal section of the Muenzel gas engine, shows a very simple and compact construction in which it would appear that the various requirements for a successful service have been adequately filled.

The governing of the Muenzel engine, as in most of the modern engines, is accomplished by throttling a charge of constant mixture. Different methods of governing have been proposed from time to time, as, for instance, the varying of the gas mixture for different loads, the changing of the point of ignition, or the changing the point of ignition in combination with the throttling or varying of the cut off of the gas. All these methods have appeared very promising at first, but have failed to effect any marked advantage in the realization of a higher efficiency through the greater complications they involve.

Outside of the "hit-and-miss" governing, which has been found to cause serious fluctuations in the speed of the engine, any of the common devices for governing the gas engine may, in connection with a suitable flywheel, be relied upon to give a very close regulation, which is most important in connection with certain kinds of service, such as flour milling, electric-light service, etc.

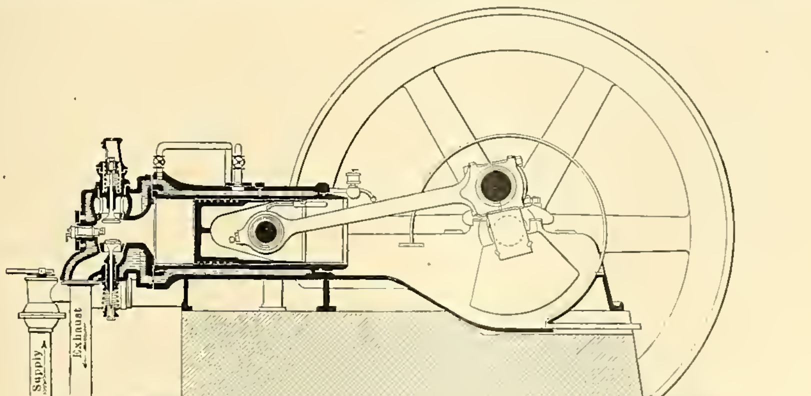


FIG. 3. LONGITUDINAL SECTION OF MUENZEL GAS ENGINE.

Suspension Insulator for High-voltage Transmission.

A suspension type of insulator, as shown in the accompanying illustration, has been designed and placed on the market by the Locke Insulator Manufacturing Company of Victor, N. Y. It was developed by J. V. E. Duncan, electrical engineer for Sanderson & Porter, New York, and W. T. Goddard, electrical engineer of the Locke company, and is believed to possess many advantages over the regulation pin-supported type of insulator for very high potentials, as used in modern power transmission.

NEW SUSPENSION-TYPE INSULATOR FOR HIGH-VOLTAGE TRANSMISSION.

The insulator is said to have an ultimate mechanical strength ranging from 10,000 to 12,000 pounds. The insulator element is made up of two pieces of porcelain—a short inner shell and an outer flaring shell. These shells are tested individually at a potential of approximately 60,000 volts before assembling, and the assembled element is tested at a potential in excess of 90,000 volts for a period of five minutes.

Great mechanical strength and low cost are claimed for the insulator. Being made up of a series of individual elements, it is extremely unlikely that the breakdown of one element will throw the line entirely out of service. The transmission line may be run with one unit, and the insulating element increased, at nominal erection expense, to at least 100,000 volts, as the increase in the transmission voltage may determine. In difficult localities one or more of the units can be carried about, thus taking advantage of the element of portability. The liability to puncture from damage is reduced, because of the wider separation between the earth and the conductors.

The Locke Insulator Manufacturing Company is just completing the engine and generator room of its 600-horsepower power house, brick and concrete; has just completed an addition to its testing facilities for cemented insulators, doubling the capacity, making it 1,800 terminals in all, and is building a brick fireproof transformer house in which will be installed, at the present time, five high-tension transformers, all of 200,000 volts and over.

Influence of Bearings on Accuracy of Integrating Watt-hour Meters.

By H. W. Young.

To the average purchaser or user of integrating watt-hour meters the subject of bearings is of keen interest in that it is quite generally appreciated that this element has a very marked influence upon the accuracy obtainable. Frequently, however, the subject is considered as being settled when it is learned that the meter to be purchased has a "jewel" bearing, and no effort is made to ascertain the kind of a bearing employed, its design, construction or arrangement.

The fact that a meter has a jewel bearing is far from being a guarantee that the accuracy obtainable is all that the purchaser has a right to expect, and it is the purpose of this article to point out some of the effects of imperfect meter bearings, their remedy, and illustrate a form of bearing which has proven to be eminently practical and reliable, a bearing which, with our present knowledge of meter designing, appears to offer a permanent solution of what has been a perplexing problem.

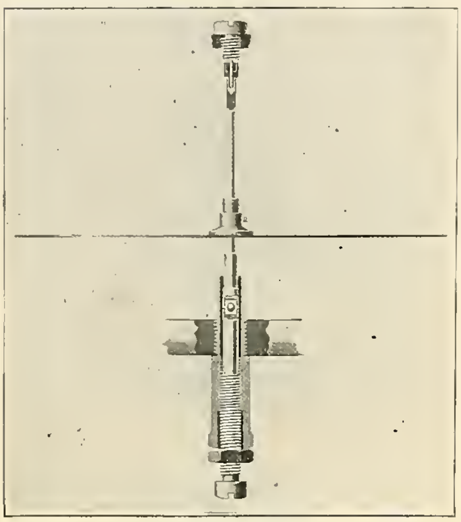


FIG. 1. COMPLETE MOVING ELEMENT OF SINGLE-PHASE INDUCTION METER.

In considering the possible effect of imperfect or improperly designed bearings it should be remembered that we are practically dealing with a miniature direct-connected motor-generator set in which the voltage and current elements of the meter are considered as the motor element, and the retarding disk and permanent magnets as a magneto-generator with a short-circuited disk armature.

The work expended by the motor is absorbed in two ways—first, in driving the generator, and, second, in overcoming friction. In a perfect meter or motor-generator, friction would be absent and all the work would be expended in driving the generator, in which case a direct ratio would exist between the disk speed and the energy passing through the motor system, thus insuring a meter accurate throughout its entire range.

Owing to the fact that a certain amount of bearing surface must necessarily be present in any meter design, it is impossible entirely to eliminate friction, but it will be seen that as the design becomes more perfect a meter is produced in which the ratio between the work expended usefully in driving the disk or armature of the generator and that expended in overcoming friction is high.

With a full knowledge that in order to produce an accurate meter it is necessary so to design and distribute the various elements as to secure a large expenditure of constant work or retarding torque in the disk, as compared to the variable or friction work, the designer has two courses open. The easier method is to increase the driving torque by using a heavier disk, thus decreasing its resistance to the induced current flow by expending a greater amount of energy, thereby increasing the watt losses in the measuring coils, or by employing both of these methods.

The second and by far the preferable method is refinement of design. This entails careful calculation and design of the measuring system, a light moving element, a light running register and a lower bearing of such construction that it will have a minimum amount of friction or wear.

Friction in meters has its greatest effect at the lower end of the calibration curve, or at light loads, and, as a meter is normally operating at this part of the curve for a large part of the time, it will easily be apparent that a commercial meter must be so designed as to give and maintain a high degree of accuracy at light loads.

In striving to secure the most efficient design of lower bearing, designers have experimented with practically every substance having a homogeneous hard composition and with pivots of various materials and forms. As a result of these efforts the "roller" or ball bearing has been developed to such an extent that it undoubtedly offers the least friction, has the largest useful life, and has solved what at one time seemed almost an insurmountable difficulty, namely, the production of an integrating meter which would hold its initial accuracy for a period of several years.

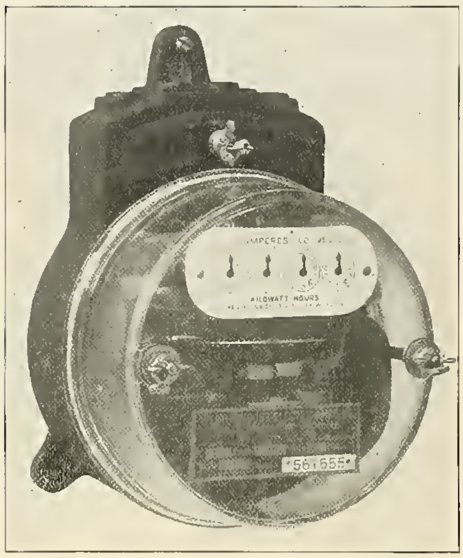


FIG. 2 SINGLE-PHASE INDUCTION METER WITH BALL BEARINGS.

Fig. 1 illustrates a complete meter movement provided with this improved form of bearing, which consists of a highly polished and hardened steel ball resting between two cupped sapphire jewels, one of which is mounted on a removable jewel screw and the other in a removable sleeve attached to the end of the disk shaft.

The action of the bearing is as follows: As the disk rotates the ball moves from its initial position, thus giving a rolling action rather than the straight rubbing action found in the older form of bearing. A changing point of contact between bearing surfaces is thus secured and insures minimum wear, a lower friction value and longer jewel life, than can possibly be secured by the older forms when combined with a light-weight rotating element.

To many unacquainted with the action of the improved bearing it may seem that this change of contact surfaces is questionable, and they may be led to believe that the action does not really occur but merely results in spinning of the ball on its jewel centers, thus giving two points of friction contact and in reality resulting in a greater total friction than would be found in the older form of bearing which had but one point of contact.

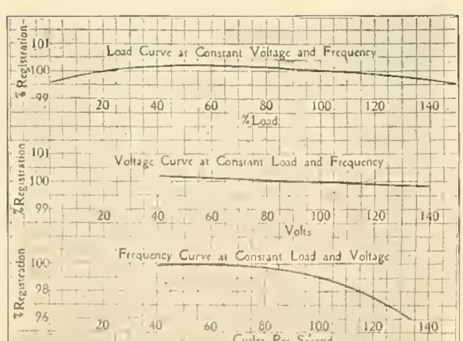


FIG. 3. CHARACTERISTIC CURVES OF INDUCTION METER.

Theoretically, a spinning rather than rolling action of the ball is possible, but to bear out this theory it is essential to have a condition impossible to obtain or maintain commercially, namely, an absolutely perfect alignment between the upper and lower jewel centers. This condition would hold the ball in practically its initial position, resulting in spinning on one or both of the jewel centers.

It is obviously impossible, however, to secure this condition of perfect alignment, owing to inevitable variations in jewels, screw threads, machine drilling of holes and magnetic side pull of the disk in seeking a magnetic balance. Any of these conditions will throw the jewels slightly out of alignment, and with centers a trifle off it will be seen that the ball must roll or revolve. Other factors which induce the rolling effect are external or internal vibration—external, from the support to which the meter is secured, internal, due to the slight disk vibration in the magnetic field. Examination of a ball which has been running in jewels containing a small quantity of dust or cutting material will show it to be surface scratched all over, another proof that it has rolled.

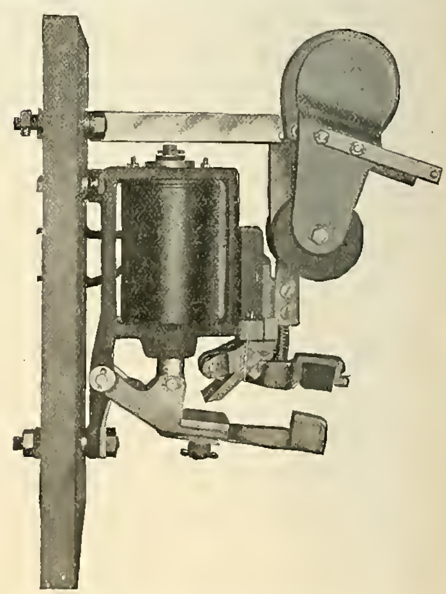
A large number of actual tests extending over a period of several years has fully demonstrated the superiority of this form of bearing. In one instance it was deemed advisable to secure absolute data on jewel life, and a considerable number of meters were put on jewel-life test, this test consisting of loading the meters slightly above full load and running them under actual service conditions over a period of three years, meaning approximately 10,000,000 revolutions of the disk (equivalent to 3,000 kilowatt-hours, or approximately 10 years of ordinary house service).

The meters were then tested and all found to be within two per cent. at full load; and one-half the meters within two per cent. at two per cent. of load. None of the remaining meters showed errors exceeding five per cent. at two per cent. load. This decided improvement in bearing construction with its attendant increase in meter accuracy means much to central stations, as it not only insures increased revenue but also effects a marked reduction in maintainance costs.

Fig. 2 illustrates a single-phase induction meter equipped with ball bearings and Fig. 3 illustrates the characteristic curves. As a matter of interest it might be stated that in addition to the refinement in bearing construction, the mechanical and electrical design is such that the moving element weighs but 15 grammes, the full load torque is approximately 42 gramme millimeters, the watt loss is but 1.6 watts and the ratio of torque to weight, 2.8.

A New Contactor for Heavy Duty.

The Cutler-Hammer Manufacturing Company of Milwaukee, maker of electric controlling devices, has recently placed on the market an improved type of contactor designed for handling main-line currents where the nature of the service is severe. In such cases, the company points out, controllers employing sliding contacts cannot be relied upon to handle the main-line current, and it is customary to employ a controlling panel consisting of a number of contactors, this panel in turn being controlled by a master controller designed to regulate the secondary current which energizes the solenoids of the contactors.



A NEW CONTACTOR FOR HEAVY DUTY.

The contactor here illustrated is a compact and strongly constructed piece of apparatus, and is provided with an exceptionally powerful blowout magnet. The main-line circuit is closed by the solenoid raising a pivoted arm carrying a thick copper plate to a point where contact is made with a pair of stationary, laminated copper brushes. Arcing on this contact is prevented by providing an auxiliary copper and carbon contact in the field of a powerful blowout magnet, which instantly extinguishes the arc incident to the breaking of the circuit. This auxiliary contact closes before the main contact is made and opens after the main contact is broken, thus effectually preventing any sparking on the main contact.

A noteworthy improvement is the pivoting of the blowout shields, permitting these to be raised (as shown in illustration), so as to expose the auxiliary carbon and copper contact. In earlier types of contactors these shields were rigidly fastened to their normal position, completely covering the copper and carbon contacts and rendering access to these difficult. The present construction makes renewal of either contact or of the coiled spring (visible just above the carbon contact) a matter of a few moments only. At a recent test at one of the largest Pittsburg steel mills a 220-volt circuit was opened and closed by a contactor of this type 88,000 times before renewal of the copper and carbon contacts became necessary, and—on a test to determine time required for repairs—the old contacts were removed and new ones inserted in less than two minutes.

A Clearing House for Second-hand Machinery.

A business which has sprung up in the West during the last 15 years and is now said to be the largest of its kind in the world, is that of the Gregory Electric Company of Chicago, a strictly Chicago institution, typical of Chicago methods and growth, able, through Chicago's central location and unequaled shipping facilites, combined with its own excellent methods and organization, to reach all over the continent and transact business with profit to itself and its customers. Speaking of the nature of the company's business, one of the officers called the establishment the "clearing house for America's second-hand electrical machinery."

Testing Department.

Machine Shop.

Warehouse.

Direct-current Motors.

A CLEARING HOUSE FOR SECOND-HAND MACHINERY.

Where does all the machinery sold by the company come from? For one thing, the company has been circularizing every central station in America, and practically every large manufacturing plant using electrical power, for years, and being a large and consistent general advertiser, the name "Gregory Electric Company" has become a household word in the electrical fraternity, identical with second-hand apparatus. Another source of supplies for the Gregory Electric Company is created when large installations are contemplated. In increasing the capacity of a central station, or changing over of an entire power circuit from one voltage to another, or from direct to alternating current, the Gregory Electric Company is frequently called upon to submit offers to competing manufactnrers on the present equipment, to be delivered as soon as the new apparatus is installed; and in this way the office of the company becomes a storehouse for information, and its works a genuine clearing house through which all of this apparatus passes, prepared for new purposes and new destinations, but cleared of defects in the meantime.

Accompanying are a few views taken in this company's works showng their size and the large stock carried. The works are well located in the heart of the shipping district of Chicago, with a branch of the Chicago, Burlington and Quincy Railroad running directly into the grounds and buildings. The works are equipped with powerful electric traveling cranes and a complete lighting, heating and power plant, thus reducing the cost of handling to a minimum.

The management of this company is in the hands of progressive and aggressive people, always on the alert for improvements and advancement. The officers are: President and general manager, A. Louis Kuehmsted; vice-president and manager of sales, A. O. Kuehmsted; general superintendent, J. D. Zook; secretary, George C. Besold. These gentlemen are favorably known wherever electrical current is used.

It has been a long step from the original small 20 by 150-foot shop at 47 South Jefferson Street, where every piece of machinery had to be moved by hand, to the modern equipment of the present works. It shows that this company has kept pace with the growth and importance of Chicago as the great central market, and as Chicago's business increases and expands, this company will no doubt continue an important factor in matters electrical.

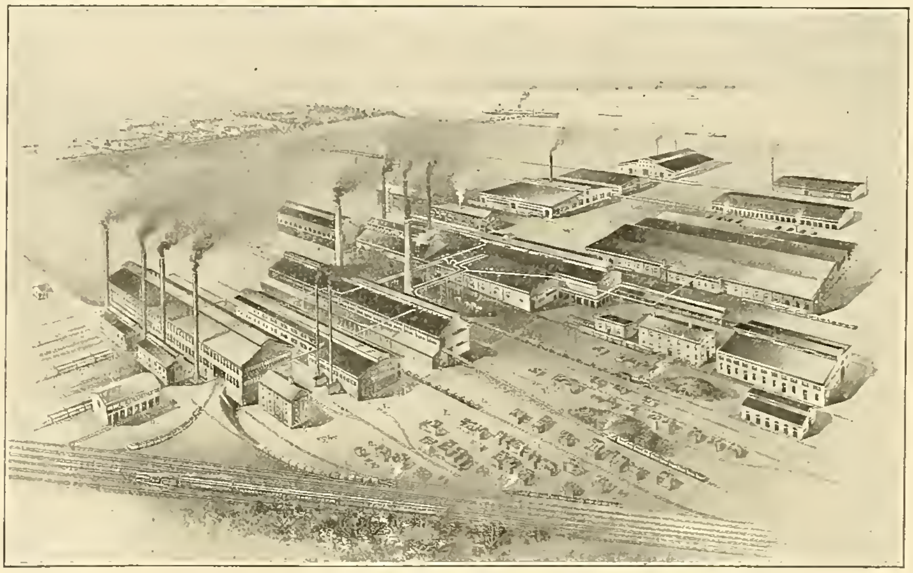
Kinkora Works of Roebling Company.

An important addition has recently been made to the works of John A. Roebling's Sons Company which will materially increase the company's facilities for the production of wire and wire rope. The addition, which is a complete plant in itself, is located about 10 miles south of the main works at Trenton, N. J., and is termed for convenience the Kinkora works, because of the proximity of a village of that name. Included in the buildings shown in the illustration are a thoroughly modern steel plant with four open-hearth furnaces, designed to produce the quality of steel suitable for high-grade wire, blooming and rolling mills, mills for drawing wire, shops for cleaning, annealing and galvanizing, and all the auxiliaries necessary for the production of wire from molten steel.

The additional works are on the line of the Pennsylvania Railroad, side tracks of which enter the yard. Rods which are not drawn into wire at the Kinkora works are loaded upon steel cars built for the Roebling company and taken to the wire mills at Trenton.

The village of Kinkora being too small to provide homes for the large number of men employed at the works, the company has built an entirely new town upon fields in the open country. This town, built of brick and stone, with wide streets and roomy houses, has its own waterworks and electric-lighting station, buildings for religious worship and secular entertainment, a schoolhouse, hotels, a public park, recreation grounds and all the conveniences of a thoroughly modern city. The United States government has established a postoffice in the town and officially named it Roebling.

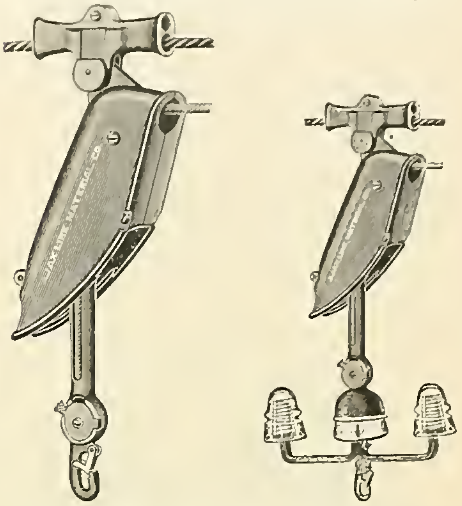
The additional works and their equipment, as well as the new town, were designed by the engineering force of the John A. Roebling's Sons Company and built under the supervision of Mr. C. G. Roebling, president of the company.



KINKORA WORKS OF JOHN A. ROEBLING'S SONS COMPANY, AT ROEBLING, N. J.

Safety Arc-lamp Pulley.

A new arc-lamp pulley is now on the market, being another product of the West. Three years after Fletcher (of Ohio) had introduced sleetproof pulleys, Lounsbury and Morgan (both of Chicago) perfected the first of the so-called lamp-supporting or safety pulleys, whose use has since become so general. Now another Chicago inventor, Albert Scheible, has brought out the new type illustrated here, which combines a smooth-acting safety arrangement with a weatherproof housing. It has only two moving parts, the sheave over which the rope runs and the hook-knob to which the lamp is fastened. When the latter enters the guideways in the pulley casing it first strikes an inclined guide, up which it climbs until the angle between the knob and the guide becomes too steep for it to move farther. There it is stopped by its own friction without striking any barrier which would halt it abruptly and jar the lamp out of adjustment. Slackening the rope allows the knob to slide to a seat, after which another pull automatically releases it. The knob part has a clamp for the rope, and the familiar Ajax snaphook for the lamp, and for series circuits it is fitted out with a high-voltage cross-arm as shown. Both types have been thoroughly tested in practice and are now offered to the trade by the Ajax Line Material Company of Chicago.



SAFETY ARC-LAMP PULLEYS.

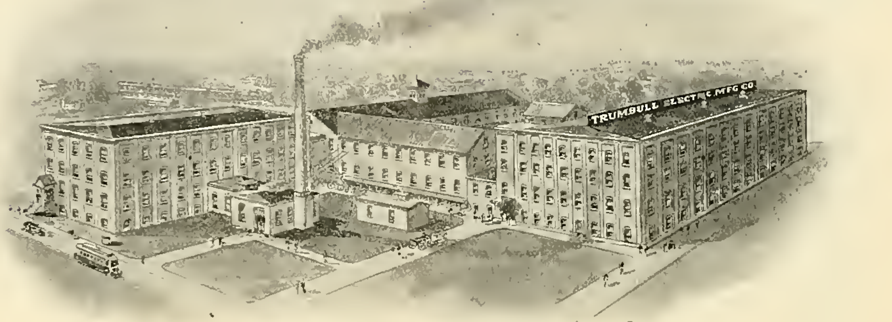
Growth of the Trumbull Manufacturing Plant.

In Plainville, Conn., on February 1, 1899, the Trumbull Electric Manufacturing Company was organized and began business in a very modest manner in the little factory building illustrated herewith. Frank T. Wheeler was elected president; John H. Trumbull, treasurer, and Henry Trumbull secretary. They occupy the same positions today,

ORIGINAL TRUMBULL FACTORY.

but now conduct an enterprise which is well known wherever electrical switches are used. The young men were practical mechanics, and had invented and perfected inventions of value. The early days were days of struggle and the patents had to be protected. This took a big part of the capital, but the fight was won, as well as recognition.

The plant and business of this concern has grown rapidly until now its territory not only covers the home country, but the trade-mark, "circle T," representing Trumbull materials, is known in many foreign countries. The recent completion and occupancy of the new factory building here illustrated has added materially to the equipment and producing capacity of the concern and makes the plant one of the most complete of its kind in the country.



THE TRUMBULL FACTORY OF TODAY.

The space originally occupied by the old factory is now used as a storeroom for copper and brass. There is carried on hand a supply of 200,000 pounds of copper and brass alone. In 1901 a building was added to the plant and the manufacture of type B switches was commenced. The second story is used for storing some of the porcelain, and in the attic are kept boxes and miscellaneous material for packing.

A large four-story brick factory was erected a year and a half ago and was promptly outgrown. At the same time there was erected a small brick building in which the enameling of the slate is done. Here the slate or marble, whichever is used in the switchboard work, is rubbed and polished. On the first floor of the large building are found the buffing rooms; also the plating and polishing rooms and those where the copper is dipped and lacquered.

The machine room is on the second floor. Here the copper is made into the various different parts. Here also are found a number of diemakers and toolmakers. This company makes practically all its own tools.

The third floor is given over entirely to the assembling of the switches, which at present is the largest line manufactured. The offices are on the fourth floor and they are equipped with every modern convenience.

The new large factory building just completed is a fine example of the modern mill construction. It about doubles the output capacity of the plant. In the basement is found a large supply of slates of various sizes used in the construction of switches. From 150,000 to 200,000 pieces are carried in stock. On the first floor are also machines for drilling the large slate and marble pieces for panel switchboards.

The second floor is devoted to the construction of switchboards and panel boards, and the construction of the iron boxes in which many of the panel boards are enclosed. The third floor is given over to the assembling of porcelain material, such as combination switches, plug cut-outs, new Code cut-outs, etc. Space is also here given to the cabinet department, where the wood panel boxes of various kinds with the doors and trims are made.

The fourth floor is at present used as a storeroom, but will probably be turned over for the making of the new lines that are contemplated.

The plant has its own sewer system, private wire connections, automatic telephone system and everything necessary for making high-class goods, which has made the concern prominent in the ranks of electrical manufacturers.

CORRESPONDENCE.

Continental Europe.

Paris, September 11.—Steps are being taken to adopt electric traction upon a certain number of sections of railroad in the north of Italy, in order to keep pace with the increase of traffic. According to recent reports coming from Rome, it appears that for some time past there has been agitation among the leading commercial houses of the Piedmont district in order to obtain from the Italian government an improvement upon the Frejus railroad line, seeing that it has now become quite insufficient for the needs of the Franco-Italian commerce. Senators and deputies from these provinces were at the head of the movement, and the result was the formation of a committee charged with obtaining the needed improvements from the government. The latter consist mainly in the establishing of a double track between Turin and Bussoleno and in the substitution of electric for steam traction on the section lying between Bussolcno and Modane. It is now announced that the government has decided to give satisfaction to the desire of the Piedmont inhabitants. Within a short time the work will be commenced upon a double-track line on the first section lying between Turin and Collegno, and all the details of the electric project have been decided upon. In this way the Piedmont region will be better able to compete with the Lombard district, since the latter now has the advantage of the Simplon Tunnel.

Somewhat of a stir has been caused by the disappearance of one of the special microphone signals which are placed off the harbor of Cherbourg. As this port is the headquarters of the northern section of the French fleet, comprising the naval construction docks and arsenal, it is desired to protect it in every way possible. To this end the Marine Department adopted a system of submarine microphone which was placed about five miles off the harbor and joined to the land station by a cable. In this way the presence of approaching ships could readily be detected, owing to the noise of the propeller, so that the system is a valuable one. It was found not long since that one of the microphone apparatus had disappeared, and the cable seemed to have been cut, so that many were of the opinion that it was carried off by a foreign vessel which wished to find out the details of the method. Others, however, claim that there is nothing especially secret about such microphones, and that they are of the usual kind, and that the disappearance is due to a simple accident. The matter stands in this way at present.

The question of the industrial use of alcohol, especially for motors, is coming specially into prominence of late in France, and the government is taking measures to promote such industries in order to give prominence to alcohol as a fuel, seeing that this is a national product, which is not the case with gasoline. From a technical standpoint, alcohol has been given a thorough test upon motors during the last few years, and is found to compete very well with gasoline for this purpose. Not long since the Chamber of Deputies appointed a special commission in order to find out the best measures to take in order to promote the use of alcohol, with M. Ribot as president. The commission is now engaged in preparing the technical data which are necessary and in drawing up the general programme to be followed.

Concerning the development of electric traction within a recent period, I may mention that a project is on foot in Sweden, which is due to Engineer Dahlender, for the application of the electric system in the southern part of the country upon no less than 1,000 miles of railroad. Not long since the Italian Parliament voted a credit of $10,000,000 for the construction of new electric railroads. The total length of lines which are to be built is nearly 200 miles. Upon the 12 new lines comprised in the project, eight will use the three-phase system, while there will be two upon the direct-current system and two using single-phase current. A. DE C.

New York.

New York City, September 21.—After several months of investigation of the New York Central's electric system Chas. F. Lacombe, chief engineer of the Bureau of Water Supply, Gas and Electricity, and Geo. F. Sever, consulting engineer to the city and a professor at Columbia University, have handed in a report setting forth that in the overhead transmission system, on which has been spent some three or five million dollars, some of the poles are not of sufficient strength to withstand the tensions which are brought to bear upon them; that some are set too close to buildings and that the building of the Kingsbridge section of the overhead line was an error in judgment and that it should be placed underground. Notice of the above decision has already been served upon the New York Central, but it is stated that the officials contend that they cannot maintain an underground system and that they will refuse to recognize any claim of municipal control over their private right-of-way. Although the Central crosses public streets, no thoroughfares are used for the right-of-way.

In the Belmont tunnel under the East River it was decided to install the third rail overhead so that any accumulation of water along the tracks would not impair the service. However, it has been found that water percolates through the roof of the tubes and in some cases has destroyed the insulation, thus delaying still further the time of completion. Although in the nature of an experiment, it was not thought that the plan would prove unsuccessful until it was noticed that moisture readily collected.

Owing to the inability of the Morris County Traction Company to obtain the necessary rights-of-way in and near Summit, N. J., work on the construction of the road in and near that city will have to be abandoned temporarily. This means that there will be no service to the center of the city this winter.

Coroner Julius Harburger, Senator William Sohmer and Alderman J. J. Haggerty, appointed as a sub-committee of the Committee of Ten named on September 3d to consider the speed of surface trolley cars through the city, have prepared an ordinance setting the limit in the Boroughs of Manhattan and the Bronx at ten miles per hour.

In the coming electrical show at Madison Square Garden, September 30th to October 9th, the Brooklyn Edison Company will exhibit a model apartment consisting of a kitchen, dining room, hall, bedroom and parlor, fully equipped with modern electrical appliances. The company is offering to supply to every customer who will drop the company a line two tickets of admission to the Garden. In addition to the exhibit itself, the company is preparing one or two contests to be carried on in connection with it. The name and address of every resident of the Borough of Brooklyn who attends the show is placed on a card and upon the last evening a drawing will be made and the lucky five will be given an order upon the Illuminating Company for the cost of wiring their homes, which in some cases amounts to as much as $250. Other contests will also be arranged for.

The first car which will be used in the Belmont tunnel, No. 601, was run through Jackson Avenue and Fourth Street, Long Island City, on its way to the incline leading down to the tunnel entrance of the north tube. It is essential to get the car through the tunnel as soon as possible in order to protect the franchise. E. H. S.

Southeastern States.

Charlotte, N. C., September 21.—The Americus Railway and Power Company of Americus, Ga., has been granted a charter; capital stock, $250,000. W. D. Dodson, A. W. Smith, E. B. Lewis and J. F. Lewis are the incorporators. This company will build a four-mile electric railway in Americus and furnish power and water to the city.

The Southern Power Company has completed its transmission lines toward Statesville, N. C., as far as Mooresville, about half way from Charlotte. The Statesville sub-station is being rapidly pushed to completion preparatory to the turning on of the current this week. The cotton mills of Concord, N. C., as well as those in Statesville and Lincolnton, N. C., will liberally patronize the company, together with many smaller industries. Concord, whither the current has been carried a distance of 40 miles, is now electrically lighted and the Carbarrus, Franklin, Young-Hartsell and other mills will also be driven by this current. The town of Mooresville is also lighted by the same system of transmission lines, which are now furnishing power to a large section of country north and northeast of Charlotte for a distance of 44 miles.

Superintendent of Lamps and Lighting McCuen of Baltimore is considering the substitution of the regulation arc lights for the incandescent lights now in use. These lights have been used in arches on Baltimore Street for some distance in the principal section of the city, and it is proposed to build a "Great White Way" in Baltimore by the use of arc lights. The cost of the change will be comparatively small.

The electric-lighting system of North Wilkesboro, N. C., is being rebuilt and otherwise improved by the owners.

C. R. Willard & Co. of Spartanburg, S. C., have been awarded the contract to build two dams for hydro-electric power development, one at Ware Shoals and the other at Brown's Mills, seven miles from Ware Shoals. Two hundred men have begun work on the plants, the first to approximate $75,000 and the second about $50,000.

The Raleigh (N. C.) electric railway has received a new 500-kilowatt generator from the General Electric Company, to be added to its equipment, while over four miles of new track is to be constructed. The power house and sheds are also being remodeled and the entire plant reconstructed on the most up-to-date plans. A new 400-horsepower boiler will also be installed.

A meeting of citizens of Washington, Ga., was held September 7th to discuss the building of an electric railway from Washington to Atlanta and to Augusta. About $100,000 has been subscribed by two counties toward this enterprise. A representative of the Atlanta and Carolina Railway was at the mass meeting in the interests of his company and the new enterprise. A second company, the Savannah, Augusta and Northern Railroad, is also interested in constructing a railroad to Washington. J. R. Dyson is president of the Washington Business Association, which is actively pushing the trolley projects, which promise to be realized soon.

The Horseford Power Company, Hickory, N. C., has gotten out its charter calling for a capital of $125,000. A. A. Shuford is interested. L.

Dominion of Canada.

Ottawa, September 21.—The deficit of the all-British Pacific cables for the year ended March 31st last was $335,340, which is considerably less than the deficit of the previous year. Canada's contribution to this deficit will be $93,150, as the Dominion is responsible for five-sixteenths of the undertaking.

Announcement is made of the issue of $1,000,000 stock by the Toronto Electric Light Company, which was ratified some time ago. The new stock is offered to shareholders at par, in the proportion of one new share to three of old. The stock is offered on the market at 150.

The town of Orillia, Ont., may make a profit this year of $9,000 from its light and power plant. The actual revenue from the enterprises owned by the town, including waterworks, is $34,500. Owing to the increased profits the Town Council has been enabled to reduce the tax rate.

The City Council of Sherbrooke, Que., refused to purchase the plant of the Sherbrooke Power, Light and Heat Company for $270,000, which was the amount demanded by the company. The city offered $250,000 cash, or $260,000 if the company would take 4 per cent. bonds of the city at par. The company has been given a limited time in which to accept or reject the city's terms, and failing to accept, work will be commenced immediately on a new power plant for the city.

A conference of managers of the electric development plants operating on the international boundary, extending from New Brunswick to the Rainy River country, will be held in Ottawa shortly. By the act of the Dominion Parliament, passed last winter, the export of electricity to the United States is now under federal control and companies supplying power for utilization across the line must operate under a Dominion license. Regulations have been prepared, but before their final adoption by the government the views of the electric interests affected by the new law will be heard by the government. The act goes into force on October 27th. W.

Winnipeg, Man., September 21.—After paying all expenses and interest the civic electric-lighting plant at Calgary, Alberta, has a surplus for the first seven months of the year of $9,469.

Notice is given in the Manitoba Gazette that the Brandon Electric Lighting Company of Brandon, Man., has increased its capital from $125,000 to $400,000.

A million dollars or more will be spent in the vicinity of Vancouver, British Columbia, by the British Columbia Electric Street Railroad Company. One large item is the Chilliwac line. About $70,000 will be spent on the equipment of the New Westminster-Eburne line. It is possible another 10,000 horsepower will be developed at Lake Buntzen to meet the growing demand for power.

It is expected that work will be commenced this fall on the Manitoba government's telephone system in Brandon, Man. The exchange will cost in the neighborhood of $15,000 and the conduits are estimated to cost about $20,000. Particulars may be obtained from Orrin F. French, superintendent of telephone construction, Winnipeg.

The civic board of control of Winnipeg has awarded several tenders in connection with the tramway to be built from the city to the power plant now being installed at Lac du Bonnet. The tenders awarded included a steam tug, flat cars and engine. Cecil B. Smith has charge of the development.

P. Cronin, Toronto, Ont., has made a proposition to buy the civic electric railroad now being built by the city of Edmonton, Alberta, and a number of aldermen are in favor of the sale of the line, owing to the failure of the city to dispose of the bonds necessary to complete the work. Mr. Cronin is representing George Balfour, an English civil engineer. R.

New England.

Boston, September 21.—The Boston and Northern Street Railway Company has filed petitions for the right to carry freight in the cities of Melrose, Lowell and Lawrence and the towns of Wakefield, Reading, North Reading, Andover, North Andover, Middleton, Danvers, Wilmington, Tewksbury and Dracut, Mass. The petition has been refused in Andover, but North Reading has granted the desired permission. After the municipal authorities have acted, the Massachusetts Railroad Commission will consider the matter. The Boston Elevated Railway Company's petition for a similar right in Boston, is pending before the aldermen. If it is granted the Boston and Northern company's freight can be brought into Boston over the Elevated company's tracks. This would allow the establishment of electric-railway freight service between Boston and Lowell and Boston and Lawrence. Lowell and Lawrence are important manufacturing cities.

The Berkshire Street Railway Company, which is controlled by the New York, New Haven and Hartford Railroad Company, has established an express service between Pittsfield and Great Barrington, Mass.

The firm of Conant, Whiting & Co. of Boston has been incorporated to do an electrical engineering business. It has a capital of $4,000, and George H. Conant, Herbert S. Whiting and Eugene H. Mahoney are the incorporators.

The Edison Electric Illuminating Company of Boston reports for the year ended June 30th as follows, the corresponding figures for 1906 being in parenthesis: Gross earnings, $4,020,620 ($3,780,911); net earnings, $1,428,797 ($1,337,625); total net earnings, $1,470,137 ($1,386,881); interest, etc., $1,406,700 ($1,227,776); surplus, $63,437 ($159,105).

The Boston Bakers' Union has voted that its members pay their fares in pennies to non-union conductors on the Boston and Northern Street Railway Company's lines.

The Massachusetts Railroad Commission has granted a certificate of "public necessity or convenience" to the Boston and Providence Interurban Railway Company, which proposes to build a fast electric railway between Boston and Providence. B.

Indiana.

Indianapolis, September 21.—The city of Logansport is rapidly developing into an interurban center. The Fort Wayne and Wabash Valley, the Indiana Union Traction, the Logansport and the Lafayette traction companies are already entering the city, while the Logansport and South Bend and the Logansport and Marion are seeking independent entrance to the city. The Board of Public Works is not inclined to grant any more independent routes, while the citizens have petitioned the board to let all come in upon favorable terms.

A contract has been entered into between the Chicago, South Bend and Northern Indiana Railroad Company and the St. Joseph Valley Traction Company for the exchange of track privileges in the city of Elkhart. Work on the Elkhart-Middlebury extension of the latter company's line is progressing rapidly, and through services will soon be afforded.

The first electric-railway express train operated by the United States Express Company out of Indianapolis was run out over the Northwestern Traction line to Lafayette during the last week, where connection is made with the Fort Wayne and Wabash Valley road, over which the company is also operating an express business.

A mortgage aggregating $4,000,000 has been filed in the recorder's office of Clark County at Jeffersonville by the Indianapolis and Louisville Traction Company in favor of the Colonial Trust Company of Pittsburg, Pa.

The Indiana Railroad Commission has decided that it has no right to compel electric-railway companies to protect crossings with streets in cities and towns by establishing and maintaining electric lights.

The Columbus Gas Light and Coke Company, a reorganization of the local company, is asking the City Council to grant to it a new and long-term franchise. The company contemplates the construction of a plant to furnish gas for heating and lighting purposes at a greatly reduced cost.

The Board of Public Works of Anderson has installed four new 310-horsepower boilers and an automatic stoker at the city waterworks and electric-light plant. The cost was $8,000. The new system consolidates the power for the two plants and discards six boilers and the services of four men besides making a decided reduction in amount of fuel required. The saving is estimated at $4,000 a year. S. S.

Mexico.

Mexico City, September 18.—The Mexican Light and Power Company is to have strong competition in supplying power and lights for Mexico City if the plans of a company which has been organized for the purpose are carried out successfully. The name of the new concern is Compania Electrica del Alameda. It will build a large hydro-electric plant at the waterfall of the Rio Alameda, situated about 40 miles from Mexico City, and will bring the power into the city by means of transmission lines. The company already has a power plant at the waterfall and it is to be enlarged. The new plant will have a capacity of about 8,000 horsepower. The firm of Donadiue & Veyan of Mexico City is largely interested in the new project. The new company claims that it will establish rates lower than those now in effect by the Mexican Light and Power Company.

A large electric power plant is to be erected at Sabinas, state of Coahuila, by Dr. Braulio Montemayor of Saltillo and associates. Sabinas is in the heart of one of the large coal fields of Northern Mexico and cheap fuel will be obtained for the plant. Transmission lines will be built to a number of industrial centers of that part of Mexico.

The Sultepec Electric Light and Power Company has completed the installation of its large power plant at Temascaltepec. The company has completed a 25,000-volt transmission line to Sultepec, and a sub-station has been built at the latter place. The company furnishes power to many mines and mills.

It is announced that more than $1,000,000 will be spent in constructing the new electric street-railway system in the city of Chihuahua and in building suburban lines to Santa Eulalia and to the new smelter of the American Smelting and Refining Company, 16 miles distant from town. The rails and other material for the new system have arrived. Enrique Creel, Mexico's ambassador to the United States, is the principal owner of the company which is to make these improvements. A. C. Nash is general manager.

Authoritative announcement is made that the Vera Cruz Electric Light, Power and Traction Company of Vera Cruz, which is owned by S. Pearson & Son, well-known English contractors, has completed arrangements to provide that city with electric traction in addition to the power and lighting service which it is now supplying. The power plant at Vera Cruz is being greatly enlarged and work of rebuilding the track will soon be started. W. D. H.

Illinois.

Peoria, September 21.—The street committee of the City Council that has been investigating the fenders submitted for use here on the street cars, met again this week, and, after considering the four kinds that were submitted by the railway company, decided in favor of the Providence. This type is in use in Chicago, and can be lowered by the motorman.

By January 1st the Illinois Traction Company will be connected with the Indiana electric railways. Congressman McKinley, while in Danville this week, said that the building of the connecting link between Ridge Farm and Clinton, Ind., would be commenced at once. This will be the first connection between the two systems by way of Terre Haute and the new line being built between that city and Indianapolis. Early in the spring another line will be built to Danville from Crawfordsville paralleling the Peoria and Eastern Railroad, making travel from St. Louis to points in Ohio and Pennsylvania a possibility.

A rumor that the Illinois Traction Company had purchased the Chicago, Peoria and St. Louis Railway was started in Springfield this week, but it is denied by the Traction Company.

An increase of $22,849.22 is shown in the net earnings of the Illinois Traction Company for the month of August over the corresponding month last year.

The new interurban road at Canton that has been using a gasoline car between Canton and St. David has decided to equip the road and use electricity for power. The Canton Electric Company will pay half the cost of the poles to St. David and use them to carry current to St. David for lighting purposes. The lighting company will also furnish the current to operate the cars. As soon as this part of the line is equipped the company will extend the lines north and south.

Damage suits aggregating $57,500 against the Central Illinois Traction Company, growing out of the wreck near Charleston on August 30th, have been filed.

The Litchfield Gas and Electric Company is installing a new equipment of machinery preparatory to the new lighting system that it will put in operation the first of October.

Henry H. Matlock, special agent of the Central Union Telephone Company, who has been away for a year on a vacation, has returned to Springfield.

A petition has been filed by the Mississippi Valley Electric Railway with the Warehouse and Railway Commission asking for permission to cross the Wabash and the Toledo, Peoria and Western railways at grade at Carthage and Elvaston. The road in question is proposed from Carthage west to Keokuk, Iowa, and from Hamilton, Ill., through Nauvoo, to Fort Madison, Iowa. V. N.

Pacific Slope.

San Francisco, September 18.—The Mono Power Company, on which Edson F. Adams has already spent $40,000 in preliminary work, has closed a contract for a temporary power plant to furnish electric lights and compressed air for completing the water tunnel leading to the initial generating plant of the company on the Owens River. Work is now under way on the diverting dam of concrete that will furnish power water for the plant. A three-mile road has been completed at an expense of $25,000 into the so-called "Impassable Canyon," where the hydro-electric plant is being constructed at a point 20 miles north of Bishop, Cal. Bids have been received on the three large generators which are to be installed in a chamber cut into the ledge of solid rock a short distance above the high-water mark in the canyon. The power will be transmitted about 100 miles to Goldfield and the other principal mining camps of Nevada.

The equipment department of the United States navy yard at Mare Island, Vallejo, Cal., has just finished the installation of a complete wireless-telegraph equipment on board the cruiser California. After three days' test it was pronounced satisfactory.

Bids are being received at Centralia, Wash., for furnishing the city with electric current for ten years.

The Seattle Electric Company of Seattle, Wash., has closed a contract with the Washington Coal Briquette Company of the same place which will result in the erection of a briquette plant at Renton, Wash., with a capacity of 125 tons daily.

E. P. Spaulding, vice-president of the Big Bend Light and Power Company of Spokane, Wash., has applied for a fifty-year light and power franchise in Spokane. The proposed ordinance provides for the construction of a power plant on the Spokane River capable of supplying the entire city, to be ready within three years.

Owing to the telegraphers' strike, the Southern Pacific has abandoned the use of its telegraph service for train dispatching at nine stations between San Jose and San Francisco, and now relies entirely on its recently installed automatic block system to keep its trains under control. Palo Alto, Mayfield and Sunnyvale are among the principal stations within the county that are affected by this new order. According to the head officials of this division, the system works out perfectly and is even more reliable than the old way.

The burning of a 50,000-barrel fuel-oil tank in the yard adjoining the main electric power plant of the Oakland Gas Light and Heat Company at First and Grove streets, Oakland, on September 18th, came very near destroying the entire works, but the actual damage was confined to the steel tank and its contents, about 5,000 barrels of crude petroleum. The report was current that the oil in the tank was ignited by the dropping of high-tension wires which melted the cover of the tank sufficiently to ignite the gas above the oil. The management is non-committal as to the short-circuit theory, however. A.

PERSONAL.

W. S. Powell, manager of the Wisconsin Telephone Company at Eau Claire, Wis., has been promoted to the management of the office at Stevens Point, Wis.

C. H. Edwards has become manager of the Citizens' Telephone Company at Mankato, Minn. He was formerly manager of the St. Paul office for the Northwestern Telephone Exchange Company.

Mr. James Lang died at his home in Chicago on September 10th at the advanced age of 84 years. Mr. Lang was the founder of the J. Lang Electric Company of Chicago some twenty-five years ago. He sold his interests about five years ago and retired.

Mrs. Marilla E. Chandler, wife of Albert B. Chandler, for many years president of the Postal Telegraph-cable Company, died at her country home in Randolph, Vt., on September 14th. She was 64 years old. Mr. Chandler is one of the best-known telegraph men in the country, having served in the military corps during the rebellion, and later as a superintendent for the Western Union Telegraph Company and the Atlantic and Pacific Telegraph Company.

The management of the United Railways of San Francisco announces that Charles N. Black, general manager of the Metropolitan Street Railway Company of Kansas City, has been appointed general manager of the United Railways of San Francisco to succeed George H. Chapman, who died some weeks ago.

H. C. Warren has resigned his position as superintendent of the Toledo, Port Clinton and Lakeside Railway in Toledo and will accept a similar one with the Toledo and Indiana Railroad, made vacant by the resignation of E. Darrow, who will accept a position as expert electrical engineer in New York.

F. J. Stout of Cleveland, Ohio, general manager of the Lake Shore Electric Railway Company and one of the best known electric-railway men in Ohio, died as the result of an operation last week. He had been prominent in railway affairs for several years and was among the first to introduce steam-railroad methods in the operation of interurban railways.

Mr. Francis E. Drake, managing director of the Société Anonyme Westinghouse of Paris, is in the United States on a short visit. Mr. Drake was in Chicago early in the week, and his old friends were delighted to see him. He is in charge of the Westinghouse interests in France, Italy and several other continental countries, and reports a good business.

Dr. Octaviano Pereira Mendes, president of Companhia Ytuana de Força e Luz, Ytu, Brazil, and Dr. Edgard Mendes of the same company have arrived in Chicago and are making their headquarters in the offices of Hays & Foster, consulting engineers. Dr. Mendes will purchase in this market additional American machinery for his power plant located on the Rio Tieta, state of Sao Paulo.

ELECTRIC LIGHTING.

Maryville, Mo., has granted a 20-year franchise to the Maryville Electric Light and Power Company.

Harley Russell is secretary of a newly organized company which is to install an electric-light plant in Ozark, Ark.

The Consumers' Electric Company, of which Atwood Benton is manager and engineer, will build a plant in Hot Springs, Ark.

The Ferris (Tex.) Light and Power Company has been incorporated with a capital stock of $4,000 by W. W. Batchelor and others.

The City Light and Power Company of Bruce, Neb., has been incorporated with a capital of $90,000 by R. C. Barney and others.

The Granite Electric Light and Power Company of Granite, Okla., has been incorporated with a capital of $10,000 by K. C. Cox and others.

The La Crosse Gas and Electric Company of La Crosse, Wis., has just been granted the right to increase its electric-lighting rates, which were declared to be so low as to be unremunerative. In accordance with the new Wisconsin public-utilities law, the company appealed to the state commission for relief and secured it.

At the meeting of the Chicago City Council this week Mayor Busse presented a message calling attention to the merging of the Chicago Edison Company and the Commonwealth Electric Company. The Commonwealth franchise has still 40 years to run and gives the city compensation of three per cent. of gross receipts, while the Edison franchise expires in a few years and pays no compensation. If the new Commonwealth Edison Company intends to operate under the Commonwealth franchise, the mayor thinks it probable that three per cent. should be forthcoming from the Edison business also. The proper committee was ordered to investigate the matter.

The corporation of East Toronto, Ont., during the summer of 1904 came to the decision that an electric power plant was needed to furnish electric light for the city and power for the electrically driven waterworks already owned by the municipality. With Mr. John Galt of Toronto acting as consulting engineer for the work, plans were drawn and contracts awarded for building the power plant and furnishing its equipment. The main generator selected is a 150-kilowatt 2,200-volt 3-phase 60-cycle machine of the revolving-field type furnished by Allis-Chalmers-Bullock, Montreal. This generator is operated at a speed of 150 revolutions per minute and has 48 poles. The exciter is a 15-kilowatt 125-volt machine of the same design.

ELECTRIC RAILWAYS.

The Snohomish Valley Railway Company of Snohomish, Wash., has let the contract to build 55 miles of road, to Renton.

The Milwaukee Northern Railway Company announces that it will sell mileage books as follows: 100-mile books $1.50, 500-mile books $7.00 and 1,000-1,000-mile books at $13. These books are to be transferable and interchaneable, their use not even being restricted to members of one family. For single-trip tickets the fare will be about 1¾ cents a mile. Cash fare paid on cars will be the legal rate, 2 cents a mile.

The Engineering, Construction and Securities Company of Chicago is just completing the third interurban electric railway in Iowa for which it has had the contract. The present road is for the Albia Interurban Railway and will be completed and in operation between Albia and Hocking by November 1st. The company has completed 11 miles of grade for the Atlantic, Northern and Southern steam road, which is to be in operation between Atlantic and Kimballton, Iowa, by January 1st. Messrs. C. B. Judd and C. A. Ross of the Chicago company are supervising the work in Iowa.

POWER TRANSMISSION.

M. H. Fiser is planning to establish a power plant at Alamogordo, N. M., to develop 600 horsepower for commercial purposes.

The Old Dominion Copper Mining and Smelting Company of Bisbee, Ariz., is about to begin the installation of a big central electric power plant, to be the largest in Arizona.

Work on the second hydro-electric plant of the Edison Electric Company on Kern River in the Sierra Nevada Mountains will soon be started. There will be five stations with an aggregate of 90,000 horsepower. V. P. Edmonson states that there will be a market for the company's power and for the city's power that may be developed in connection with the Los Angeles aqueduct.

The Falkenau Electric Construction Company of Chicago recently obtained the contract for installing a complete hydro-electric plant for the city of Paw Paw, Mich., a well known summer resort center. The electrical equipment consists of a 150-kilowatt and an 80-kilowatt Allis-Chalmers waterwheel type generator for direct connection to waterwheels, two nine-kilowatt belted exciters and a number of motors ranging from 15 to 40 horsepower.

It is announced that Helena, Mont., is to have a third great dam across the Missouri River for the development of electrical power, a portion of which will be utilized for a pumping plant to reclaim 10,000 acres of land in Prickly Pear Valley. The same interests which built the present dams are behind the new one and include the estate of Abram Hewitt, the Guggenheims, the Amalgamated Copper interests, Governor Hauser and A. M. Holter of Helena. The pumping plant will cost about $500,000 and the dam approximately $1,000,000. The power will be utilized to a great extent in the Butte mines, East Helena, the Anaconda smelters and minor industries. Already the horsepower development of Helena dams exceeds 35,000 and the new dam will swell this upward of 50,000 horsepower. Work will begin immediately on the new dam and ditches.

PUBLICATIONS.

The first number of Holophane, dated September, has been published and makes a creditable appearance. It is to be a monthly publication devoted to the Holophane system of illumination, and issued from the sales and engineering departments of the Holophane Company.

The latest bargain sheet of the Gregory Electric Company, Sixteenth and Lincoln streets, Chicago, is a booklet of 62 pages in which is listed a large stock of second-hand electrical machinery, including dynamos, motors, transformers, meters, arc lamps, instruments, repairs, etc.

The annual report of the Wire Department of the city of Boston has just been issued. The report gives interesting data on electrical properties and conditions in Boston, dealing especially with the removal of poles and wires from the streets. Patrick J. Kennedy is commissioner of wires.

All who have to do with the installation and care of electric meters will appreciate the efforts of the Fort Wayne Electric Works in publishing Instruction Book No. 3028, which thoroughly covers type K single-phase integrating wattmeters. The book is illustrated with halftones and drawings.

Two attractive bulletins just issued by the Fort Wayne Electric Works are numbered 1098 and 1100, respectively. The former goes into the details of type MPL generators for light and power, and includes some excellent illustrations. Likewise the latter treats exhaustively of small direct-current motors, type L.

The Sprague Electric Company, 527 West Thirty-fourth Street, New York, has just issued a number of handsome bulletins containing data and information on several subjects of interest to all electrical men. All are illustrated with half tones and drawings. Bulletin No. 108 goes into the subject of electric dynamometers for testing gasoline engines. Bulletin No. 229 is especially attractive, being an excellently printed book of 74 pages, going thoroughly into the subject of electric motor equipments for printing, electrotyping, sterotyping and binding machinery. Bulletin No. 230 is an interesting illustrated story, going into the general subject of the electric equipment of a modern factory. Direct-current motor equipments for single and double-magazine Mergenthaler linotype machines are well covered in Bulletin No. 231.

The story of how the New Bremen (Ohio) Electric Light Company sells $8.50 worth of electric current to every inhabitant in the town, written by Mr. F. H. Plaice for the Western Electrician, has been reproduced in pamphlet form by the Co-operative Electrical Development Association, with this recommendation: "Every man in the electrical business should read this story, whether interested as a central station, manufacturer, jobber, dealer, contractor, salesman or otherwise."

The Western Electric Company, Chicago, has just issued a little booklet describing the advantages of its "black enameled wire" as compared with the ordinary cotton or silk-covered magnet wire. A few of the good points of this wire are: Humidity and chemical reagents will not affect its insulating qualities, nor will heat up to 500° F.; it is a thinner insulation than cotton and even silk, and is yet so tough and elastic as to withstand ordinary handling. The company has used it on its apparatus for four years with very good results and is now ready to supply the market on a large scale.

"Curtis Steam Turbine Generator" is the title of a large pamphlet (No. 4531), issued by the General Electric Company, Schenectady, N. Y., that is a particularly complete and handsome publication. The printing and general style of the pamphlet are very attractive; it will be found of special interest to engineers on account of the information given with regard to superheat, vacuum, economy, etc., and the details of construction and operation of all parts of the Curtis apparatus. Under the heading of "Economy," detailed tests are given of 9,000-kilowatt, 5,000-kilowatt, 2,250-kilowatt and 1,000-kilowatt turbines, which show some remarkable high efficiencies. The advance made by this type of turbine is illustrated by the maker's assertion that nearly 1,000,000 kilowatts of Curtis steam-turbine generators have been sold. Special attention is called to the flat efficiency curve, giving high efficiency at overloads and light loads, the simplicity of design, the low maintenance, the economy in space, etc. This publication seems to be typical of the recent desire to have such information written by and to engineers, and the following synopsis of its contents will show the wide field covered: Advantage of vertical shaft type; economy of space, building materials and steam; clearances; flow of steam; balance; lubrication; the construction of buckets and governors; foundation; low pressure turbines; vacuum and regulation; parallel operation; ventilation, economy, etc. The illustrations are profuse and especially clear and good.

SOCIETIES AND SCHOOLS.

The articles of association, officers and committees, membership and general directory of the National Fire Protection Association have been published in book form from the office of the secretary, 382 Ohio Street, Chicago.

By the direction of the "Great Jupiter Fulminator" all faithful "Jovians" will meet in Dallas, Tex., on Jupiter's Day, October 15th, when the annual meeting of the order of Rejuvenated Sons of Jove will be held. Many important matters are to be considered, as well as the annual election of officers. The organization of the "Jovian Cloister," the second degree of Jovianism, will be perfected at this time. Mr. H. B. Kirkland, New York city, is Jupiter, and Mr. C. B. Roulet, Wilson Building, Dallas, Tex., is Mercury.

It has been decided to place Prof. Charles E. Lucke at the head of the Department of Mechanical Engineering of Columbia University. It was Professor Lucke who was chosen by the United States government to conduct the experiments with alcohol as a fuel. In addition to strengthening the regular teaching staff, the university is planning a series of lectures by prominent expert engineers. Part of Professor Lucke's plan is to require all the first, second and third year men to spend their vacations in practical engineering, the first vacation in the machine shops of some good manufacturing company, the second in the draughting rooms, and the third in the big power plants of the city.

MISCELLANEOUS.

The Copper Queen Consolidated Mining Company of New York city has recently concluded the purchase of some fifteen standard Allis-Chalmers induction motors for use on the properties of the Montezuma Copper Company, Nacozari, Sonora, Mexico. These machines are wound for 60 cycles, 3-phase, 220 volts and range from 10 to 75 horsepower. The mill where the motor will be installed is a new one just reaching completion.

In an agricultural machinery factory in Peoria, Ill., is an old Edison bipolar generator which has seen much service. The machine has been rewound and speeded up from about 900 revolutions per minute to 1,300 revolutions. It is carrying 400 lights. At the opposite end of the city is the latest type of generating machinery. Two 2,000-kilowatt turbine generator units installed at the power house of the Illinois Traction Company send their output almost to the Indiana state line, nearly 100 miles away.

BUSINESS.

The J. L. Hudson Company of Detroit, Mich., has let contracts recently covering a 20 by 36-inch Allis-Chalmers Reliance Corliss engine direct connected to a 250-kilowatt direct-current engine-type generator. The new equipment will be utilized to furnish light and power in the Hudson company's store. Messrs. Smith, Hinchman & Cryalls were the engineers and architects in charge of the work.

The Brilliant Electric Company of Cleveland, Ohio, is vigorously pushing the sale of its tantalum lamps. The company has just issued a circular showing how a 20-candlepower tantalum lamp effects a saving of $2.20 in the current charge in 1,000 hours' life as compared with the 3.1-watt carbon lamp. An interesting offer to prospective buyers is made that holds good till October 5, 1907, for a liberal allowance for every carbon-filament lamp replaced.

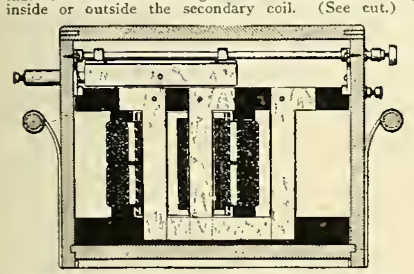
The Jones & Laughlin Steel Company is a recent purchaser of two 1,000-kilowatt Allis-Chalmers 6,600-volt generators wound for 25 cycles, 3-phase, and designed to operate at 94 revolutions per minute. These units, together with a 600-kilowatt direct-current generator, will be installed in the new Aliquippa Works near Pittsburg. A new 500-kilowatt motor-generator set, comprising a synchronous motor rated at 6,600 volts, wound for 3-phase, 25 cycles, and a 250-volt direct-current generator is also being added to the structural shop to carry a portion of the steel-mill load.

ILLUSTRATED ELECTRICAL PATENT RECORD.

Issued (United States Patent Office) September 17, 1907.

865,985. Variable-voltage Transformer. Thomas M. Bains, Jr., Philadelphia, Pa., assignor to the General Electric Company, Schenectady, N. Y. Application filed February 8, 1907.

The transformer has a three-legged core; the primary winding surrounds the middle leg and the secondary winding surrounds the middle and one of the outer legs. An adjustable laminated armature is arranged so that it can shift the magnetic flux from a return path inside or outside the secondary coil. (See cut.)



NO. 865,985.—VARIABLE-VOLTAGE TRANSFORMER.

865,988. Electric Locomotive. Asa F. Batchelder, Schenectady, N. Y., assignor to the General Electric Company, Schenectady, N. Y. Application filed October 21, 1905.

An electric locomotive has a plurality of shafts, two armatures on each shaft, and field coils and cores for producing a magnetic flux through the armatures in series.

865,997. Electromagnetic Variable-speed Mechanism. Alexander Churchward, New York, N. Y., assignor to the General Electric Company, Schenectady, N. Y. Application filed December 20, 1902.

A controller is arranged for a nearly constant speed motor that drives a system of speed changing gears. A set of magnetic clutches connects the different gears to the motor. The controller successively connects the clutches and increases the speed of the motor to above normal after each change of gears.

866,001. Sparking Mechanism for Internal-combustion Engines. Leslie S. Cushman, Lincoln, Neb. Application filed June 3, 1907.

One terminal of the circuit is always in contact with a rocker arm that periodically touches the other terminal and thus closes the circuit. A casing surrounds the mechanism.

866,011. Method of Improving Vapor Electric Devices. Samuel Ferguson, Schenectady, N. Y., assignor to the General Electric Company, Schenectady, N. Y. Application filed February 9, 1907.

This is a method of relieving a mercury-vapor rectifier from the dangers arising from mercury around or in the anodes and consists in initially operating the rectifier on a low-voltage current and distilling the mercury from the neighborhood of the anodes before the rectifier is put in service on high voltage.

866,012. Arc Lamp. Richard Fleming, Swampscott, and Cromwell A. B. Halvorson, Jr., Lynn, Mass., assignors to the General Electric Company, Schenectady, N. Y. Application filed March 12, 1904. Renewed April 7, 1906.

This lamp has its arc between a carbon and a non-consuming electrode. In feeding an auxiliary non-consuming electrode is oscillated to momentarily engage the carbon and strike the arc.

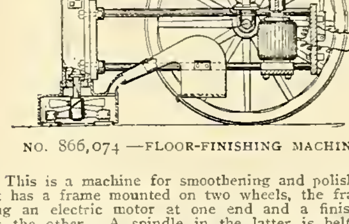
866,019. Rotary Vibratory Massage Brush. Jacob Handel, New York, N. Y. Application filed October 26, 1906.

An electric motor drives a flexible shaft that vibrates and rotates a massage brush.

866,036. Telephone Mouthpiece. Rudolf Knoll, Vienna, Austria-Hungary. Application filed August 11, 1905.

A tube having its outer end slotted and provided with an annular flange is screwed to the diaphragm box. The mouthpiece has a slotted inner end and is provided with spring tongues to fit over the flanged tube and to permit the mouthpiece to be readily removed or rotated.

866,074. Floor-finishing Apparatus. Eduard Schenk, Sheradan Borough, Pa. Application filed June 6, 1906.



NO. 866,074.—FLOOR-FINISHING MACHINE.

This is a machine for smoothening and polishing floors. It has a frame mounted on two wheels, the frame carrying an electric motor at one end and a finishing head at the other. A spindle in the latter is belted to the motor and carries the rotating finishing tools at its lower end. (See cut.)

866,075. Water-jet Grounder for Protection Against Excessive Potentials in Electrical Systems. Stephan Schneider, Berlin, Germany, assignor to the General Electric Company, Schenectady, N. Y. Application filed January 26, 1907.

A protective device against high potentials has a spark gap formed between a conductive plate and a grounded nozzle delivering a stream of liquid in proximity to the plate, but normally out of contact therewith, and projections from the plate and nozzle forming a horn gap.

866,076. Electric Self-winding Clock. Emil Schultz, Berlin, Germany. Application filed April 29, 1907.

This clock has a pivoted armature carrying an arm and contact piece and a pivoted lever contact near the first contact piece and held in its middle position by a spring.

866,081. Control of Separately Excited Generators. Georg Stern, Berlin, Germany, assignor to the General Electric Company, Schenectady, N. Y. Application filed January 23, 1907.

A controlling switch for connecting, varying and disconnecting the separate excitation of a generator and also for changing the field to connect it across the armature so as to annihilate the residual magnetism.

866,089. Combined Lamp Socket and Shade Holder. Julius C. Tournier, Schenectady, N. Y., assignor to the General Electric Company, Schenectady, N. Y. Application filed March 25, 1903.

The shade holder has a web with a central flanged opening to fit over the end of the socket shell, beads in the shell and a flange permanently holding them together.

866,090. Fuse Box. Lewis E. Troutman, Schenectady, N. Y., assignor to the General Electric Company, Schenectady, N. Y. Application filed November 11, 1905.

This fuse box consists of an insulating block having recesses in opposite sides and a handle at one edge, contact blades in the recesses on one side, an inclosed fuse in the recess on the opposite side, and bolts passing through the block and connecting the blades and fuse.

866,105. Flush Receptacle and Plug. George P. Whittlesey, Washington, D. C., assignor to the General Electric Company, Schenectady, N. Y. Application filed September 13, 1905.

A casing has a circular socket provided with shoulders, a face plate with a round opening and a circular shutter that has segmented flanges extending between the shoulders and the face plate, so that the shutter can be locked by turning.

866,128. Device for Transmitting Sound Through Water. Elisha Gray, Highland Park, Ill., assignor to the Submarine Signal Company. Application filed December 1, 1899.

A system of submarine telegraphy has a sounding plate in magnetic circuit or circuits, whereby it is maintained in a state of constant polarization and also adapted to be vibrated by magnetic lines of force, electrically induced in magnets in close proximity thereto, the polarity of which is alternately reversed.

866,138. Telephone System. Henry F. Joeckel, Clayton, Ill. Application filed February 23, 1904. Renewed March 11, 1907.

This system has two line circuits with the magnets and bell signaling instruments connected to one line circuit and the talking instruments connected to the other line circuit as they are usually connected in the common bridging system that has only one line circuit.

866,193. Trolley Guide. Frank G. Clark, San Francisco, Cal. Application filed February 20, 1907.

This trolley guide consists of a fork secured to the trolley pole near its upper end, each tine of the fork being made in three sections pivotally connected by two knuckle joints, and springs for maintaining the sections in a continuous line with each other, the springs permitting the sections to bend at the joints when passing a cross wire supporting the overhead or conducting wire.

866,212. Current Distributer for Sparking Devices. Montague S. Napier, London, England. Application filed September 26, 1904.

An ignition device has two shafts geared together, one operating the make and break in the primary circuit of an induction coil and the other closing the secondary circuit so as to distribute the induced current to the required sparking points.

866,224. Trolley Pole. Alexander Ross, Rochester, N. Y. Application filed February 5, 1906.

This pole has an outer tubular section and an inner section made of two pivotal connected members. A spring tends to force the inner section outward.

866,241. Ignition System for Explosion Engines. Richard Varley, Englewood, N. J., assignor to the Autocoil Company. Application filed November 13, 1906.

An auxiliary magneto generator is provided in this system, which is put in operation by the chauffeur depressing a pedal when he desires to start the engine. As soon as the pedal is released the auxiliary generator is cut out of circuit and the main generator operates the igniters.

866,261. Railway Traffic-controlling System. Clarence W. Coleman, Westfield, N. J., assignor to the Hall Signal Company. Application filed January 10, 1907.

This system has stationary and movable contact terminals, the latter being operated by an oscillating arm carrying a spring and a pawl to hold the arm while the spring is being put under tension.

866,262. Commutator. Clarence W. Coleman, Westfield, N. J., assignor to the Hall Signal Company. Application filed January 24, 1907.

The commutator is made of contact bars of nonmetallic material coated on their lateral surfaces with metal, and has means for engaging the ends of the bars and clamping them in place under pressure.

866,266. Telephone System. William W. Dean, Chicago, Ill., assignor to the Kellogg Switchboard and Supply Company, Chicago, Ill. Application filed June 19, 1903. Renewed February 27, 1907.

This patent relates to a supervisory lamp signal in one of the talking strands of the cord circuit of a central energy system. While conversation is going on the current through the lamp is too feeble to light it. As soon as the subscriber's telephone is hung up, a relay in his circuit sends sufficient current through the lamp to light it.

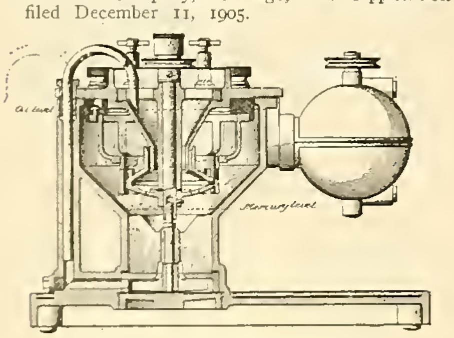
866,281. Railway Signal. William H. Jordan, Brooklyn, N. Y., and George T. Hanchett, Hackensack, N. J., assignors to the Jordan Automatic Signal Company, New York, N. Y. Application filed June 14, 1905.

A pair of opposed magnets has a plunger connecting their cores. The plunger has cylindrical teeth forming a circular rack. Pinions engaging with the teeth operate the signals.

866,286. Electric Generator and Motor. Alvaro S. Krotz, Springfield, Ohio, assignor of one-half to Paul A. Staley, Springfield, Ohio. Application filed January 12, 1905.

The field cores are in two sections, one thinner than the other. A special winding is placed on this thinner section and the main field coil about the entire core. The auxiliary winding is intended to overcome armature reaction.

866,289. Mercury Interrupter. August R. Luschka, River Forest, Ill., assignor to the Western Electric Company, Chicago, Ill. Application filed December 11, 1905.



NO. 866,289.—MERCURY INTERRUPTER.

A rotary shaft carries a mercury cup having a peripheral discharge opening. A stationary contact is so placed as to be struck by the jet of mercury from the opening when the cup is rotated. An inclosing vessel surrounds the parts and catches the discharged mercury, which is returned to the rotary cup by means of a centrifugal pump. (See cut.)

866,292. Ceiling Fan. Charles R. Meston, St. Louis, Mo., assignor to the Emerson Electric Manufacturing Company, St. Louis, Mo. Application filed June 2, 1906.

This fan has a hollow sectional frame of skeleton construction and a high-speed electric motor arranged inside of the frame and supported thereby and having its armature shaft disposed vertically. Fan blades connected to the armature shaft of the motor and located entirely within this frame are so formed that they dispel the air radially across the ceiling.

866,301. Method of Forming Seals and Terminals for Electric Apparatus. Henry N. Potter, New Rochelle, N. Y., assignor to the Cooper Hewitt Electric Company, New York, N. Y. Application filed November 19, 1903.

This method of sealing silicon within a tube of silica consists in passing an inert gas through the tube and fusing the silicon out of contact with gases active relative to it.

866,311. Electroplating Apparatus. Albert F. Schroeder, Cleveland, Ohio. Application filed March 18, 1907.

A tank is provided with removable castings which form the bearings for a tumbling drum and gearing to revolve it. The drum may be removed independently of the other mechanism.

866,327. Automatic Time Call. Jesse E. Boone, Almedia, Pa. Application filed July 2, 1906.

This is an annunciator with a signal operated by the hour and minute hands of a clock. The minute hand makes several short contacts while the hour hand makes one long one.

866,331. Railway Signal. Frederic B. Camors and Charles Pelletier, New Orleans, La. Application filed May 1, 1906.

This system employs the rails and auxiliary conductors insulated from the earth to form the circuits for a signal and a telephone carried in the car.

866,349. Trolley-pole Support. Hugh W. Fellows, Cahuenga, and Ira A. Cammett, Hollywood, Cal. Application filed September 15, 1905.

A spring working through a jointed brace is used in raising a rigid trolley pole. If the pole is raised above the wire, another spring causes it to drop to a point below the wire.

866,363. Trolley Wheel. Henry L. Humphrey, Monroe, Mich. Application filed October 12, 1906.

The hub of the wheel is parted on its middle plane, the two parts being flanged to fit and to be bolted together, and one of the flanges carrying the grooved rim of the wheel. The central part of the wheel journal is globular, so that the wheel can oscillate sideways through a small angle as well as rotate freely.

866,377. Push Button. George H. Mebold, New York, N. Y. Application filed March 16, 1907.

This push button has T-shaped contact plates attached to the base-plate and extending radially toward each other and a button provided with a shoulder and an interior metallic rim adapted to be placed in contact with the inner ends of the contact-plates, a helical spring being interposed between the base-plate and a cavity in the interior of the button.

866,387. Galvanometer. Jules Richard, Paris, France. Application filed January 27, 1905.

The galvanometer has two magnets with pole-pieces curved on concentric lines, the poles of one magnet being located within those of the other. The galvanometer coil is mounted on a V-shaped frame having one of its sides in each of the magnetic fields.

866,421. Process of Effecting Chemical Reductions and Producing Metals or Alloys. Frederick M. Becket, Niagara Falls, N. Y., assignor to the Electro Metallurgical Company. Application filed January 31, 1907.

This is a process for reducing vanadic oxide and consists in effecting reduction to vanadous oxide by the oxidation of carbon and reduction to vanadium by the oxidation of silicon and electrically supplied heat.

866,462. Selenium Cell. William J. Hammer, New York, N. Y. Application filed February 5, 1907.

A selenium cell of the incandescent lamp type comprises an inclosing envelope consisting in part of fused quartz and forming a vacuous inclosure for the selenium, screw-shell and central stud terminals upon the outside of the envelope, and means for connecting the selenium to the terminals outside of the envelope.

866,471. Electric Bell. Robert L. Hunter, Lakewood, Ohio, assignor of one-half to Don M. Osborne, Cleveland, Ohio. Application filed June 9, 1905.

This bell is of solenoid construction and has a casing of magnetic material inclosing the solenoid and provided with an integral pole-piece projecting within one end of solenoid and an insulating non-magnetic head inserted in the end of the casing opposite this pole-piece. A contact member is mounted in this head, and a plunger reciprocates within the solenoid and is resiliently held in contact with the contact member.

866,473. Electric Lamp Bracket. Daniel C. Keefe and Thomas M. Smith, New York, N. Y.; said Smith assignor to said Keefe. Application filed June 7, 1906.

This lamp support consists of an extensible lamp carrying tube having telescoping sections, the tube fitting into a cup which provides a receptacle wherein the wire automatically coils and uncoils.

866,484. Alarm. Thomas R. Kinsella and Christopher W. Hodgetts, Hartwell, Ohio. Application filed March 21, 1907.

This is an electric alarm for street cars. The top of the controller box has two adjacent arcs forming terminals of the alarm circuit. The controller handle has a button connecting by means of a flexibe shaft in a bore through the handle to a shoe adapted to bridge the terminal arcs and thus sound the alarm in any position of the handle.

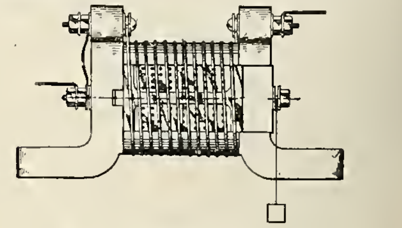
866,498. Method of Melting Through Masses of Material. Adolf E. Menne, Creuzthal, and Wilhelm Zollenkopf, Cologne, Germany, assignors to Cöln-Müsener Bergwerks Actien Verein, Creuzthal, Germany. Application filed August 27, 1906.

This method of perforating masses of metal and masses containing combustible parts consists in providing a pipe in an electric circuit, contacting it with the mass, and then withdrawing it to form an electric arc, permitting the arc to play for a brief interval of time only, and then admitting gases containing oxygen to the pipe, blowing out the arc, and burning out the required perforation in the mass.

866,521. Automatic Safety Apparatus for Railways. George E. Ryan, New York, N. Y. Application filed September 27, 1906.

A track device has a pin adapted to project into the path of a trip mechanism, a cam controlling the position of the pin, an electromagnet having a core connected with the cam, a catch for maintaining the cam in a set position, and an electromagnet controlling the catch to release the cam.

866,556. Lightning Arrester. Azel Ames, Jr., New York, N. Y., assignor of one-half to Asbury G. Wilson, Wilkinsburg, Pa. Application filed August 16, 1906.



NO. 866,556.—LIGHTNING ARRESTER.

This lightning arrester has a recessed body of insulating material open at one side, wire coiled around the body and extending over the recess, and a combined core and ground terminal within the body-recess and held therein by the pressure of the coil. (See cut.)

866,561. Process of Producing Alloys. Frederick M. Becket, Niagara Falls, N. Y., assignor to the Electro Metallurgical Company. Application filed December 22, 1906.

This is a process for producing ferro-vanadium and consists in reacting in an electric furnace upon vanadium oxide with ferro-silicon, the ferro-silicon containing not less than fifty per cent. of silicon.

866,577. Telephone-receiver Holder. Arlington D. Brittain, Youngstown, Ohio. Application filed December 15, 1906.

This holder consists of a number of connected levers for adjustably holding the receiver to the subscriber's ear.

866,590. Electrical Switch. Michael J. Kehoe, Fort Wayne, Ind., assignor of one-third to Benjamin Lehman, Fort Wayne, Ind. Application filed November 2, 1905.

An open-air high-tension switch has a horizontally movable frame carrying the contact blade. The frame oscillates on two long arms pivoted at their bottom ends.

866,596. Insulator. William A. Morton, Los Angeles, Cal. Application filed November 6, 1906.

This insulator comprises a body having a screw-threaded passage with a slot therein, and a screw-threaded part engaging in the passage, and having a longitudinal groove.

866,597. Process of Producing Manganese Silicide. Edgar F. Price, Niagara Falls, N. Y., assignor to the Electro Metallurgical Company. Application filed November 14, 1905.

The process consists in smelting a charge of compounds of manganese, silicon and carbon in an electric furnace and surrounding the zone of reduction and protecting the electrodes by a considerable body of the charge, the current being maintained at the lowest potential difference possible.

866,610. Massage Vibrator. Walter J. Bell, Los Angeles, Cal., assignor of one-half to Samuel L. Kistler, Los Angeles, Cal. Application filed October 8, 1906.

This consists of an applicator driven by an electric motor through an eccentric. The vibratory stroke is adjusted by varying the eccentricity of the eccentric.

PATENTS THAT HAVE EXPIRED.

Following is a list of electrical patents (issued by the United States Patent Office) that expired September 23, 1907:

436,779. Electric-motor Car Truck. E. W. Goss, Amesbury, Mass.
436,814. Electric Arc Lamp. A. Wagniere, Los Angeles, Cal.
436,843. Electric Controller for Power Mechanisms. R. D. O. Smith, Mishawaka, Ind.
436,857. Coupling for Electric Wires. F. R. Jones, Kearney, Neb.
436,864. Electric Heater. E. Abshagen, Chicago, Ill.
436,874. Electric Contact Device. J. J. Hoppes, Springfield, Ohio.
436,895. Process of Electro-depositing Aluminum. J. A. Jeancon, Newport, Ky.
436,910. Electrical Weighing Machine. W. Snelgrove, King's Norton, England.
436,923. Electric Railway. H. W. Libbey, Boston, Mass.
436,952. Thermal Cut-out. G. H. Whittingham, Baltimore, Md.
436,961. Portable Electric Fire Alarm. F. R. Upton, Orange, N. J.
437,008. Holder for Electric-light Shades. L. J. Atwood, Waterbury, Conn.
437,010. Telephone Exchange System. E. M. Bentley, Boston, Mass.
437,011. Artificial Resistance. E. M. Bentley, New York, N. Y.
437,012. Telephone Exchange System. E. M. Bentley, Boston, Mass.
437,069. Electric Distance Heat Indicator and Alarm. F. W. Wieschrock, New York, N. Y.
437,111. Rheostat. J. H. Gunnings, New York, N. Y.
437,126. Underground Electric Conduit. C. E. Loth, Troy, N. Y.
437,158. Electric Railway. R. M. Hunter, Philadelphia, Pa.
437,160. Dynamo-electric Machine or Motor. M. Mayer, New York, N. Y.

20TH ANNIVERSARY AND FALL TRADE NUMBER.

Western Electrician

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ALPHABETICAL INDEX TO ADVERTISEMENTS.

For Classified Index of Advertisements See Page 6.

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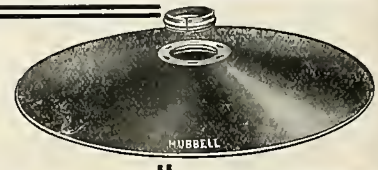

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Central Electric Co.
Manhattan Elec. Supply Co.
Ostrander & Co., W. R.
Wesco Supply Co.
Western Electric Co.

Batteries, Primary.
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Belt Dressing.
Dixon Crucible Co., Jos.
Leather Preserver Mfg. Corp.

Belting.
Leather Preserver Mfg. Corp.
Shultz Belting Co.

Belt Tighteners.
Minn. Steel & Machy. Co.

Boiler Fronts and Castings.
Minn. Steel & Machy. Co.

Boilers.
Babcock & Wilcox Co.
Minn. Steel & Machy. Co.

Bolts, Expansion.
Star Expansion Bolt Co.

Books, Electrical.
Drake & Co., F. J.
Electrician Publishing Co.

Boxes, Junction.
Bossert Elect. Const. Co.

Brass, Sheet and Rod.
Plume & Atwood Mfg. Co.

Bridle Rings.
Bissell Co., The F.
Star Expansion Bolt Co.

Brushes, Dynamo.
Central Electric Co.
Holmes Fibre Graphite Co.
Speer Carbon Co.
Western Electric Company.

Bulbs, Incan. Lamp.
Lippincott Glass Co., The.

Bushings.
Appleton Elec. Co.

Cable Dogs.
Star Expansion Bolt Co.

Cable Hangers.
Barron & Co., J. S.
Bissell Co., F., The.
Wesco Supply Co.
Western Electric Co.

Cable Splices.
Bissell Co., The F.

Cable Trolleys.
Bissell Co., The F.

Cables (See Wires and Cables)

Carbons, Points and Plates.
Chicago Carbon Co.
Central Electric Co.
Commonwealth Edison Co.
National Carbon Co.
Reisinger, Hugo.
Speer Carbon Co.
Wesco Supply Co.

Castings.
Minn. Steel & Machy. Co.

Cement, Cable, Transformer.
Massachusetts Chemical Co.

Chains.
Jeffrey Mfg. Co.

Chests, Tool.
Vanderman Plbg. & Htg. Co.

Circuit Breakers.
Cutter Elec. Co.
Switchboard Equipment Co.

Clamps, Cable.
Cook, Frank B.
Matthews & Bros., W. N.

Cleats.
Blake Signal & Mfg. Co.

Climbers.
Klein & Sons, Mathias.

Clusters.
Benjamin Elec. Mfg. Co.

Clutches.
Minn. Steel & Machy. Co.

Coils and Magnets.
Western Electric Co.

Commutator Compound.
McLennan & Co., K.

Commutator Segments.
Commutator Co. The.

Compounds, Boiler
Dearborn Drug & Chem. Wks.

Compound, Insulating and Splicing.
Massachusetts Chemical Co.

Condensers (Steam).
Minn. Steel & Machy. Co.

Conduits.
American Circular Loom Co.
American Conduit Co.
Fibre Conduit Co., The.
Gest, G. M.
McRoy Clay Works.
National Metal Molding Co.

Conduit Rods.
Bissell Co., The F.

Contractor, Electric Subway.
Gest, G. M.

Contractors and Electric Light Plants.
Allis-Chalmers Company.
Crocker-Wheeler Co.
Ft. Wayne Elec. Wks., Inc.
General Electric Co.
Northern Electrical Mfg. Co.
Wagner Electric Mfg. Co.
Western Electric Co.
Westinghouse El. & Mfg. Co.

Controllers.
Cutler-Hammer Mfg. Co.
National Rheostat Co.
Schureman Co., J. L.
Ward Leonard Electric Co.

Conveying Devices.
Jeffrey Mfg. Co
Minn. Steel & Machy. Co.

Cord, Arc Lamp.
Ajax Line Material Co.
Samson Cordage Wks.

Cordage, Electrical.
Belden Mfg. Co
Samson Cordage Wks.

Cross-Arms, Pins and Brackets.
Berthold & Jennings.
Bissell Co., The F.
Central Electric Co.
Lindsley Bros. Co., The.
Manhattan Elec. Supply Co.
Wesco Supply Co,
Western Electric Company.

Current Controllers.
Universal Mfg. Co.

Cushions, Field, Coil.
Massachusetts Chemical Co.

Cutouts and Switches.
Bissell Co., The F.
Bossert Elec. Const. Co
Bryant Electric Co.
Central Electric Co.
Commonwealth Edison Co.
Cutter Elec. Co.
Ft. Wayne Elec. Wks., Inc.
General Electric Co.
Hart Manufacturing Co.
Manhattan Elec. Supply Co.
Perkins Elec. Switch Mfg. Co.
Trumbull Elec. Mfg. Co.
Wesco Supply Co.
Western Electric Co.
Westinghouse El. & Mfg. Co.
Worcester Electric Mfg. Co.

Diggers, Post Hole.
Iwan Bros.

Drills, Electric.
Chicago Pneumatic Tool Co.

Drills, Star Pipe and Special.
Star Expansion Bolt Co.

Drying Machinery.
Devine Co., J. P.

Dynamos and Motors.
Allis-Chalmers Company.
Bissell Co., The F.
Central Electric Co.
Century Electric Co.
Crocker-Wheeler Co.
Ft. Wayne Elec. Wks., Inc.
General Electric Co.
Gregory Electric Co.
Northern Electrical Mfg. Co.
Roth Bros. & Co.
Stow Manufacturing Co.
Wagner Electric Mfg. Co.
Warren Electric Mfg. Co
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Western Electric Co.
Westinghouse El. & Mfg. Co.

Electric Railways.
Allis-Chalmers Co.
General Electric Co.
Westinghouse El. & Mfg. Co.

Electroliers.
Goodwin & Kintz Co., The.

Electro-Plating Machinery.
Crocker-Wheeler Co
General Electric Co.

Elevators and Conveyors.
Jeffrey Mfg Co.

Employment Agency.
Hapgoods.

Engineers, Electrical and Mechanical.
Arnold Co., The.
Badt, F. B.
Byllesby & Co., H. M.
Hunt & Co., Robt. W.
Jackson, D. C. & W. B.
Randolph, Isham.
Rushel & Wells.
Sargent & Lundy.
Schott, W. H
Willis, G. M.

Engines, Gas, Gasoline and Oil.
Allis-Chalmers Co.
American Diesel Engine Co.
Minn. Steel & Mchy. Co.
Otto Gas Engine Works.
Westinghouse Machine Co.

Engines, Steam.
Allis-Chalmers Co.
Buckeye Engine Co.
Minn. Steel & Machy. Co.
Westinghouse Machine Co.

Exposition, Electrical.
Elect'l Trades Exposition Co.

Fans and Fan Motors.
Central Electric Co.
Century Electric Co.
Crocker-Wheeler Co.
Edison Mfg. Co.
Ft. Wayne Electric Wks., Inc.
General Electric Co.
Wesco Supply Co,
Western Electric Co.
Westinghouse El. & Mfg. Co.

Fibre.
Kartavert Mfg. Co.
Vulcanized Fibre Co.

Fixtures, Gas and Electric.
Beardslee Chandelier Mfg. Co.

Flashers.
Bissell Co., The F.
Haller Machine Co.
Reynolds El. Flasher Mfg. Co.

Flexible Shafts.
Stow Mfg. Co.

Fuses and Fuse Wire.
Bissell Co., The F.
Central Electric Co.
Chase-Shawmut Co.
Chicago Fuse Wire & Mfg. Co.
D. & W. Fuse Company.
Manhattan Elec. Supply Co.
Wesco Supply Co.
Western Electric Company.

Gas Producer Power Plant.
Minneapolis Steel & Mchy. Co.

Gears.
Minn. Steel & Machy. Co.

Glass Tubing.
Lippincott Glass Co., The.

Globes, Inner.
Fostoria Glass Specialty Co.
Lippincott Glass Co., The.

Globes, Reflectors and Shades.
Holophane Co., The.
Phœnix Glass Co.
Wesco Supply Co.
Western Electric Co.

Gloves and Overalls.
Carhartt, Hamilton.

Graphite Specialties.
Dixon Crucible Co., Jos.
Holmes Fibre-Graphite Co.

Heaters.
Stewart Heater Co., The.

Heating Appliances, Electric.
American Elect'l Heater Co.
Simplex Elec. Heating Co.

Heating (Exhaust Steam).
American District Steam Co.

Inspection and Insurance.
Hartford Steam Boiler Inspection & Insurance Co.

Instruments, Electrical. (Recording and Testing.)
Bissell Co., The F.
Bristol Co
Central Electric Co.
Conn. Tel. & Elec. Co.
Duncan Elec. Mfg. Co.
Eldredge Elec. Mfg. Co.
Ft. Wayne Elec. Wks. Inc.
General Electric Co.
Helios Mfg. Co.
Machado & Roller.
Pignolet, L. M.
Wagner Electric Mfg. Co
Wesco Supply Co.
Western Electric Co.
Westinghouse El. & Mfg Co.
Weston Electrical Inst. Co.
Whitney Elec. Inst. Co.

Insulators and Insulating Materials.
American Electrical Works.
Central Electric Co.
Commonwealth Edison Co.
Cutter, Scott C.
Indiana Rub. & Ins. Wire Co.
Kartavert Mfg. Co.
Locke Insulator Mfg. Co.
Manhattan Elec. Supply Co.
Massachusetts Chemical Co.
Mica Insulator Co.
Munsell & Co., Eugene.
National India Rubber Co
New York Insulated Wire Co.
Okonite Co., The.
Phillips Insulated Wire Co.
Simplex Electrical Co.
Standard Underground C. Co.
Vulcanized Fibre Co.
Wesco Supply Co.
Western Electric Co.
Westinghouse El. & Mfg. Co.

Joints, Wire.
Cook, Frank B.

Lamps, Arc.
Adams-Bagnall Elec. Mfg. Co.
Badt & Co., F. B.
Bissell Co., The F.
Central Electric Co.
Excello Arc Lamp Co.
Ft. Wayne Elec. Wks., Inc.
General Electric Co.
Manhattan Elec. Supply Co.
Wesco Supply Co.
Western Electric Co.
Westinghouse El. & Mfg. Co.

Lamp Guards.
Benjamin Elec. Mfg. Co.
Hubbell, Harvey, Inc.
Matthews & Bros., W. N.
Morse Frank W.

Lamps, Incandescent.
Banner Electric Co.
Bissell Co., The F
Brilliant Elec. Co.
Central Electric Co.
Columbia Incan. Lamp Co.
Commonwealth-Edison Co.
Economy Electric Co.
Fostoria Incan. Lamp Co.
General Electric Co.
General Incan. Lamp Co.
Moline Incand. Lamp Co.
Monarch Elec. Mfg Co.
New York & Ohio Co.
Novelty Incan. Lamp Co.
Shelby Electric Co.
Standard Elect'l Mfg. Co.
Sunbeam Incan. Lamp Co
Warren Elec. & Specialty Co.
Wesco Supply Co.
Western Electric Co.
Westinghouse El. & Mfg. Co.
Westinghouse Lamp Co

Lamps, Incandescent—Replacers and Cleaners.
Morse, Frank W.

Lightning Arresters.
Lord Electric Co.

Line Material.
Ajax Line Material Co.
Cutter Co., George

Magnet Wires.
(See Wires and Cables.)

Meters.
Columbia Elec. Meter Co.
Duncan Electric Mfg. Co.
Ft. Wayne Electric Wks Inc
General Electric Co.
Helios Mfg Co
Universal Mfg. Co.
Westinghouse Elec. & Mfg Co.

Mica.
Chicago Mica Co.
Mica Insulator Co.
Munsell & Co., Eugene

Mining Apparatus, Elec.
Allis-Chalmers Co.
Crocker-Wheeler Co.
General Electric Co.
Jeffrey Mfg. Co.
Westinghouse El. & Mfg Co.

Motors (See Dynamos and Motors).

Nernst Lamps.
Nernst Lamp Co.

Newels.
Goodwin & Kintz Co., The.

Nippers and Pliers.
Klein & Sons, Mathias.

Paints, Insulating.
Massachusetts Chemical Co.

Paints, Preservative.
Massachusetts Chemical Co.

Patent Attorneys.
Bain, Foree & May.

Phosphor Bronze.
Phosphor Bronze Sm. Co. Ltd.

Pipe Bending Machines.
Chicago Pneumatic Tool Co.

Platinum, Wire and Sheet.
Baker & Co., Inc.

Poles and Ties.
Berthold & Jennings.
Bissell Co., The F.
Bruer, Will F.
Church Lbr. & Coal Co., W. C.
Fowler & Co., John H.
Huebel Co., C. J
Kellogg Switch. & Sup. Co.
Lindsley Bros. Co., The.
Menominee White Cedar Co.
Morrison Lumber Co., J. W.
National Pole Co.
Pacific Coast Pole Co.
Perrizo & Sons.
Porter Cedar Company
S-E. Missouri Cypress Co.
Sterling & Son, W. C.
Torrey Cedar Co.
Valentine-Clark Co., The.
White Pine Lumber Co.
Worcester Co., C. H.

Polish (Metal).
Hoffman, Geo. W.

Portables, Electric.
Goodwin & Kintz Co., The

Power Transmission Machinery.
Allis-Chalmers Company.
Jeffrey Mfg. Co.
Minn. Steel & Machy. Co.

Pumps.
Minn. Steel & Machy. Co.

Rail Bonds.
Lord Electric Co.

Rail Joints.
Rail Joint Company, The.

Railway Conductors, (Third Rail.)
RailwaySafetyServiceCo.The

Re-Winding—Repairs.
Commonwealth Edison Co.
Gregory Electric Co.

Rheostats.
Cutler-Hammer Mfg. Co.
General Electric Co.
National Rheostat Co
Schureman Co., J. L.
Ward Leonard Electric Co.
Westinghouse El. & Mfg. Co.

Rubber, Moulded.
Massachusetts Chemical Co.

Scale, Automatic.
Avery Scale Co., The.

Screw Machine Products.
Hill Co., Geo. Q.

Schools and Colleges.
Highland Park College.

Second-Hand Machinery.
Graham, Jas. A.
Gregory Electric Co.

Selectagraphs.
RailwaySafetyServiceCo.The

Service Boxes.
Trumbull Elec. Mfg. Co.

Shade Holders.
Hubbell, Harvey, Inc.
Jem Shade Holder Co.

Sign Letters.
Haller Machine Co.
Matthews & Bros., W. N.

Signs, Electric.
Haller Machine Co.
Peglow, G. F.

Sleeving, Braided.
Belden Mfg. Co.

Smoke Stacks, Steel.
Minn. Steel & Machy. Co

Solder, Self Fluxing.
Belden Mfg. Co.

Soldering Paste
Blake Signal & Mfg Co.

Sockets.
Benjamin Electric Mfg. Co
General Electric Co.

Speaking Tubes.
Central Electric Co.
Manhattan Elec. Supply Co.
Ostrander & Co., W. R.
Wesco Supply Co.
Western Electric Co.

Speed Indicators.
Weston Electrical Inst. Co.

Springs.
Manross, F. N.

Staples.
Blake Signal & Mfg. Co.

Steel Castings.
Minn. Steel & Machy. Co.

Stokers.
Westinghouse Machine Co.

Supplies, General Electric.
Bissell Co., The F.
Central Electric Co.
Chicago Edison Co.
Manhattan Elec. Supply Co.
Wesco Supply Co.
Western Electric Co.

Switchboards.
Bissell Co., The F
Trumbull Electric Mfg. Co.
Wagner Electric Mfg. Co.
Weston Electric Co.
Worcester Electric Mfg. Co

Switches.
(See Cut-outs and Switches.

Tanks.
Minn. Steel & Machy. Co

Tapes.
Massachusetts Chemical Co

Telephones, Telephone Material
American El. Telephone Co
Automatic Electric Co
Cook, Frank B.
Conn. Tel. & Elec. Co.
International Tel. Mfg. Co.
Kellogg Switchb. & Sup. Co
Long Distance Tel. Mfg. Co.
Western Electric Co.

Telephone Service.
Chicago Telephone Co.

Testing Laboratory.
Elect'l Testing Laboratories.

Time Switches.
Bissell Co. The F.

Tools.
Klein & Sons, Mathias.

Tools, Pneumatic.
Chicago Pneumatic Tool Co.

Torches, Gasoline.
Zeidler Lamp & Brass Co.

Transformers.
Allis-Chalmers Company.
Crocker-Wheeler Co.
Ft. Wayne Elec. Works, Inc
General Electric Co.
Kuhlman Electric Co.
La Fayette Elect'l Mfg. Co.
Wagner Electric Mfg. Co.
Western Electric Co.
Westinghouse El. & Mfg. Co.

Trucks, Electric Car.
General Electric Co.
Westinghouse El. & Mfg. Co.

Turbines, Steam.
Allis-Chalmers Co.
General Electric Co.
Westinghouse Machine Co.

Turbine Water Wheels.
Leffel & Co., Jas.

Vacuum Drying.
Devine Co., J P.

Varnishes, Insulating.
Massachusetts Chemical Co.

Vulcanized Fibre.
Vulcanized Fibre Co.

Wires and Cables.
American Electrical Works
Atlantic Ins. Wire & Cable Co.
Belden Mfg. Co.
Bissell Co., The F.
Central Electric Co.
Chicago Insul. Wire & Mfg. Co.
Crescent Ins. Wire & Cable Co.
General Electric Co.
Hazard Manufacturing Co.
Indiana Rub. & Ins. Wire Co.
India Rubber & Gutta Percha Insulating Co.
Manhattan Elec. Supply Co.
National India Rubber Co.
New York Insulated Wire Co.
Okonite Co., The.
Phillips, Eugene F.
Phillips Insulated Wire Co.
Roebling's Sons Co., J. A.
Simplex Electrical Co.
Standard Underground Cable Co.
Wesco Supply Co.
Western Electric Company.

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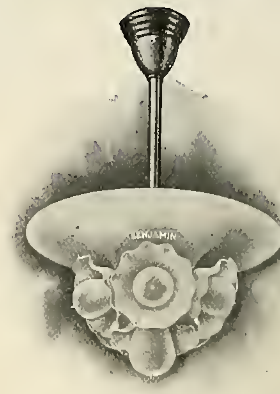
BENJAMIN
WIRELESS CLUSTERS
LIGHTING SPECIALTIES


Catalog No. D 47


Benjamin Cluster Bodies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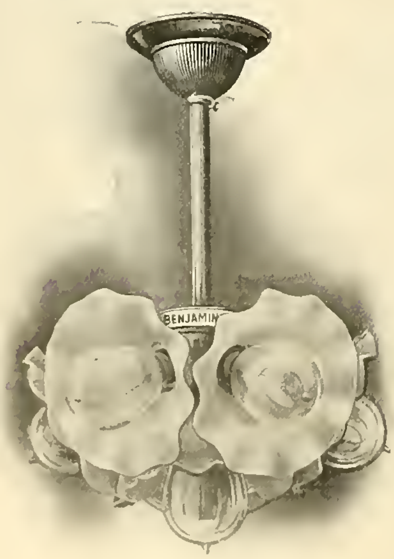
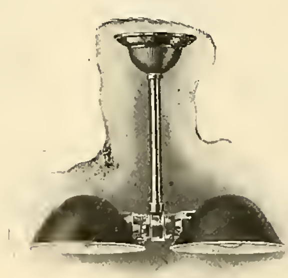
Catalog No. O 15 P


Catalog No. O 22 P

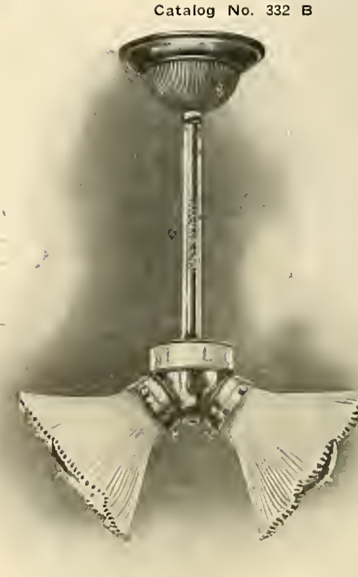

Catalog No. 33 K B


Catalog No. 332 B


Catalog No. O 16 K G


Catalog No. O 43272


Catalog No. 482742


Catalog No. O 82 V

WRITE FOR ILLUSTRATED CATALOG

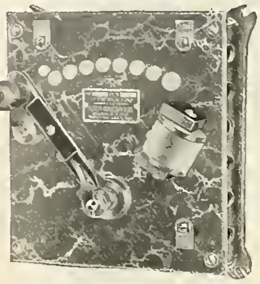
BENJAMIN ELECTRIC MFG. CO.

New York ***CHICAGO*** ***San Francisco***

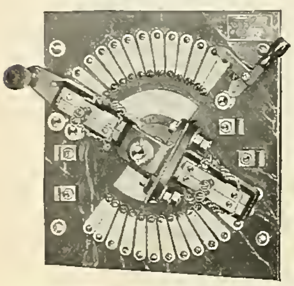
CUTLER-HAMMER

MOTOR STARTING RHEOSTATS

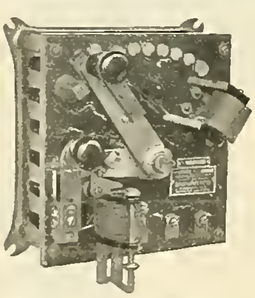
More than 300 Standard Types and Sizes



Motor Starting Rheostat with no voltage release. (Bulletin 10.)



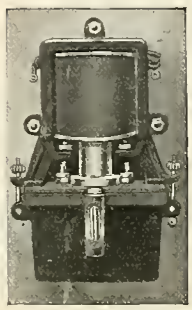
Starting Rheostat for induction motors —squirrel-cage type. May be used in place of auto-transformer or compensator with small motors. (Bulletin 18.)



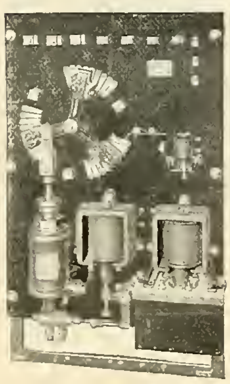
Double Lever Motor Starting Rheostat. Moisture proof Resistance. (Bulletin 17.)

A. C. SELF STARTERS

Controlling Apparatus for the automatic starting and stopping of motors operating on A. C. Circuits is one of our specialties



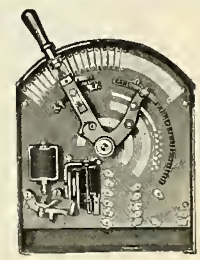
Self-starter for alternating-current motor—single, two or three phase. (Bulletin 33.)



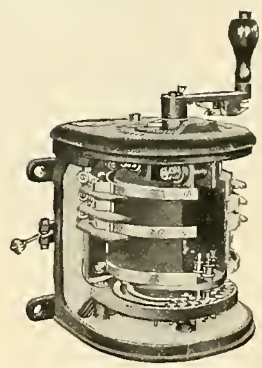
Self-starter for two or three phase A. C. motor—slip ring type. (Bulletin 35.)

MACHINE TOOL and PRINTING PRESS Controllers

Nearly 100 pages of our complete catalogue are devoted to descriptions of Cutler-Hammer Machine Tool and Printing Press Controllers



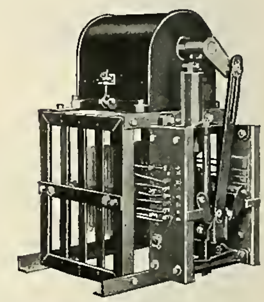
Printing Press Controller, "Carpenter" Type. (Bulletin 85½.)



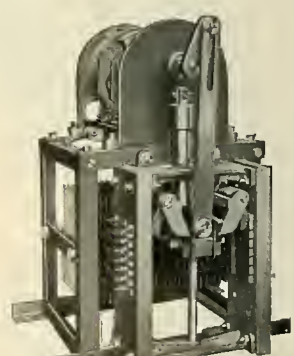
Machine Tool Controller. (Bulletin 78.)

Elevator Controllers

Our line of Elevator Controllers is now the most complete on the market



Elevator Controller, for use in connection with direct-current motors. (Bulletin 54.)



Elevator Controller for alternating-current motor—slip ring type. (Bulletin 56.)

THIS ADVERTISEMENT gives only an inkling of what we make. Our catalogue gives a better idea, for in it are listed no fewer than 2,500 types and sizes of STANDARD Cutler-Hammer controlling devices. Even the catalogue, however, does not tell the whole story for we make special apparatus as well.

WE DO NOT MAKE motors, nor generators, nor any appliances for electric lighting (except Theater Dimmers), but we DO make every conceivable device for CONTROLLING the electric current. Let us know in what line of controlling apparatus you are interested and we will gladly send descriptive Bulletins covering it.

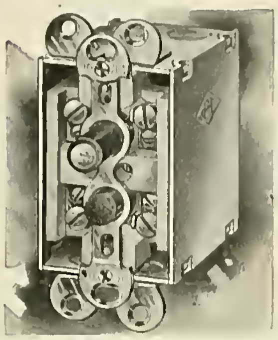
The Cutler-Hammer Mfg. Co.

Milwaukee, Wisconsin

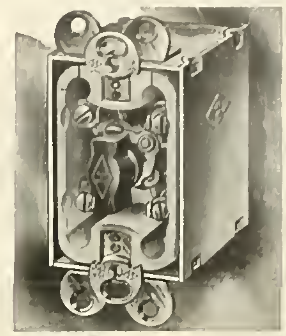
New York Office	Chicago Office	Pittsburg Office	Boston Office
136 Liberty Street	Monadnock Bldg.	Farmers Bank Bldg.	176 Federal Street

LARGEST MAKERS OF ELECTRIC CONTROLLING DEVICES IN THE WORLD

1897-1907



Push-Button Switch in Wall Case



Rotary Flush Switch in Wall Case

"DIAMOND H"

SWITCHES AND RECEPTACLES

Standard Switch without Dial

Standard Switch with Indicating Dial

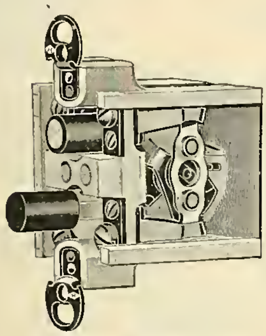
When "Diamond H" Switches and Receptacles were first placed on the market in 1897 they were better than other makes. We have constantly strived to bring them nearer perfection, and they are today absolutely the best on the market. Slight improvements are always being made with the object in view to improve them faster than their new features can be copied by others. In simplicity of design, constructive strength and mechanical excellence they are unequaled.

"Diamond H" Steel Wall Cases are for "Diamond H" push-button and rotary-flush switches and for "Diamond H" flush receptacles. The reversible ear in these cases is a new feature and allows the case to be used in the regular way for old work, or for new work, by simply reversing the ear. The cases are made of cold rolled steel, eighty-five thousandths thick, and galvanized by the hot process to prevent rusting. They are made single and in gangs up to number ten. Made for flexible conduits and for iron pipes; provided with plug outlets.

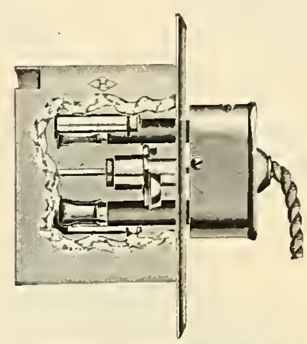
"Diamond H" Switches are best because they are backed by seventeen years of practical experience in electric switch construction.

"Diamond H" Flush Receptacles are specified by exacting architects and contractors. They cannot ground or short-circuit. No lids to pry open, no broken finger-nails. Open or close alternately by inserting or withdrawing plug.

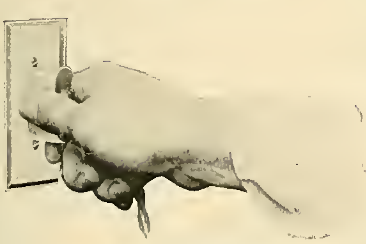
Write *to-day* for our new literature.



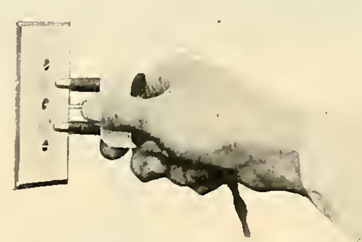
Push-Button Switch with Mechanism Enclosed



Receptacle with Plug Inserted



"Diamond H" Automatic Flush Receptacle. Plug Inserted

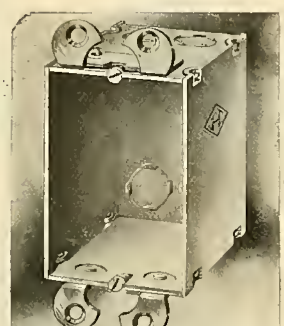


"Diamond H" Automatic Flush Receptacle. Plug Ready to Insert

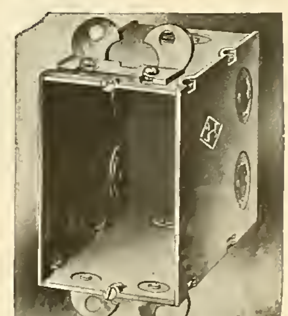
HART MFG. CO.

HARTFORD, CONN.

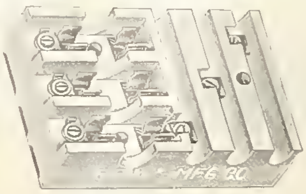
New York Boston Chicago
Denver San Francisco
Toronto, Canada London, England



"Diamond H" Wall Case with Ears in Regular Position. To Use for Wiring Old Walls



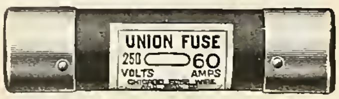
"Diamond H" Wall Case with Ears Reversed. To be Plastered in for New Work



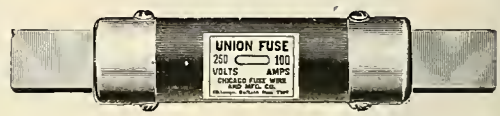
From the first Fuse we ever made to the last Fuse finished today we have never lost sight of the principle that absolute perfection must prevail, in consequence of which our fuses are recognized to be scientifically constructed, accurately and carefully designed, perfect in operation, under all conditions.

The combined effect of these features makes the "Union" fuse the most accurate

"UNION" MEANS PERFECTION



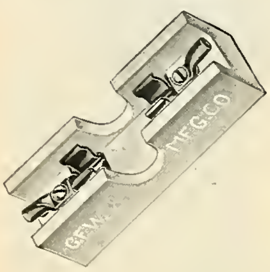
Have you seen our new No. 19 Catalogue? Perfect in every detail giving all measurements of fuses and blocks. Write for one today.



Approved by Underwriters' Laboratory
250 Volt our entire line 600 Volt

Goods shipped same day as order is received

TRADE UNION MARK



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CHICAGO FUSE WIRE & MFG. CO.

CHICAGO NEW YORK

Highest Grade Fixtures

Not only illuminate the home but by their attractive and artistic appearance encourage the use of more current.

We have a well-tried plan for LIGHTING COMPANIES wishing to increase their current sales by modern methods.
Let us send you our new 1907 catalog and details.

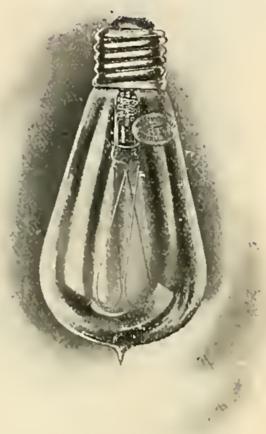
The Goodwin & Kintz Co.

Office and Factory: Station H, Winsted, Conn.

Salesrooms: New York, Boston, Baltimore, Chicago, San Francisco, Montreal; Cape Town, South Africa; Sydney, N. S. W.

Westinghouse

High Efficiency Metallized Filament Lamps



50 Watt Type.

Meridian Type.

High Candlepower Type.

THE NAME IS YOUR GUARANTEE

TRADE MARK WESTINGHOUSE LAMP COMPANY W NEW YORK

WESTINGHOUSE LAMP CO.

510-534 WEST 23d ST., NEW YORK

TRADE MARK WESTINGHOUSE LAMP COMPANY W NEW YORK

Product Sold by

Westinghouse Electric and Manufacturing Co.

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Boston
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San Francisco
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Denver
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Joplin
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Los Angeles
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Minneapolis
New Orleans
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Richmond
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IMPORTANT!!!

"G. I." LAMPS

WHERE TO GET THEM

NOTE THE RELIABLE LIST!

THEY ALL CARRY STOCKS

FOR PROMPT DELIVERY WRITE THE NEAREST AGENT

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1635 17th St., Denver, Colo.

COAST ELECTRIC CO.
312 San Pablo Ave., Oakland, Cal.

HOBSON ELECTRIC CO.
172-174 Commerce St., Dallas, Texas.

CHRISTOPHER ELECTRIC CO.
Beaumont, Texas.

W. F. IRISH ELECTRIC CO.
60 Cortlandt St., New York.

ELECTRICAL EQUIPMENT CO.
Sandusky, Ohio.

FRANK ADAM ELECTRIC CO.
904-914 Pine St., St. Louis, Mo.

ROYSE ELECTRIC CO.
125 So. Meridian St., Indianapolis, Ind.

SOUTHERN ELECTRIC CO.
423 N. Calvert St., Baltimore, Md.

JACKSON & EARLE
Stockton, Cal.

MOUNTAIN STATE ELECTRIC CO.
911-913 Market St., Wheeling, W. Va.

CROSBY, CRAFT & CO.
723 Williamson Bldg., Cleveland, Ohio.

Prompt shipments—prices right, and backed up to the limit by the G. I. Co.
Any statements regarding G. I. Lamps made by our agents will be substantiated by us.

General Incandescent Lamp Company

CLEVELAND, O. San Francisco Office, 404 Atlas Building

N. B.—GOOD AGENTS WANTED IN TERRITORY NOT COVERED. SEND FOR LATEST CIRCULARS

CURRENT IS CURRENCY!

Save it by Using

Sunbeam Tantalum Lamps

2 watts per (actual) candlepower
For either alternating or direct current

These lamps give a soft, white, brilliant light, and their value is greatly enhanced by the use of Holophane Pagoda Shades.

Special free trial proposition which it will pay you to investigate at once, as the plan is only operative until October 5th.

Write today for proposition and bulletins.

TWO SIZES
No. 1 - - 40 Watts
No. 2 - - 80 Watts
Also supplied in round bulb styles in above efficiencies

LOOK FOR THE LICENSE LABEL IN THE STEM

WRITE NOW—RIGHT NOW

Sunbeam Incandescent Lamp Co.

Established 1889
CHICAGO NEW YORK

DISTRIBUTING AGENTS
WESTERN ELECTRIC COMPANY
Chicago Philadelphia New York St. Louis Pittsburg Kansas City
Denver Seattle Atlanta
San Francisco (California Electrical Works)
St. Paul (American Electric Company)
Cincinnati (Standard Electric Company)
Los Angeles (California Electric Company)

$30.00 WORTH FOR $20.00

IS WHAT WE OFFER YOU IN "BRIGHT" AND "ECONOMY"

LAMPS

Reliable Goods

Honestly Rated

Closely Assorted

Seven Years

Increasing Business

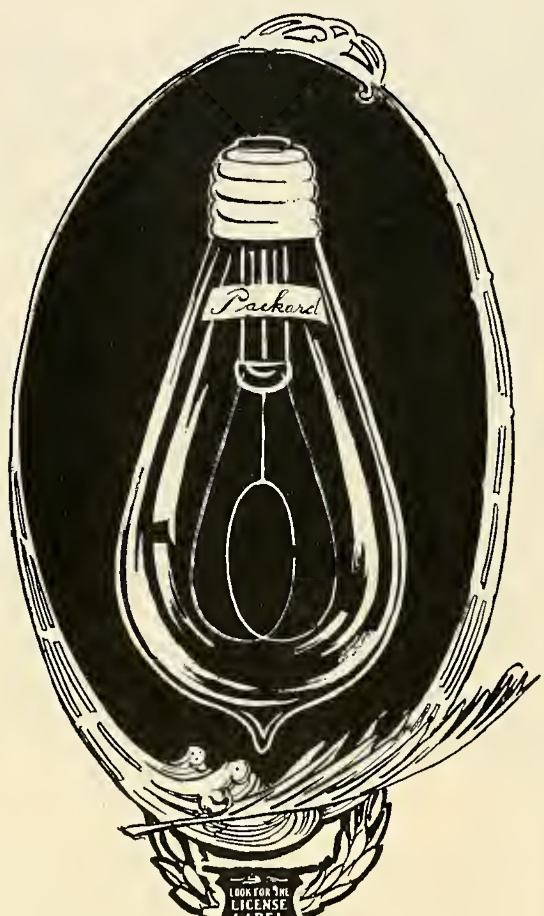
From Satisfied Customers

WE HAVE A SPECIAL TRIAL OFFER THAT WILL INTEREST YOU. WRITE US TODAY

THE ECONOMY ELECTRIC CO.

WARREN, OHIO

Packard



LOOK FOR THE PACKARD LABEL WHEN ORDERING LAMPS

We make all types of incandescent lamps.
Regular Packard Lamps Class A,
Warren Lamps Class B,
Gem Zenith,
Gem High-Candlepower,
Tantalum, Miniature,
Special Street Series, etc.

Manufactured by

NEW YORK & OHIO CO.
401 North Avenue
WARREN, OHIO

SOLD BY

ELECTRIC APPLIANCE COMPANY,
Chicago, Dallas, San Francisco, New Orleans

THE B-R ELECTRIC & TELEPHONE MFG. CO.,
Kansas City, Mo.

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BOWIE & LOVE,
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JOHN M. FOX & CO.,
Portland, Me.

W. N. MATTHEWS & BRO.,
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Lamps

100,000 VOLTS

THE WORD

For Decisions of great moment; for a crucial test; for installations demanding the avoidance of all questionable material and service, so far as possible and for great pioneer work, "VICTOR" Insulator quality and Victor service are demonstrated.

Stanisiaus Electric Power Co.
100,000 Insulator

THE DEED

This company has supplied the first

60,000-volt Insulators
The Bay Counties Electric Co., California
The Standard Electric Co. of California

66,000-volt Insulators
Grand Rapids-Muskegon Power Co., Mich.

75,000-volt Insulators
Edison Electric Co., California

and now has just been awarded the contract for 150 miles of 100,000-volt Insulators for the Stanislaus Electric Power Co., California; Sanderson & Porter, Engineers, New York City.

Your conclusions will satisfy us. "Victor" Insulators and service are insurance at 6,600 or 16,000 or 33,000 as well as at 100,000 volts.

The Locke Insulator Mfg. Co., Victor, N. Y., U. S. A.


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STEEL DRAWN BOXES
Approved by the Underwriters and used by those who know.
Our new pamphlet gives details. May we mail it?
We also manufacture
Monitor Conduit Bushings,
Flexible Conduit Bushings,
Erickson Conduit Insulators,
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BOSSERT
ELECTRIC CONSTRUCTION CO.
Utica, N. Y.
Chicago Office, 269 S. Canal Street

WANTED, FOR SALE *and similar* **WANT COLUMN** *advertisements (50 words or less), $1.50 an insertion; additional words 3c each* **POSITION WANTED** *advertisements (50 words or less), $1.00 an insertion; additional words 2c each.*

POSITION WANTED

As manager of light and power plant in western state. Have been in present position four and one-half years, and can furnish splendid references from present employers. Have had fifteen years' experience in installing and operating plants. Have technical knowledge covering all the branches of steam and electrical business. Am familiar with office work, can secure and keep the good will of customers. Have been very successful in increasing the net earnings of the plants I have been connected with. Would expect a salary of $1,800 per year, and to be given full sway to manage plant to what I consider best advantage. Address Box 751, care of Western Electrician, 507 Marquette Bldg., Chicago.

POSITION WANTED

By an electrical engineer, technically educated and experienced in both operation and construction. Until recently employed by large power company on Pacific coast. Superintendent of plants in central states. Best of references, Asso. A. I. E. E. Prefer construction work, but will consider anything where ability and integrity will be appreciated. Address Box 750, care of Western Electrician.

WANTED

The Universal Mfg. Co. desires to enter into correspondence with reliable traveling salesmen who call on central stations, and who are in position to handle effectively an important and well-paying line. Liberal terms. Address The Universal Mfg. Co., 204-206 Illinois Street, Chicago, Ill.

WANTED

Line man for permanent position. Must be sober and a hustler. Reference required. State salary expected. Wabash Water and Light Co., Wabash, Ind.

WANTED

An up-to-date manager, capable in every way to take charge of an electric-light plant in central Wisconsin, in a city of 7,000 inhabitants. Address Box 749, care of Western Electrician Chicago.

FOR SALE

One 2 1-2 K. W. 125 volt Sprague, direct connected to 4 H. P. Metz and Weis Kerosene Engine; new.
One 4 K. W. 125 volt C. & C. 2-pole Compound Generator.
One 6 K. W. 125 volt Claus 2-pole Compound Generator.
One 10 K. W. 125 volt Sprague 6-pole Compound Generator.
One 10 H. P. 115 volt Crocker 4-pole Shunt-wound Motor.
One 15 H. P. 115 volt C. & C. 2-pole Shunt-wound Motor.
Two 25 K. W. 125 volt Edison 2-pole Compound-wound Generator.
One 25 K. W. 116 volt Card Generator D. C. to Payne Engine.
One 65 K. W. 115 volt Westinghouse D. C. to Atlas Compound Engine.

JAMES A. GRAHAM
39 Cortlandt St. New York City

HAPGOODS

THE NATIONAL ORGANIZATION OF BRAIN BROKERS

With offices in 12 cities and a force of 350 people, is at your disposal and can be of inestimable value to both employer and employe.
Do you need a man?
We can get him for you.
Is your present position unsatisfactory?
We can provide the opportunity for a better one.
Call or write today for a copy of either Hapgoods opportunities or Hapgoods men. Mention this paper.

HAPGOODS
1010 HARTFORD BLDG.
CHICAGO, ILL.

Offices in all Principal Cities

FOR SALE

Electric-light plant at a bargain, in a prosperous and growing Missouri town of 3,000. Full particulars and satisfactory reason for wishing to sell, on application. Address Box 746, care of Western Electrician, Chicago.

FOR SALE

An old-established and well-paying ice, light and power business in a good town in Champaign County, Ill. Good public lighting contract. Address A. L. Van Meter, Tolono, Ill.

FOR SALE

Telephone exchange, and from 100 to 200 miles long-distance line in Missouri making good money, for sale at a bargain. Full particulars and satisfactory reason for wishing to sell, on application. Address Box 747, care of Western Electrician, Chicago.

FOR SALE
250-VOLT GENERATORS

	KW	
2	8¼	Northern, M. P.
1	15	Westinghouse, M. P.
1	20	Lundell, 6 pole, Comp.
1	20	Northern, M. P.
1	22½	Westinghouse, M. P.
1	25	Holtzer-Cabot, M. P.
1	30	Westinghouse, M. P.
1	33	Jenney, M. P., Comp.
1	35	Bernard, M. P., Comp.
1	35	Northern, M. P.
1	37½	Westinghouse, M. P.
1	50	Maine, M. P., Comp.
1	56¼	Westinghouse, M. P.
2	60	Milwaukee, M. P.
2	100	Crocker-Wheeler.
1	100	General Elec., M. P.
2	200	Eddy, M. P., Comp.

All machines actually in stock and fully guaranteed. Send for monthly Bargain Sheet with net prices.

GREGORY ELECTRIC CO.
16th and Lincoln Sts.
CHICAGO

BOOK ORDERS

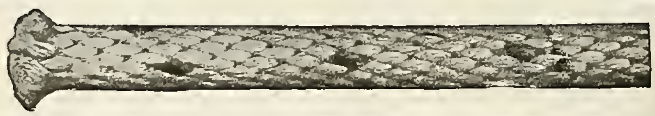
GIVEN PROMPT ATTENTION

Electrician Publishing Co.,
Suite 507 Marquette Bldg., CHICAGO

80 PAGES ON LUBRICATION

New, fresh information on the modern practice of graphite lubrication. Tells what graphite has done, what it will do, what you can do with it. Copy 125 FREE

JOSEPH DIXON CRUCIBLE CO., JERSEY CITY, N.J.



SAMSON SPOT WATERPROOFED CORD FOR TROLLEYS AND ARC LAMPS.
SEND FOR SAMPLES **SAMSON CORDAGE WORKS, Boston. Mass.**

PLACE YOUR

"Want" and "For Sale" advertisements in the

WESTERN ELECTRICIAN.

Immediate Returns.

WE BUY OLD BELTS

OR SCRAPS, ANY SIZE OR CONDITION.
WE CLEAN, REPAIR AND RENEW OLD BELTS.

LEATHER PRESERVER MFG. CO.
27 W. MONROE ST., CHICAGO.

WORKS QUICK AND EASY. KEEPS ITS LUSTER. HOLDS OLD TRADE AND MAKES NEW. DOES NOT DETERIORATE. ESTABLISHED 16 YEARS. SOLD BY AGENTS AND DEALERS ALL OVER THE WORLD

U.S. METAL POLISH

3 OUNCE BOX 10 CENTS. SAMPLES SENT FREE. GEO. W. HOFFMAN

POLISHES ALL METALS. Branches: New York, Chicago, San Francisco. 295 E. Washington St. Indianapolis, Ind. HIGHEST AWARD, CHICAGO WORLD'S FAIR, 1893. LOUISIANA PURCHASE EXPOSITION 1904.

THE COMMUTATOR COMPANY, Minneapolis, Minn.

Manufacturers of COLD DRAWN COMMUTATOR SEGMENTS.
We duplicate any segment made without cost of dies or special tools
Electric light companies and repair men given special attention.

899

NORTHERN Generators for direct connection to engine are characterized by accessibility, simplicity and reliable service. They conform to the general requirements of various engine builders. Northern Generators specified by progressive architects and engineers who set a high ideal for the electrical equipment for their clients. Note bulletin 2551.

NORTHERN ELECTRICAL MFG. CO.
Standard and Special Electrical Machinery
MADISON, WIS. - - - U. S. A.

DISTRICT OFFICES: 425 Monadnock Block, Chicago, Ill.
1236 Wells Bldg., Milwaukee, Wis. 801 Land Title Bldg., Philadelphia, Pa.
403-406 Atlas Bldg., 604 Mission St., 29 Broadway, New York.
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Insulated Staples

4 Sizes

Pat. Nov. 1900

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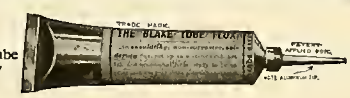
Tube Flux for Soldering

Full Size of Tube 1″ x 5″



Compressed Cleats

FOR USE ON PLASTERING

EXACT SIZE PAT. JULY 1906.

BLAKE SIGNAL & MFG. CO. WRITE FOR SAMPLES **246 Summer St., Boston, Mass.**

LIGHTING FIXTURES, UP-TO-DATE CATALOGS
EXPRESS PREPAID TO DEALERS

CATALOG No. 15 contains ELECTRIC FIXTURES only. CATALOG No. 14 contains COMBINATION and GAS FIXTURES. CATALOG No. 13 illustrates GAS FIXTURES only. CATALOG No. 12 is a small book containing ELECTRIC, COMBINATION and GAS FIXTURES carried in stock for IMMEDIATE SHIPMENT.

ALL ABOVE CATALOGS 1907 ISSUE.
Get our Catalogs and they will get the business for you.

BEARDSLEE CHANDELIER MFG. CO.
176, 178, 180 So. Clinton Street, CHICAGO

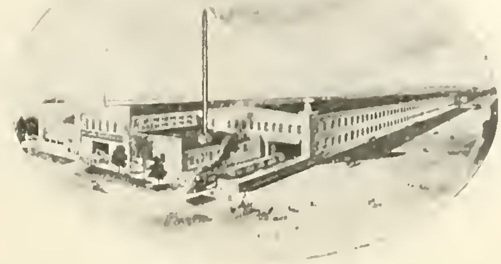
COMMONWEALTH EDISON COMPANY REPAIR SHOPS

76 MARKET STREET, CHICAGO. TELEPHONE MAIN 1280

High-Grade Machine Work of All Kinds Correspondence Solicited.

FIRST CLASS EQUIPMENT THROUGHOUT.

Dynamos, Armatures, Motors, Arc Lamps, Fans, Instruments.



America's Leading Bargain House

Headquarters for Second-Hand Electrical Machinery

Every machine sold is completely overhauled here before shipment and delivered practically new. Send for our Monthly Bargain Sheet showing complete stock with net prices.

For Sale 125 Volt Generators

	H.P.	
6	3	Westinghouse, M. P.
1	4	Hobart, M. P.
1	4	Gibbs, M. P.
10	3¾	Westinghouse, M. P.
1	4½	Gen. Elec., I. B.
1	3¾	Phoenix, d. c. to Case engine.
1	4	Bernard, M. P.
1	6	Westinghouse, M. P.
7	6	Crocker-Wheeler, M. P.
1	7½	Gen. Elec., M. P.
4	7½	Westinghouse, M. P.
2	9	Western Elec., M. P.
1	9	Gen. Elec., M. P.
1	10	Amer. Eng. Co., M. P.
1	11	Burke, M. P.
1	11¼	Westinghouse, M. P.
1	12½	Milwaukee, M. P.
3	13	Crocker-Wheeler, M. P.
1	13	Gen. Elec., M. P.
1	13	Lundell, M. P.
2	15	Edison.
1	15	Bullock, M. P.
1	17½	Crocker-Wheeler, M. P.
1	20	Amer. Eng. Co., M. P.
1	20	Card, M. P.
2	22½	Westinghouse, M. P.
1	25	Quaker City, M. P.
3	30	Eddy, M. P.
1	30	Crocker-Wheeler, M. P.
2	35	Gen. Elec., M. P.
1	75	Westinghouse, d. c. to Westinghouse comp. engine. Big bargain.
2	100	Eddy, M. P.
1	100	Triumph, M. P.
1	100	Westinghouse, M. P.
1	130	Gen. Elec., d. c. to Ideal engine.
1	150	Western Elec., d. c. to Ball & Wood engine.

250 Volt Generators

	K. W.	
2	8½	Northern, M. P.
6	12½	Gen. Elec., M. P.
3	13½	Gen. Elec., M. P.
4	17½	Gen. Elec., M. P.
1	20	Northern, M. P.
1	30	Westinghouse, M. P.
1	30	Gen. Elec., M. P.
2	25	Bernard, M. P.
1	37½	Westinghouse, M. P.
2	42½	Milwaukee, M. P.
1	50	Milwaukee, M. P.
1	60	Gen. Elec., M. P.
2	60	Milwaukee, M. P.
1	75	Gen. Elec., M. P.
1	100	Crocker-Wheeler, M. P.
1	100	Thompson-Ryan, 10-pole.

550 Volt Generators

	K. W.	
3	6	Westinghouse, M. P.
3	7½	Westinghouse, M. P.
1	12	Westinghouse, M. P.
2	30	Westinghouse, M. P.
1	33	Westinghouse, M. P.
3	100	Gen. Elec., M. P.
1	500	Westinghouse, M. P.

60 Cycle Alternators

	K. W.	
1	2	Ft. Wayne 110-125 volts, exciting current, 4 amp., 50 volts.
2	45	Westinghouse.
1	50	Westinghouse, 2-phase.
1	50	Westinghouse.
1	60	Westinghouse, 2-phase.
1	75	Westinghouse.
1	75	Westinghouse, 2-phase.
1	75	Westinghouse.
1	75	Warren-Medbury, 2-phase, inductor type.
1	100	Gen. Elec., monocyclic.
1	100	Gen. Elec., A. T. B., 3-phase.
1	120	Gen. Elec., type A. S.
2	150	Westinghouse.
2	180	Gen. Elec., type A. S.
1	200	Gen. Elec., 3-phase.

125 Cycle Alternators

	K. W.	
1	30	Gen. Elec., type A-30.
1	50	Ft. Wayne, Wood.
1	60	Stanley inductor type, 2-phase.
1	60	Westinghouse, comp.
1	60	Gen. Elec., type A. S.
2	120	Gen. Elec., A-120.
1	160	Westinghouse.
1	160	Stanley, inductor type, 2-phase.
1	200	Ft. Wayne, W. A. L.
1	400	Stanley, 2-phase.

Three-Phase 25 Cycle Alternators.

	K. W.	
1	86	Westinghouse, 440 volts.
2	275	Westinghouse, 6,600 volts.
1	700	Bullock, 13,200 volts.
1	250	Rotary converter.

For Sale 3 Phase 60 Cycle Motors.

	H.P.		Speed.
2	1	Gen. Elec., 110 v.	1800
1	5	Westinghouse, 220 v.	1700
1	5	Gen. Elec., 110 v. variable speed	1200
1	5	Gen. Elec., 220 v.	1200
1	7½	Gen. Elec., 220 v.	1200
1	7½	Westinghouse, 220 v.	1120
1	7½	Westinghouse, 440 v.	1120
1	10	Gen. Elec., 220 v.	720
1	10	Westinghouse, 220 v.	1120
6	20	Westinghouse, 220 v.	1120
1	30	Gen. Elec., 220 v.	900
1	30	Gen. Elec., 440 v.	900
4	30	Westinghouse, 220 v.	1120
3	30	Westinghouse, 440 v.	1120
3	40	Westinghouse, 220 v.	850
4	40	Westinghouse, 440 v	850
4	40	Westinghouse, 440 v., vertical	850
4	40	Westinghouse, 220 v., vertical	850

110 to 125 Volt Motors

	H.P.		Speed.
1	1	Electro-Dynamic, inter-pole, variable speed, 4½-1 ratio, with Ward Leonard flat type controller	600-2700
11	2	Colonial, M. P., new	2000
1	2	Gen. Elec., type C. A.	1800
1	3	Western Elec., type S. N. M.	1950
1	3	Western Electric, M. P.	1025
1	3	Crocker-Wheeler	850
4	3½	Westinghouse, M. P., type M., new	1050
1	4	Hobart, M. P.	950
1	4	Westinghouse, M. P., type S.	1175
1	5	Western Elec., type E. B.	2000
2	5	American Engine Co., M. P.	1425
1	5	Jantz & Leist, M. P.	900
1	5	Holtzer-Cabot, M. P.	1100
9	6	Westinghouse, M. P., type M., new	1500
1	6	Westinghouse, M. P., type M., new	600
2	7½	New England, M. P., new	1100
7	7½	Crocker-Wheeler, M. P., type C. M.	875
1	8½	Elwell-Parker, M. P.	1450
1	9	Gen. Elec., M. P., type C. E.	750
1	10	Gibbs, M. P., type A	1500
1	10	Jantz & Leist, M. P.	900
3	10	Cincinnati, M. P.	1000
1	10	Commercial, M. P., series	550
1	10	Western Elec., M. P., type G.	700
1	12	Eddy, M. P., type G.	650
1	12½	Amer. Eng. Co., M. P.	1020
2	13½	Eddy, M. P., type G.	825
1	15	Milwaukee, M. P.	1100
1	15	Burke, M. P.	1450
2	15	Westinghouse, M. P., type M.	1100
1	15	Gen. Elec., M. P., form H.	1200
3	15	Crocker-Wheeler, M. P., type C. M.	875
1	15	Lundell, M. P., 3 bearing	500
4	18	Edison, 15 K. W.	1150
1	18	Bullock, M. P.	1300
1	25	Columbian, M. P.	900
1	25	Commercial, M. P.	1150
1	25	Card, M. P.	475
1	25	Fisher, M. P.	700
1	30	Quaker City, M. P., 6 pole	875
1	35	Edison, 30 K. W.	830
3	35	Eddy, M. P., type G.	800
1	40	Milwaukee, M. P.	575
2	50	Western Elec., M. P.	400
1	50	National, 6-pole	575
1	50	Gen. Elec., M. P., type C. L.	600
1	75	Westinghouse, M. P., type M. new	750
1	100	Northern, M. P.	600

220 to 250 Volt Motors

	H. P.		Speed.
1	1½	Holtzer-Cabot	1200
1	2	Holtzer-Cabot	1250
1	2	Watson, M. P.	1200
1	2	H. P. Sturtevant direct connected to Sturtevant Blower, 24-in. inlet, outlet 18½x31 ins.	350
1	2½	Bullock	1800
1	3	Storey, enclosed, Grinding and Buffing Motor	2000
6	3½	Westinghouse, type L series, crane motors, size No. 3	930
1	5	Peerless, M. P.	1150
6	5	Westinghouse, M. P., type L, enclosed, shunt	1100
1	7½	Westinghouse, M. P.	1350
1	10	Storey, M. P. enclosed series, crane or elevator motor	600
1	10	Crocker-Wheeler	850
1	10	Northern, M. P.	550
1	15	Gen. Elec., M. P., type C. E.	1100
1	15	Western Elec., M. P.	675
3	15	Gen. Elec., M. P., form H.	800
2	15	Gen. Elec., M. P., form A.	635
1	20	Sprague, self-oiler	1100
1	20	Aaron, M. P.	750
4	20	Gen. Elec., M. P., type C. E.	1040
1	25	Northern, M. P.	1200
1	25	Bullock, M. P.	750
1	35	Gen. Elec., M. P., form H.	900
1	40	Northern, M. P.	775
2	50	Milwaukee, M. P.	575
1	60	Milwaukee, M. P.	900
2	75	Milwaukee, 6 pole	475
1	75	Westinghouse, M. P., type M, new	300
1	125	Crocker-Wheeler, 6 pole	650
1	125	Ft. Wayne, wood, 6 pole	650

500 Volt Motors

	H. P.		Speed.
3	1½	Crocker-Wheeler	1550
2	1½	Holtzer-Cabot	1300
1	2	Perrett	1360
4	2	Gen. Elec., type C. A.	2000
3	2	Holtzer-Cabot	1300
1	2	Commercial, round type	1250
1	2	Gen. Elec., type C. E.	1200
1	2	Crocker-Wheeler	1100
1	2	Wagner, type M.	1100
2	2½	Holtzer-Cabot	1450
1	2½	Lundell	1200
1	3	Western Elec., M. P.	2200
2	3	Gen. Elec., type I. B.	1800
1	3	Ft. Wayne, M. P., type E.	1150
1	4	Sprague-Lundell	400
1	4½	Aaron, M. P.	1100
1	5	Paragon, M. P.	950
1	5	Holtzer-Cabot	1650
3	5	Northern, M. P.	1950
2	5	Gen. Elec., M. P., type C. E.	1800
2	5	Northern, M. P.	1200
1	5	Gen. Elec., type CQ.	1200
1	6	Lundell	1125
1	6	Westinghouse, M. P.	1500
1	7½	Wagner, M. P.	1450
1	7½	Lundell, M. P.	1050
1	7½	Paragon, M. P.	900
1	10	Belknap	1400
2	10	Crocker-Wheeler, type C.	1200
4	10	Gen. Elec., M. P.	1500
2	10	Holtzer-Cabot, M. P.	1275
1	10	Gen. Elec., M. P., type C. E.	800
1	10	Westinghouse, M. P., type M, new	1250
1	15	C. & C., type M.	1170
4	15	Gen. Elec., M. P., type C.E.	1200
1	15	Western Elec., M. P., type G. S.	500
1	20	Crocker-Wheeler, M. P.	1150
1	20	Sprague-Lundell, M. P.	1080
1	20	Lundell, M. P.	775
1	20	Westinghouse, M. P., type M, new	960
1	25	Westinghouse railway type, No. 12 series, for hoisting, etc., back-geared	485—100
1	25	Crocker-Wheeler, M. P.	780
1	30	Milwaukee, M. P.	1075
1	30	Westinghouse, M. P., type M, new	975
1	35	Gen. Elec., M. P.	975
1	35	Crocker-Wheeler, M. P.	775
1	40	Crocker-Wheeler, M. P.	725
2	40	Westinghouse, M. P., type M., new	950
5	45	Westinghouse, M. P., type S.	750
2	60	Electron, M. P., latest type	775
1	50	Gen. Elec., M. P., form H.	900
1	50	Crocker-Wheeler, M. P.	660
1	65	Gen. Elec., M. P., form A.	800
1	75	Westinghouse, M. P.	800
1	80	Westinghouse, M. P., type S.	800
2	100	Westinghouse, M. P.	700
1	150	Westinghouse, M. P., No. 1.	590

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Railway Motors

We have just closed out from the Westinghouse Electric and Manufacturing Co., East Pittsburg, Pa., their entire stock of No. "33 S," Walker railway motors. These are 30 H. P. brand-new motors complete with gears, pinions and gear cases—3¾-in. axles. We have 70 of these motors in stock in Chicago ready for immediate shipment.

Single-Phase—125-133 Cycle Motors

	H. P.		Speed.
1	¼	Holtzer-Cabot, 110 volts, self-starting	2500
1	½	Century auto., 110 volts	1940
1	1	Holtzer-Cabot, 110 volts	2500
2	1	Wagner auto., 208 volts, model B	1815
1	1	Wagner auto., 208 volts, model A	2000
1	1½	Holtzer-Cabot, 110 volts	2600

Single-Phase —60 Cycle Motors

	H. P.		Speed.
2	⅛	Emerson, 110 volts, class 3242 B. A.	1700
5	⅙	Emerson, 110 volts, class 3242 B. A.	1700
5	¼	Holtzer-Cabot, self-starting, 110 volts	1800
1	¼	Wagner, 110 volts, Model C.	1800
1	½	Gen. Elec., hand-starting, 110 volts	1800
1	½	Century, 110 or 220 volts	1750
1	½	Century, variable speed, auto., with controller, 220 volts	1750
1	½	Century, vertical type, 110 or 220 volts, automatic	1750
1	1	Stanley, type I, 220 volts, with condenser	1800
1	1	Century, 110 or 220 volts, auto.	1750
1	1	Century, vertical type, 110 or 220 volts	1750
1	1½	Century, 110 or 220 volts, auto.	1165
1	2	Century, 110 or 220 v., auto.	1750
1	3	Wagner, 220 volts, model B. auto	1750
1	3	Century, 110 or 220 v., auto.	1750
1	4	Century, 110 or 220 v., auto.	1750
3	5	Westinghouse, 110 volts, type C. C., with phase splitters	1120
1	5	Century, 110 or 220 v., auto.	1750

Single-Phase—40 Cycle

	H. P.		Speed.
1	¼	Emerson, 115 volts	740

Two-Phase—60 Cycle

	H. P.		Speed.
1	2	Gen. Elec., form K, 220 v.	1800
1	5	Gen. Elec., form K, 110 volts, with starter	1200
1	7½	Westinghouse, type C. X., 110 volts, with auto.-starter	1120
1	25	Gen. Elec., 220 volts, form K, with starter	1200
1	15	Gen. Elec. form L.	2200

Three Phase—25 Cycle

	H. P.		Speed.
1	3	Stanley 110 volts	750
1	10	Westinghouse, 440 volts	1420
1	10	Westinghouse, 440 volts	720
2	20	Westinghouse, 440 volts	1420
1	20	Westinghouse, 440 volts	720
2	30	Westinghouse, 440 volts	720

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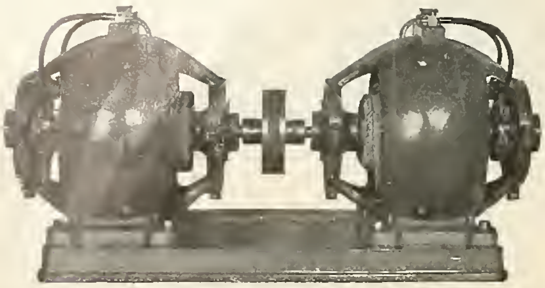
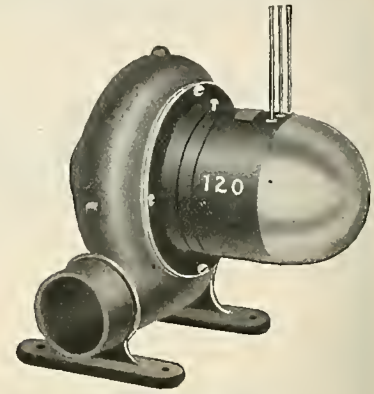
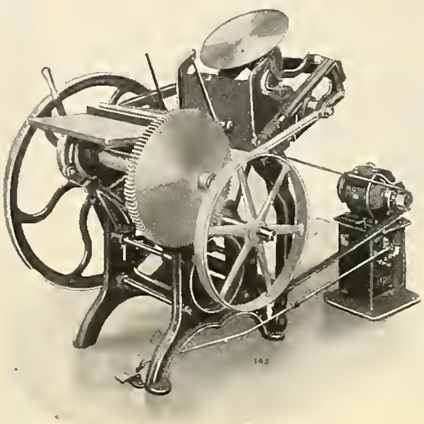


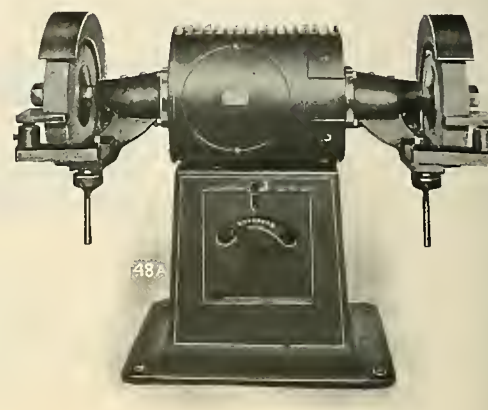
Twin-Motor Dynamo, "O" Type



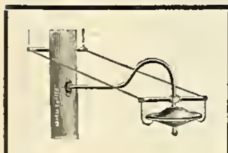
Electric Forge Blower

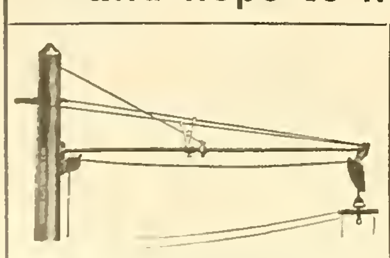


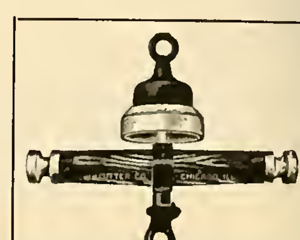
Printing-Press Outfit

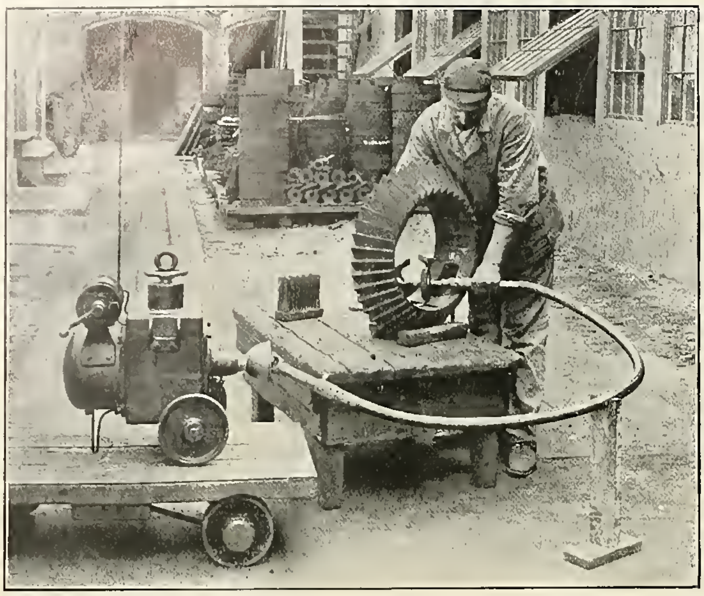


Grinding and Polishing Machine









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as manufactured by

STOW MFG. CO.

BINGHAMTON, N. Y.

General European Agents

Selig, Sonnenthal & Co.

85 Queen Victoria St., London, England

Portable Electric Grinders

We build these in four sizes:

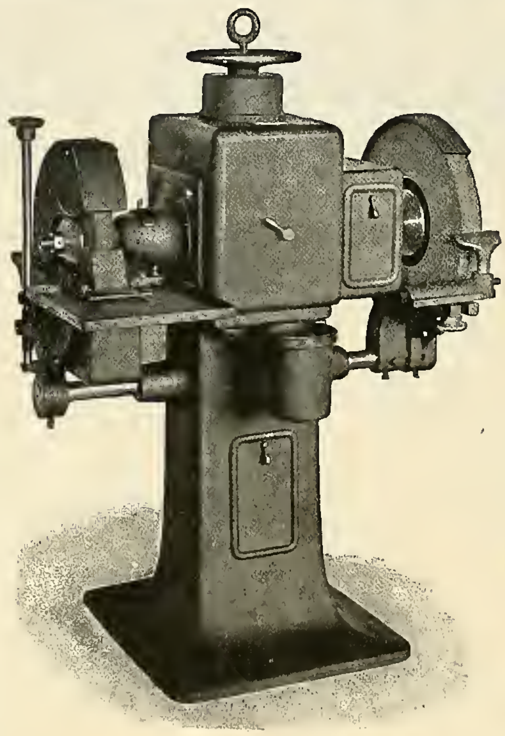
No. 4—¾ H. P. Motor
Emery Wheel capacity 6x1¼ in.

No. 5—1½ H. P. Motor
Emery Wheel capacity 8x1¼ in.

No. 6—2 H. P. Motor
Emery Wheel capacity 10x1½ in.

No. 8—3 H. P. Motor
Emery Wheel capacity 12x2 in.

For 110 or 220 volts they are furnished as shown in cut. For 500 volts with wood truck for better insulation. This latter is extensively used by street railways for grinding rails in bonding.



The Stow Multi - Speed Motor

is used in these machines.

RESULT:

Wide Range of Speed
Infinite Variation in Speed

A fraction of a turn of the regulating wheel on top of motor will make a corresponding change in speed of emery wheel.

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No rheostats or controllers to fill up with dust and burn out.

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We build these machines in two sizes, the smaller taking two dry wheels, 2x18-inch or one 12-inch wet wheel and one 2x18-inch dry wheel.

The larger tool will carry two 3x24-in. wheels.

We build these machines for direct current only.

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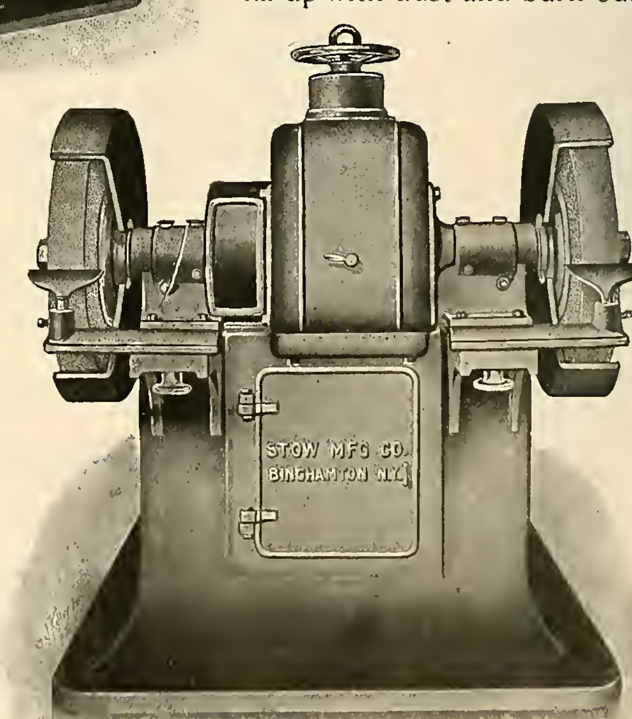

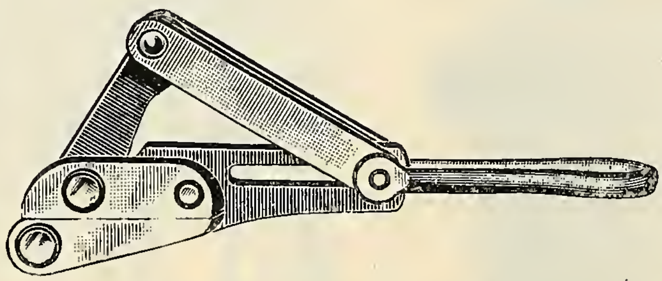

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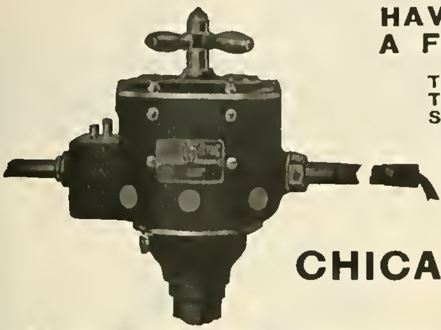

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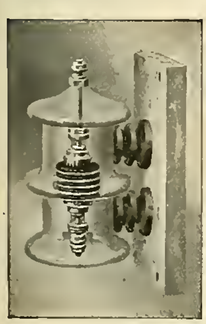

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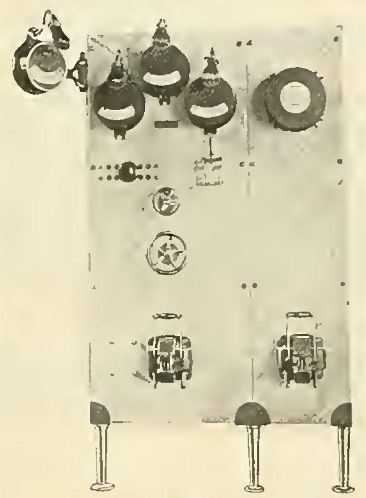

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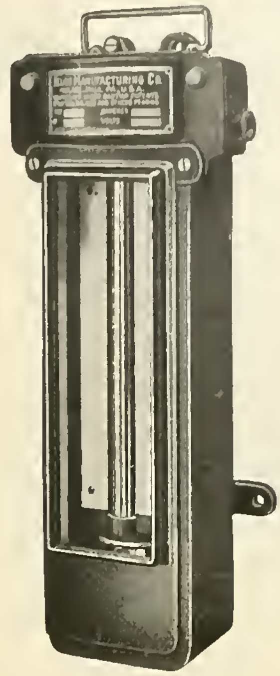

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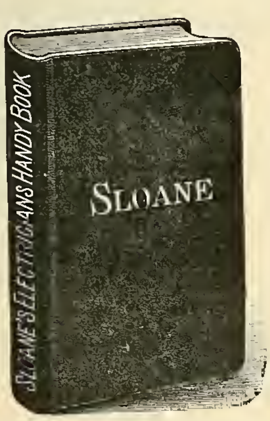

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The exchange limits cover the entire city without mileage charge.

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The reduction affects more than 95 per cent of the telephones in the city and provides a greatly improved service.

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The design of the ordinance is to provide the best possible service at the lowest possible cost.

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"We must have girls

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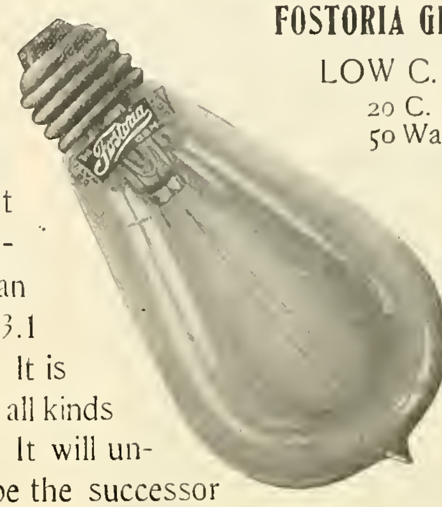

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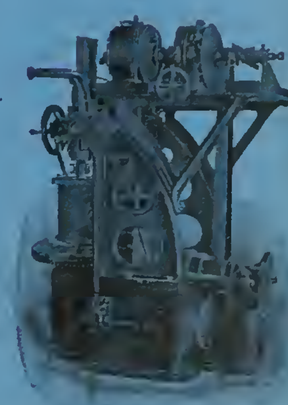

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WESTERN ELECTRICIAN

EVERY SATURDAY

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The Schaffhausen-Schleitheim Electric Railway.

By Dr. Alfred Gradenwitz.

Cars of the Schaffhausen-Schleitheim Electric Railway of Switzerland are designed for two operating voltages, the lower tension being that of the municipal tramways of the city of Schaffhausen (the tracks of which the railway uses), with a higher tension for the interurban section. The construction of the motors, as well as the arrangement of the car-lighting plant, had accordingly to be adapted to these two voltages.

Starting at the Rheinhof terminal at Neuhausen, the railway goes through a number of towns and terminates at the station of Oberwiesen situated behind Schleitheim on the frontier of Switzerland and Baden. From its present terminus the railway is to be continued on Baden territory as far as Stühlingen, connecting with the strategical railway.

The road, 17.17 kilometers in length, with a gauge of one meter, runs on the public roads throughout its length and has a maximum gradient of 60 per 1,000 over a length of 50.39 meters. The difference in altitude between Schaffhausen and the highest point on the line, viz., Siblingerhöhe, is 149.26 meters. The track construction is of grooved rails on village streets and road crossings, with Vignole rails on other portions. The roadbed is 2.1 meters in breadth and 30 centimeters in height, consisting of crushed stone covered with gravel. The rails are placed on ingot-iron sleepers 1.6 meters in length, weighing 15.3 kilograms per meter. The grooved rails are 12 meters in length and have a weight of 30.8 kilograms per meter. The Vignole rails have the same length and a weight of 24.2 kilograms per meter. The minimum radius of curvature is 12 meters.

The electric works of the city of Schaffhausen has two 150-kilovolt-ampere transformers, raising the tension of the current supply to 10,000 volts. The high-tension line leading to the transformer station consists of three wires five millimeters in cross-section, while six-millimeter wires are used only at railway crossings. The line is carried on wooden poles and crosses the Rhine River on iron framework towers. After repeatedly crossing the municipal tramways and the Swiss and Badenian railways, it terminates at the converter station of Siblingen. The high-tension wire is protected at both ends by lightning arresters, in the earth conductors of which are inserted water resistances. Three-pole circuit-breakers are arranged at both ends.

The converter station comprises the high-tension transformer room, the engine room (containing the converter set and switching plant), the battery room, car shed, painting and other shops, and the offices and accommodation for the superintending staff.

The shed contains three tracks, with two cleaning pits in which the tracks are supported by concrete pillars. One of the tracks leads to the workshop containing two lathes, one drill, one planing machine and a forge, the ventilator of which is operated by hydraulic vanes. All the machine tools are operated from a main shaft run by an electric motor.

The transformer room is planned for receiving three transformers, and at present contains two of the Oerlikon type. These transformers, of 150-kilovolt-ampere capacity each, will reduce the tension from 10,000 to 380 volts, their number of periods being 50 per second. They are placed in oil baths without any artificial ventilation, which, owing to the intermittent operation, was not found necessary. The three high-tension cores have each a coil of 780 windings of a wire 2.6 to 3 millimeters in thickness, and the low tension cores a coil of 30 windings of 40 by 3 millimeters copper tape. The housings are grounded. The efficiency of the transformer is 97 per cent. in the case of full load, 96.5 per cent. on three-fourths load and 96 per cent. on one-half load.

For each transformer there has been provided an iron frame carrying the three-pole high-tension train switch and three tubular fuses designed for being cut out. The lightning arresters are arranged on a special frame. The five-kilowatt station transformer, mounted on a bracket, and which supplies the lighting current, will reduce the high tension to 125 volts.

The engine room, which is served by a three-ton hand-operated traveling crane, is designed for three motor-generator sets, two of which have at present been installed. Each of these sets comprises an asynchronous motor connected by an insulating flexible clutch to a four-pole direct-current dynamo.

The motors, giving an output of 165 horsepower under a tension of 380 volts with 735 revolutions per minute, are designed as double-bearing machines, with stationary primary windings and rotating induced windings. The iron body of the rotating and stationary parts is laminated.

The dynamos are designed on the external-pole type for a capacity of 110 kilowatts, and will

View of Track and Trolley Construction.

Car Barn and Repair Shop.

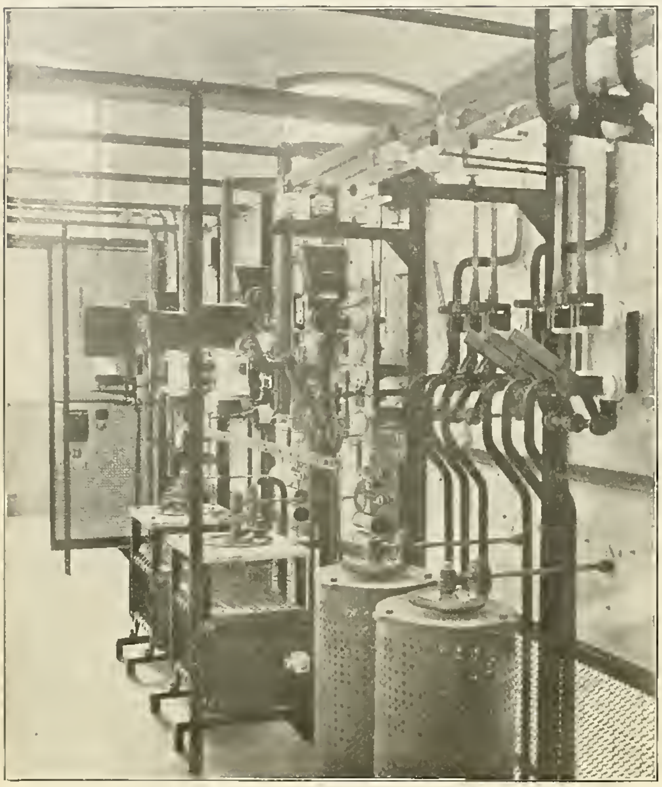
A Motor Car and Trailer.

Transformer Room in Sub-station.

SCHAFFHAUSEN-SCHLEITHEIM ELECTRIC RAILWAY OF SWITZERLAND.

generate direct current at 800 volts and 138 amperes with 735 revolutions per minute. The commutator is made of hard-drawn mica-insulated copper, and the brushes of carbon. The exciter windings are arranged in shunt and are fed from the bus-bars. The dynamos are assisted by a storage battery consisting of 390 cells, which is able to yield 200 ampere-hours with a one-hour discharge.

Two triple pole switches, six single-pole safety fuses and two amperemeters are inserted into the circuit leading from the secondary terminals of the two transformers to the bus-bars of the switchboard. For the secondary bus-bars of the transformer is further provided a voltmeter. The stator coils of the two converters are connected to the secondary bus-bars of the transformers. An amperemeter is arranged for each motor to control the current input. The rotor circuit comprises the starter, which is used both for regulating the speed in starting and for switching out of circuit. When the rotor circuit is short-circuited the brushes are lifted off the slip rings, that is, during the operation of the motor the starter is switched off the rotor circuit.



DIRECT-CURRENT SWITCHING PLANT OF THE SCHAFFHAUSEN-SCHLEITHEIM ELECTRIC RAILWAY.

The trolley-wire circuit comprises a ground-circuit tester, two automatic maximum cut-outs, two amperemeters and two lightning arresters with magnetic blowouts. The ground-circuit tester consists of two push-buttons (one for each trolley wire), an intermediary resistance, an amperemeter and a small battery. In the case of short-circuit in one of the lines, the automatic switch of the latter being thrown out, the corresponding push-button of the ground-circuit tester will be first actuated, so that, on inserting the automatic switch, no short-circuit can be produced, the current being compelled to traverse the resistance. In the case of a continued short-circuit, the amperemeter will indicate the maximum current consumed by the resistance.

The trolley line consists of two shaped-copper wires 80 square millimeters in cross-section, suspended from wooden outriggers, partly by means of span wires. The feeder consists of a copper wire 34.48 square millimeters in cross-section, carried partly on the trolley poles and partly on span wires.

The rolling stock comprises four four-axle passenger cars (gross weight, inclusive of electrical equipment, 19,450, electrical equipment 6,060 kilograms), three passenger trailers (gross weight 5,510 kilograms), three enclosed freight cars for five tons effective load (gross weight 3,550 kilograms), and three open freight cars for the same effective load (gross weight 3,220 kilograms).

The motor cars are of the four axle type and are 15 meters in total length across buffers, the [illegible] center being 8.6 meters from each other.

Access to the interior of the car is obtained at the head ends through enclosed platforms. While the latter can be locked laterally by sliding doors, provision has been made for maintaining these doors in the open position or for replacing them by safety bars, which may be bolted. At each car head there is a rotary door giving access through an iron hinging bridge to the trailer. Connection between the platforms and passenger compartments is likewise obtained by sliding doors. Each motor car contains a passenger compartment for smoking and one for non-smoking, with 18 seats each. The compartments are separated by a baggage compartment with postal outfits.

The bogeys are provided with double springs, so as to insure a perfectly smooth running of the cars. The brake generally used is a compressed-air brake of the Böcker system, combined with a hand spindle brake. Electric braking has likewise been provided for.

The four car motors are designed on the Oerlikon type for an output of 45 horsepower each at a tension of 750 volts. The ratio of transmission to the running wheels has been chosen as 1:5. The motors, wound on the lattice drum type, are entirely enclosed.

According to contracts, the rise in temperature of the car motors after one hour's operation was not to exceed 75° C. with 45 horsepower, and this limit is far from being reached.

The mean output of the motor will be found at

$$\frac{748.8 \text{ volts} \times 55.3 \text{ amperes} \times 84}{746}$$

$= 47.2$ horsepower, allowing for the measuring instrument correction, 0.84 being the efficiency corresponding to 55.3 amperes. The energy input of the motor, corrected, thus works out at $748.8 \times 55.3 = 41.5$ kilowatts, while the energy output of the generator, corrected, is $450 \times 67.3 = 30.28$ kilowatts. The efficiency of the motor is thus 0.854.

The controllers are arranged on the series-parallel system, magnetic blowing being provided for. The arrangement of connections allows of both forward and backward traveling, with on or two motors, one motor being in each case replaced by a set of two motors connected up in parallel or in series. The motor cars are further equipped with maximum-current circuit-breakers, designed also for hand operation, as well as with lightning arresters and electric heating and lighting.

All trailers are of the double-axle type, with free guiding axles. The capacity of the passenger trailer cars is 24 seated and eight standing passengers.

Proposed Railroad Electrfications in Idaho.

Plans are under consideration for the electrification of the Bitter Root Mountain Division of the Chicago, Milwaukee and St. Paul's extension to the Pacific Coast. The section of the line, which it is planned to operate by electricity, is about 54 miles long and includes 8,000 feet of tunnel through the Bitter Root Mountains of Idaho and grades on both sides of the mountain. Considerable interest is being taken by railroad men in the fact that the St. Paul is considering the electrification of a protion of its new line, for all railroad plans for electrification are now being watched closely.

Writing under date of September 25th the San Francisco correspondent of the Western Electrician says:

"There is no further doubt as to the intention of the Southern Pacific Company to electrify its transbay lines in the immediate future, as it has closed contracts to the value of nearly $900,000 for the Fruitvale power house. The central power house will serve the lines in Oakland, Berkeley, Alameda and Fruitvale. The entire cost of changing the motive power from steam to electricity is estimated at $3,000,000, of which $900,000 will be for the power house, $500,000 for the cars and the remainder for track and other expenses. The portion of the Fruitvale plant already contracted for includes two 5,000-kilowatt turbo-generators and ten boilers. A third generating unit of 5,000-kilowatt capacity is to be ordered later. The cars will have overhead trolleys and direct-current motors, will be 71 feet long and will have a seating capacity of 64 in the motor cars and 80 in the ordinary cars. They will be run in solid trains."

This is the Oakland terminal electrification which Mr. Bion J. Arnold mentioned in his article on "The Rise of the Electric Railway" in the Western Electrician of September 28th.

Three-wire Direct-current Generators.[1]

By B. T. McCormick.

It is the purpose of this paper to give briefly the principles of operation of three-wire generators and to call attention to some of their advantages. The three-wire generator is the outgrowth of the well-known Edison three-wire system, in which two direct-current generators are connected in series, with a line known as the "neutral" tapped into the point where the machines are connected together. A load, usually light, is fed between each outside wire and the neutral. If the load is balanced on either side, no current will flow in the neutral, while in the event of an unbalanced system the neutral will be required to carry the current corresponding to the amount of "unbalancing." The main lines must be of sufficient capacity to carry current corresponding to the combined output of the machines at a voltage equal to twice the voltage of one machine, while the neutral need be only large enough to take care of the unbalancing. Such an installation when applied to a well-balanced 120-volt incandescent lighting load combines a saving in copper as a result of transmitting at the higher pressure of 240 volts, together with the advantage of a 120-volt installation for supplying the lights. It also possesses the advantages of a 240-volt system for power purposes, the motors being connected across the outside lines.

The three-wire generator is designed to accomplish the same results as the Edison three-wire system. It is more efficient, and not nearly so cumbersome, as only one generator is required instead of two generators of half the capacity.

The three-wire generator consists of a direct-current generator of the standard type, but provided with slip rings to which are attached taps from the armature winding, as in a rotary converter. A transformer known as the "balancing transformer" is mounted behind the switchboard or in some convenient position, and connected across the slip rings. A tap is brought out of the center of the transformer winding, to which the neutral wire is connected. Fig. 1 shows diagrammatically a three-wire generator in its simplest form, the two-pole diagram being used for simplicity. (A) and (B) are the main leads and (N) is the neutral. So long as the loads on each side of the neutral are equal, the balancing transformer (T) takes only the magnetizing current for which it is designed, but where one side is loaded more heavily than the other, the excess of current flows through the neutral into the middle tap of the transformer, and divides, as shown by the arrows (P) (P), half flowing to one ring and half to the other. In so dividing, the ampere turns in one-half of the transformer, due to the direct current, exactly balance the ampere turns in the other half, thus the magnetic flux in the balancing transformer remains constant regardless of the amount of direct current flowing. From the above it is evident

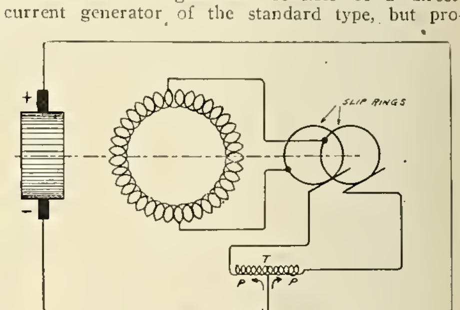


FIG. 1. DIAGRAM OF THREE-WIRE GENERATOR IN ITS SIMPLEST FORM.

1 Paper read at the annual convention of the Canadian Electrical Association in Montreal, September 12th. Mr. McCormick is electrical engineer for Allis-Chalmers-Bullock, Limited.

that the requirement for a balancing transformer is, that it shall have sufficient current carrying capacity to carry the unbalanced current and a sufficient number of turns and core area to generate a counter-electromotive force, the effective value of which is $\frac{E}{\sqrt{2}}$ where E is the normal direct current voltage between brushes.

A core-type of transformer is admirably suited to such service, and the coils on either side of the neutral tap are comprised of sections staggered from one leg of the core to the other, in order to reduce the magnetic leakage to a minimum.

Probably the most efficient three-wire outfits consist of a generator as described above but provided with a two-phase combination of balancing transformers, as shown in Fig. 2. The center taps are tied together and the neutral wire joined to the point of connection. Two pairs of slip rings are used, connected to taps in the armature winding situated 90 electrical degrees apart. Such a combination of two transformers results in a more even current distribution in the armature than can be secured by the use of a single transformer.

The cost of the balancing transformer is a very small part of the total cost of the apparatus, and depends, of course, upon the amount of unbalancing to be allowed. Ordinarily an allowance for about

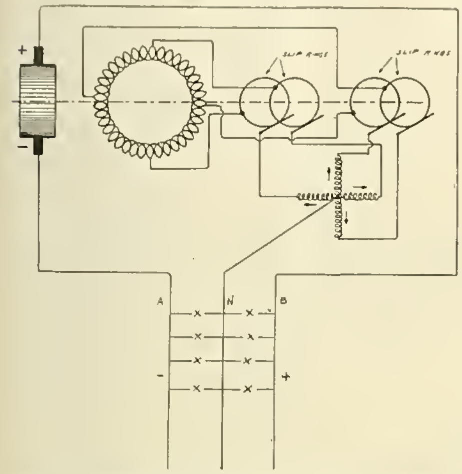


FIG. 2. THREE-WIRE GENERATOR WITH A TWO-PHASE COMBINATION OF BALANCING TRANSFORMERS.

25 per cent. unbalancing is sufficient. A concrete case will serve best to illustrate the size of transformer required. Suppose we wish to design a two-phase combination of balancing transformers for a 100-kilowatt 250-volt machine to take care of 25 per cent. unbalancing. The amount of current taken by two transformers is that corresponding to 25 kilowatts, or 100 amperes, and for one transformer, 50 amperes. As the current divides on entering the center tap of the transformer, the copper sections need be made only large enough to carry 25 amperes. The number of turns and core area must be such as to give a counter-electromotive force of $\frac{250}{\sqrt{2}}$ The volt-ampere capacity must therefore be $\frac{250}{\sqrt{2}} \times 25$. As a balancing transformer has but one winding, whereas an ordinary transformer has both a primary and a secondary, the above value must be divided by two to get a basis of comparison with a standard transformer $\frac{250}{\sqrt{2}} 25 \times \frac{1}{2} = 2.2$ kilowatts. Roughly speaking, therefore, the transformer should be about the size of a 2.2-kilowatt lighting transformer.

The generator, if shunt-wound, differs from standard generators only by the addition of the slip rings, while, if compound-wound, the alternate poles are connected so that half the poles receive their series excitation from each of the main leads. In this way the corresponding characteristics are still maintained even if one side of the system is completely unloaded.

Three-wire generators can be operated in multiple with one another, or in multiple with two-wire generators, and it is often convenient to operate a 120-volt machine in multiple across one side of 240-volt three-wire systems, to maintain a better balance, in case that side is unloaded.

The two-wire generator with rotating direct-current balancers, as a competitor of the three-wire generator, possesses a great many good points, but the cheapness, simplicity and compactness of the three-wire generator are points not to be overlooked in deciding on a three-wire system.

The world's production of coal in 1906 amounted to about 1,106,478,707 short tons, of which the United States produced 414,157,278 tons. Since 1868, during a period of 39 years, the percentage of the world's total coal produced by the United States has increased from 14.32 to 37, and this country now stands far in the lead of the world's coal producers.

Measuring Total Output of Station.

In the Question Box of the September Bulletin of the National Electric Light Association the question was asked:

"In registering the total output of the station, which will give you the more accurate record: wattmeters on the feeders or wattmeters on the generators?"

Answers to this question were as follows:

T. O. Ripley: This company follows the practice of placing wattmeters on feeders, thus obtaining the total output of the station, and at the same time obtaining information regarding the amount of current consumed by the various sections of the city supplied by the various feeders. The character of the load carried by various feeders, particularly the light-load conditions, should be considered before discussing the accuracy of the two methods mentioned.

Robert J. Clark: You will find in a great many stations that the day load is very light, and if this load is distributed over several circuits with a meter on each feeder the load will be so light that the meters will not run up to efficiency, as we all know that meters with a light load on do not run as well as with a heavy load. I would therefore say install one meter on the generator, which will give a more correct record of your output.

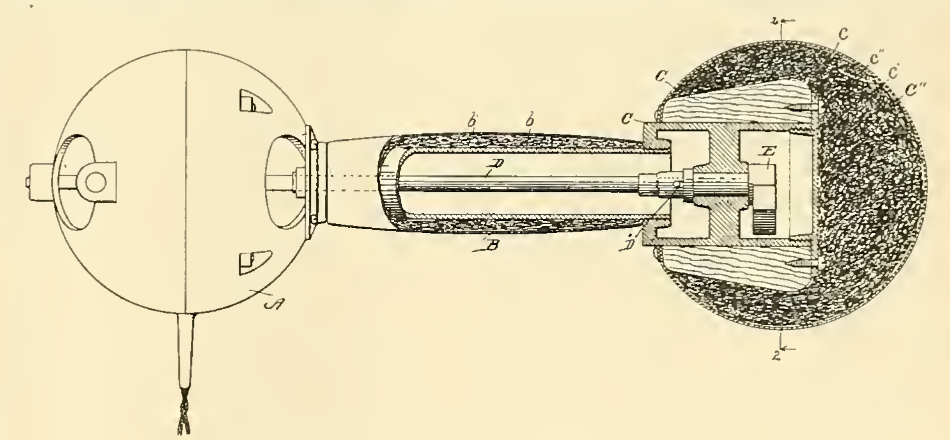
Alex Dow: The less the number of wattmeters the more accurate will be the record. Therefore, if there are few generators and many feeders it is best to put the wattmeters on the generators. If there are few feeders and many generators the wattmeters should be put on the feeders. Of course, in both cases, provision must be made for metering the current used in the station.

J. L. Moore: Wattmeters on the feeders will probably be more accurate, as they will be smaller capacity and more accurate on light loads. Have wattmeters on both generators and feeders, and, as soon as the output recorded on one set does not agree with the other, look up the reason. Test meters at regular intervals.

Vibratory Dumb-bell.

The popular demand for vibrators has brought out many new inventions in this line. One that was recently patented was devised by John H. Kellogg of Battle Creek, Mich. The main object of the invention is to provide an improved dumb-bell adapted to vibrate when in use.

Referring to the drawing, (A) is an electric motor inclosed in a suitable casing forming one of the dumb-bell balls. A hollow handle or grip (B) is secured to the motor casing. This handle consists of a tube (b), of metal, having a suitable covering (b'), preferably padded, as illustrated. The other dumb-bell ball preferably consists of a metal core (C), which is threaded upon the end of the tube (b). A plate, as (c), having an inwardly projecting annular threaded flange (c'), is threaded into the outer end of the core (C). About the core (C) is a wood ring or covering (C'). This is secured upon the core by screws, as (c''), arranged through the plate (c). The padded covering (b')



DUMB-BELL ADAPTED TO VIBRATE WHEN IN USE.

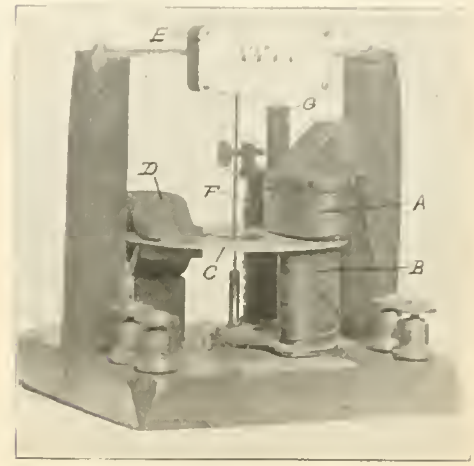
is secured over these parts, preferably by tacking to the inner end of the wood ring (C), as illustrated. Within the core (C) is a bearing for one end of the shaft (D). This shaft is preferably made up of sections secured together by a slip-joint (D') for convenience in assembling the structure.

An eccentric weight (E) is arranged upon the shaft (D) in a manner to throw the same out of balance, so that when the shaft is rotated by the motor the dumb-bell is vibrated. This is said to be a valuable exercising device, as the muscles, in addition to the benefit of movement secured by the use of the dumb-bell, are vibrated in an effective manner.

The First Induction Watt-hour Meter.

The accompanying illustration will be of interest to electrical engineers, and particularly to users of induction meters. It shows the first induction watt-hour meter made in which a single armature was used for both the motor part of the meter and the magneto-electric drag.

This model was made by Thomas Duncan (now manager of the Duncan Electric Manufacturing Company, Lafayette, Ind.) in 1891 and embodies



THE FIRST INDUCTION WATT-HOUR METER.

many features still incorporated in meters of the present day.

Referring to the illustration, (A) represents the current field coil in series with the load, (B) the shunt or pressure coil, (C) the aluminum disk armature, (D) the permanent magnet, (E) the registering train, (F) the impedance coil, and (G) an adjustable iron core for regulating the speed.

The operation of the instrument is similar to that of all induction watt-hour meters in use today, even to possessing a high torque.

At the time this instrument was built, only commutator watt-meters and induction lamp-hour and ampere-hour meters were used; and although this model is now sixteen years old, Mr. Duncan says that its design, involving the aluminum armature common to both motive and retarding elements, has been followed by all makes of induction meters to the present day.

No Lighting Wires on Telephone Poles in Fort Wayne.

A decision of considerable importance has been rendered by Judge Heaton of the Superior Court in Fort Wayne against the city of Fort Wayne in a suit to restrain the Home Telephone Company from interfering with the city's purpose to use the top cross-arms of the company's poles on which to string electric-light wires. The city is proposing to build a municipal light plant, and asserts the right to use the telephone company's poles for its wires under the clause in the franchise which purports to give the city the right to string wires for police and fire-alarm purposes. The court held that the franchise reserves no right to the city to string wires of such a disturbing character on the telephone poles as those for the conveyance of current for electric lighting. While the decision will greatly increase the cost of the city's plant, it is gratifying to the telephone company and to telephone men generally throughout Indiana, where conditions of a similar character exist.

New Patents for Motor-controlling Systems.

On September 10th the United States Patent Office granted 12 patents on systems for motor control that were assigned to the Allis-Chalmers Company. William H. Powell of Norwood, Ohio, was the inventor of nine of these; Walter J. Richards, also of Norwood, invented two, and Louis E. Bogen of Cincinnati one.

The first patent covers the idea of a combined starting box and speed-regulating field rheostat. A generator and a motor have their armatures connected together through a starting resistance. The fields of the machines are of the shunt type, one terminal of each field being connected to one pole of the generator, the other field terminals end on opposite sides of two separate adjustable resistances arranged with contact buttons in two adjacent concentric arcs. An adjacent continuous metallic arc connects with the other pole of the generator. A contact arm swings over the three arcs, cutting resistance out of the generator field circuit and thus raising its voltage and cutting in resistance into the motor field circuit, each of these actions increasing the speed of the motor. The armature resistance is arranged to lie in the same circle as the field resistances, so that the same contact arm is used to start the motor and then to regulate its speed. The buttons in the field rheostat arcs are staggered so as to get a still more uniformly varying and wider range of speed.

In the next patent a motor-control system is referred to that consists of a number of machines. An induction motor having a flywheel on its shaft is direct-connected to a generator supplying the armature current for the motor to be controlled. The last two machines have separately excited fields, that of the generator being reversible so as to reverse the polarity of its electromotive force and thus the direction of the motor's rotation. The field rheostats of these two machines are of the type covered by the first patent, with reversing device for the generator field just referred to. Reversing is brought about by first strengthening the motor field and weakening that of the generator. The speed of the generator and its driver is allowed to vary in an inverse manner as the load on the motor varies, and a flywheel is provided on the generator shaft to take up the load fluctuations.

The third patent covers a system similar to the previous one, but with the added feature that a single controller is so arranged that, as its arm is moved from "off" position, the generator field circuit is first closed and its resistance gradually decreased to a minimum, and then the resistance of the motor field circuit gradually increased to a maximum, both operations increasing the motor speed. In reversing, a high resistance connected across the generator field circuit prevents arcing at the contact points when that circuit is opened.

The fourth patent relates to substantially the same system as the two preceding, the new feature being that the controller simultaneously and inversely varies the field strengths of the motor and generator.

In the fifth patent a motor-control system is treated of that has an induction motor supplying mechanical power to a main generator and an auxiliary generator or exciter, the main shaft carrying a flywheel. The armature of the working motor is connected across the main generator. The armature of the auxiliary generator is connected in series with that of the main generator. The field of each of these three machines is supplied by the two generators in series, one field terminal being in common and connected to the remote pole of the exciter armature. The other terminal of each field circuit ends in a separate set of resistances on a single rheostat, and these resistances are so disposed that a contact arm can cut resistance into the field circuits of the working motor and of the exciter and at the same time cut resistance out of the field circuit of the main generator.

A working motor with two windings is covered by the sixth patent. One winding is separately excited and of practically constant value and the other is a variable and reversible shunt winding supplied, along with the motor armature, from a generator whose field is variable, reversible and separately excited. The two motor field windings normally oppose each other. The motor shunt field and the generator field are varied separately or at the same time, either correspondingly or inversely.

The next patent relates to the use of two generators in series to supply the armature of the working motor, the field of which is a separately excited one of practically constant value. The fields of the generators are also separately excited, but are variable and reversible either separately or together. The electromotive forces of the two generators are normally equal and opposed, the algebraic sum being impressed on the motor.

In the eighth patent the generator has its field excited jointly from its own armature and from a separate source, such as an exciter, the two sources being in series. The excitation from its armature is the main one and is varied by a rheostatic controller. The separate excitation is nearly constant in value, but is reversible by the controller at a time when the self-excitation has been reduced to a minimum. This reverses the polarity of the generator and the direction of rotation of the working motor to which it supplies armature current. The field of this motor is separately excited and is regulated by the controller at the same time and inversely as the main generator field.

The feature of the ninth patent is the use of a main generator and a working motor supplied by it, each of which has two distinct field windings, one self and the other separately excited. An auxiliary generator or exciter supplies the separate excitation, and this is controlled by resistance in the exciter field. For the generator both excitations are varied in an inverse manner and the separate excitation is reversible as in the previous patent. For the motor the self-excitation alone is variable.

The patents granted to Messrs. Richards and Bogen relate to still other methods of regulation of the generator and motor, with the object of getting complete and wide control of the latter. The entire set of 12 patents gives a multiplicity of systems of motor control, such as are particularly adapted to the operation of motors for rolling-mill work.

Mexican Mining Progress Due to Electricity.

Applications of electric power in the operation of the mines in the Guanajuato district, Mexico, and the wonderful development of that district as a direct cause of this cheap power, have caused steps to be taken to supply the same power to many of the other leading mining camps of the country. The districts of El Oro and Pachuca are already being supplied with the cheap power, and the same stimulus of development is witnessed in those places.

American capital and American engineers are back of most of the electric power projects in Mexico. The big generating and transmission plant which supplies Guanajuato and a number of other towns and districts with electric power and lights is owned by a syndicate of Colorado men. The name of the company is the Guanajuato Light and Power Company. A Canadian syndicate, known as the Mexican Light and Power Company, is not only supplying Mexico City with electric power and lights but has reached out to El Oro, Puebla, and will probably extend its transmission lines to other more remote places.

Mexico is abundantly well supplied with waterfalls from which the initial power for the hydroelectric plants may be obtained. These waterfalls, which are mostly situated in remote parts of the mountains, were formerly considered to have little value. With the use of electric power and the knowledge that it could be transmitted long distances, a value came to be fixed upon the waterfalls, and some of them which have been sold recently have brought good prices. It is said that there is hardly a mining camp of importance in Mexico which cannot be easily reached by transmission lines from some one of these waterfalls. The general introduction of this cheap power means that many low-grade mines which cannot now be worked profitably will be opened and become paying producers of ore.

An X-ray Outfit for Country Doctors.

The use of X-rays for medical purposes has been extended to such an extent in the course of the last few years that even ordinary practitioners at present cannot do without an X-ray apparatus. But in many cases difficulty is experienced in obtaining the electric current for operating the tube. This applies particularly to country doctors, who often live far away from any generating station capable of supplying the required "juice."

FIG. I. CAPSTAN-DRIVEN DYNAMO IN OPERATION IN THE COUNTRY

Primary cells, Leclanché elements, dry batteries and the like, which may be used for this purpose, are hardly convenient, owing to their short life and small capacity. Storage batteries might be employed, but in many cases there is no opportunity for charging them.

These drawbacks to the use of X-rays by country doctors have been done away with by a capstan-driven dynamo which has been recently constructed at Berlin, and which can be used practically anywhere. This small machine does not require any superintendence worth speaking of in comparison with a dynamo driven by a gas engine or small steam engine. The current generated by the machine is sufficient to operate a small X-ray outfit, while also ample to charge a storage battery of a size convenient not only for the operation of X-ray apparatus but of nearly any other electrical apparatus used in medicine or surgery.

Figs. 1 and 2 show, respectively, the capstan-driven dynamo and X-ray outfit in operation, while Fig. 3 represents a machine with the protective hood removed.

The dynamo is designed for 10 amperes at 30 volts and is driven by two horses through a toothed wheel gearing fitted in an angle-iron frame. Two extensible steel-pipe poles, which are taken apart for transportation, are attached to the upper and projecting end of the dynamo, as shown in Fig. 1. The gearing is so designed that the required speed of rotation (1,000 revolutions per minute) will be obtained with five revolutions of the horses. Four pegs bolted to fishplates secured sideways to the ground surface are used to attach the iron frame to the ground. In order to protect against moisture, dirt, etc., the frame is surrounded with a readily removable water-tight canvas cover.

The outfit also includes a marble switchboard, an ammeter and a voltmeter, two fuses, switches and plugs. Two of the plugs are used for connecting the two conductors starting from the dynamo, and two others for connecting the X-ray apparatus or for charging a storage battery.

When the capstan-driven dynamo is used for the direct operation of an X-ray outfit a convenient portable apparatus has been especially arranged for this purpose. It is shown in Fig. 2 and includes an induction coil for 25-centimeter spark length, fitted with a regulating resistance, a controlling switch, a fuse, a platinum interrupter (with condenser), a connection box inclusive of a cable four meters in length provided with pole tips, an X-ray bulb-holder and two insulated conductors for connecting the X-ray bulb to the inductor.

Portable X-ray outfits of the kind described have the undoubted advantage of being independent of the electrical facilities at the place at which they are to be used, whether at the doctor's house or at the house of the patient, which is specially important in the case of patients whose removal is difficult. A portable storage battery, charged by the capstan-driven dynamo, may then be used as source of current.

Similar X-ray sets operated by capstan-driven dynamos are constructed for military purposes, and Fig. 4 illustrates a military X-ray car of the type used in the German Army. G.

Central Electric Railway Association.

The fall meeting of the Central Electric Railway Association was held in the assembly room of the Chittenden Hotel, Columbus, Ohio, on September 26th. This being the first meeting after the summer vacation, the attendance was unusually large. The members of the association came to the meeting in special trolley cars from all parts of Ohio and Indiana. The meeting was called to order by the president, H. A. Nicholl, at 10:30 a. m. A committee was appointed, with E. E. Spring, chairman, to draft resolutions relative to the death of Mr. F. J. Stout. President Nicholl announced the meeting of the American Street and Interurban Railway Association to be held at Atlantic City October 14th to 18th, and Messrs. Nicholl, Wilcoxon and Sloat were appointed delegates. The report of the secretary-treasurer showed the association to be in an excellent financial condition.

Under head of reports of committees the report of the committee on train rules was presented by F. D. Carpenter, general manager Western Ohio Traction Company, who said that the committee, having familiarized itself with the rules now in vogue on the electric railways, had drawn up what it believed to be a practical set of rules which can be used upon all interurban railroads with satisfaction and uniformity. The report of the committee was adopted without being read in entirety, and the delegates to the national convention were instructed to present it to the Atlantic City meeting with a view of having it adopted by that association as well.

The first paper on the programme was read by

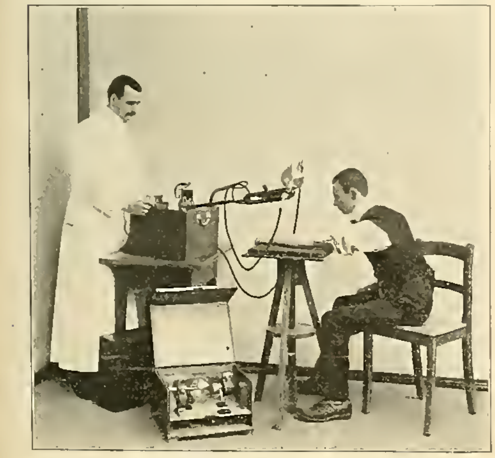


FIG 2. PORTABLE X-RAY OUTFIT IN USE.

G. D. Nicholl, electrical engineer on the Indianapolis and Cincinnati Traction Company of Rushville, Ind., on "Single-phase Catenary Line Construction." The paper is given in full elsewhere.

Henry N. Statts of Cleveland, chairman of the committee on fire insurance, presented a long report showing that the movement for the better protection and insurance of the properties of street and interurban railways and lighting companies was progressing successfully. After careful consideration on the part of the executive officers of a number of leading electric railway and lighting companies as to the best plan for producing lowest cost of insurance, it has been deemed advisable by the companies to perfect their own organization and to surround themselves with the best methods of safeguarding their property against loss by fire. Mr. Statts next outlined the organization and incorporation of the American Railway Insurance Company and the Electrical Mutual Insurance Company of Ohio, which co-operate with each other in writing insurance at a rate, it is said, not to exceed one fourth of that charged by old line insurance companies. Mr. Statts stated that the committee had communicated with 420 companies and their reports show that they paid during the last 10 years for fire insurance premiums to old-line companies $6,400,641.45, while during the same period the amount returned to the 420 electric companies for fire losses amounted to $1,073,336.27, leaving a balance to the credit of the insurance companies of $4,376,305.18. These figures, Mr. Statts said, prove beyond question that electric traction companies of United States and Canada have been paying excessive rates, and the leading electric railway companies are now quite willing to join in the movement to establish an insurance fund to carry their insurance on a co-operative plan. The report of the committee was adopted and a further discussion of it will be taken up at some future time.

The report of the express committee, with reference to the best manner of handling express matter, was presented by J. S. Starkey of the Indiana Union Traction Company of Anderson. Mr. Starkey said that the committee sent out inquiries to 80 interurban roads of Indiana, Ohio and neighboring states, with a view of learning what roads have contracts with express companies, and asking for opinions as to the advisability of entering into contracts with the old companies or of organizing an independent express company. The report gave considerable detailed information as to the terms of contracts where they exist, and the replies received indicate that only a small proportion of the lines have as yet

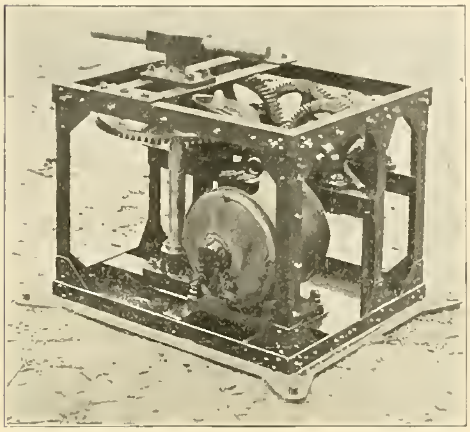


FIG. 3. CAPSTAN-DRIVEN DYNAMO WITH CASING REMOVED.

contracted with express companies to handle their business over their lines.

The report is quite complete, giving many experiences of electric railways relative to the methods of handling express matter, but on the proposition as to the advisability of contracting with old-line companies, the organization of independent companies, or handling of express as they do now along with their freight matter, the companies seem to be equally divided on the several propositions. A number of companies expressed the belief that they could do better than to go in with any old-line company; while other companies said that the laws of the states would soon compel them to deliver express in the towns and cities, and it is necessary to make arrangement for that contingency either through contracts, the most favorable that can be made with old-line companies, or organize an interurban express company, which some of the companies believe can be operated successfully. The committee, however, reports that its conclusion, from information obtained, is that the contracting with old-line express companies has a little advantage, and for this reason the committee recommends this course.

The next paper on the programme was read by E. H. Anderson of the General Electric Company of Schenectady, N. Y., on the "1,200-Volt System." This paper consisted in showing the General Electric Company's commutating pole motors ranging from 600 to 1,200 volts direct-current, and explaining each in the form of a lecture that was exceedingly interesting to members of the association. At the conclusion of Mr. Anderson's lecture and description of the illustrations he answered many questions of the electricians present, who were greatly pleased with the information obtained along these technical lines.

The Central Electric Railway Auditing Association, which is an adjunct of the railway association, was also in session, but made no report to the meeting. The work of the auditing association is to adopt and maintain uniform methods of keeping accounts. In addition to a large representation of the members of the association there were present traction men from Illinois, Michigan and West Virginia. The next meeting will be held in Indianapolis on November 28th.

British Postmaster-general Reports on the Telephone, Telegraph and Radio-Telegraphy.

London, September 20. The annual report of the postmaster general naturally has a good deal to say concerning the radio-telegraphic convention, but it cannot be said that it adds much to our existing knowledge on the subject, beyond stating quite

FIG. 4. MILITARY X-RAY WAGON FOR GERMAN ARMY.

finally, if this were needed, that the government intended to ratify.

The report, however, contains one or two other items of interest in relation to wireless. During the year covered by the report, viz., to March 31, 1907, 45 new applications for licenses were made under the wireless-telegraph act, of which no less a proportion than 36 were for experimental purposes. These 36 licenses have all been granted, but the other applications have been held over pending the consideration of the whole question of the use of wireless telegraphy in the United Kingdom for commercial communication with ships. This, in its turn, depends largely upon the ratification of the Berlin Convention, and as the government has announced its policy in regard to this, we should soon hear all about the attitude of the government concerning competitive licenses for commercial ship and shore work, for, whatever the views of the Marconi company may be, there is no doubt that the hesitancy on the part of the Postoffice to grant such licenses in the past has been no mean factor in building up the Marconi company's present position.

During the last year the Postoffice has continued to collect and deliver Marconi company's telegrams to and from ships at sea under the agreement of 1904, and it may be noted that the inward messages amounted to 15,853, as against 11,094 in the previous year; the outward messages increased from 558 to 1,140.

As usual, the telephone system monopolizes the greater portion of the report, and in the present position the letterpress concerning this is more than usually interesting. Apart from the question of mere figures of capital expenditure and new lines, etc., it tells a story of great efforts at development in face of difficulties more or less peculiar to this country. The most important of these latter is the inherent objection to overhead wires, and in the linking up of sparsely populated areas overhead wires are a sine qua non. Yet we read of the use of wires, primarily intended for telegraphic purposes, for telephonic purposes in rural districts. These, of course, are what might be termed local trunk messages, i. e., communication between the central town and the postoffices of surrounding villages.

The capital expenditure upon the British trunk telephone system to March 31, 1907, amounted to roughly, $10,000,000, the expenditure during the year being $2,000,000. The total number of conversations during the year were 19,803,000, an increase of over 1,000,000. In connection with the London telephone service, carried on in co-operation or competition with the National company, it is interesting to note that new subscribers are being added at the rate of about 150 per week, the total number now standing at 45,000. Five new exchanges were opened during the year under review, and 65,000 miles of new wire was laid.

Another interesting figure is the cost of constructing an exchange circuit in the Metropolitan area; this has been reduced from $175 to about $163. These figures include instruments and exchange apparatus, and the anticipations of previous reports have been amply realized, inasmuch as the average for the whole system, including spare plant, is $250, as against $270 and $320 in the two years previous. After payment of working expenses, depreciation and interest, there is a balance of, roughly, $100,000.

The record for the year in relation to the telegraph service deals with considerable extensions to the underground trunk lines, in connection with which there are increasing complaints year in and year out. There has, however, practically been no increase in the number of telegrams sent, due, in the main, to the increasing use of the telephone.

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CORRESPONDENCE relating to electricity or any of its practical applications is cordially invited, and the co-operation of all electrical thinkers and workers earnestly desired. Clear, concise, well written articles are especially welcome; and communications, views, news items, local newspaper clippings, or any information likely to interest electricians, will be thankfully received and cheerfully acknowledged.

REMITTANCES.—All checks, drafts and other remittances should be made payable to the order of the publishers, the **Electrician Publishing Company**, and addressed to the offices of publication, Suite 507, Marquette Building (204 Dearborn Street), Chicago, Illinois, U. S. A.

CONTENTS OF THIS NUMBER.

DEPARTMENTS.

DATES AHEAD.

New York Electrical Show, Madison Square Garden, September 30th to October 9th.

American Street and Interurban Railway Association and affiliated societies (annual convention), Atlantic City, N. J., October 14th to 18th.

Western Association of Electrical Inspectors (annual meeting), Hotel Ryan, St. Paul, Minn., October 22d, 23d and 24th.

THE SUCCESS of the Chicago Electrical Show has resulted in a number of other electrical shows in other cities. The Canadian show at Montreal was a pronounced success. The New York Electrical Show was begun on September 30th and is to last until October 9th. This also, from early accounts, seems to be "making good." The electrical show seems to have made a hit, and the result is largely due to the prestige which attaches to these exhibitions since the Chicago show blazed the way to popular favor.

IN HIS instructive article on "The Industrial Uses of the Electric Motor" in the Western Electrician of last week Mr. E. W. Lloyd set forth in a very convincing way the reasons why manufacturers should use electric power. One of these is of particular interest. Not only may the output of machines be doubled in many instances by equipping them with individual motors, but "the cost of labor for a given amount of work is materially reduced, notwithstanding the fact that it has been possible to increase the wages of the men operating motor-driven tools by offering them a premium for the extra output." It will be seen by this that not only the employer but the workman may benefit in pocket by the use of the electric motor, and thus the modern method of power application has a sociological bearing which not many persons have suspected.

FALL TRADE prospects in the electrical field may be described as "reasonably satisfactory," in the language of Mr. Sunny as given last week in the Twentieth Anniversary and Fall Trade Number of the Western Electrician. The views of a number of other gentlemen well qualified to judge were given at the same time, and on the whole there was a cheerful tone in the review of the business situation. A quieting of the bounding pulses of industrial activity is not dreaded; on the contrary it will probably make for the health of the body politic in the long run.

The general situation seems to be well described by the 1907 edition of "Crop Reports and General Business Conditions," recently issued by the Commercial National Bank of Chicago. This compilation is based on nearly thirty thousand replies from banking, manufacturing and merchandising correspondents throughout the country. The consensus of opinion is that the financial situation is sound and satisfactory. We quote three extracts from the general summary:

"The overwhelming preponderance of evidence is that the business situation is sound and satisfactory. Not one of the thousands of replies negatives this conclusion in definite terms. That there has been a marked easing down from the tension of the spring and winter months of the year is generally admitted, but it is admitted without a trace of regret or misgiving. The country had been rushing ahead at a whirlwind pace until the tax on credit and capital accumulations compelled a respite. The demand for goods to meet instant needs, or to replace other goods destroyed by wars and calamities, or to provide for the certain needs of the future, has been unprecedented. To meet this it has been necessary for the manufacturers and distributive agencies of the entire world to employ almost every available unit of money and to put into action every potentiality of credit. The result is too familiar to all men of affairs to need exposition."

"Business is generally reported to be good in volume, making an exception for the great hesitancy in the metal markets, especially in copper and the alloy metals. Voluntary concessions in the prices of these materials have made buyers wary, and they are generally waiting in the hope of further forced declines. The iron and steel industry is going ahead under the pressure of orders previously booked for fall delivery; but it is conceded that the current inquiry is lighter, leading to shading of prices in pig and billets—the basic articles of the industry. The demand for consumption has been steadily in advance of production for many months, hence a slight relaxation in the demand is regarded with favor."

"In general, it seems justifiable to conclude from the data at hand that any further slowing down of business will be accompanied by moderate recessions in the prices of raw materials without any serious decline in consumption due to decreased purchasing power, and that the recessions in prices will prove to be encouraging rather than discouraging factors in the trade situation."

We believe that the above outlines existing conditions with accuracy and also that it is a judicious forecast of the probable business situation during the next three or four months. Conditions in the electrical industry are no less sound than in other branches of trade.

EXTRAVAGANTLY worded claims for alleged electrical cure-alls have not disappeared by any means, although it does seem that the crop of "electric" belts, hair-brushes, insoles and the like is somewhat less plentiful than in former years. As showing some of the things that electrical men themselves do not know about electricity and as of curious interest, the following extracts from a recent circular are given:

"It has been demonstrated that electricity is the most natural of all remedies for the cure of ailments that inflict the human body. What steam is to the locomotive, electricity is to the human body. It stands first in the list of positive and wonderful cures. It is the infallible conqueror of pain and disease, and the only permanent cure for rheumatism and all nervous ailments." If the foregoing is true, it will be of importance to know how best to secure the advantages of electricity, "the greatest blood purifier and nerve builder in the world." This point is not neglected, for we are told of certain devices which "are worn in the heels of the shoes with no inconvenience to the wearer and nobody knows you are wearing them. They differ from all other electrical appliances, as they are not batteries and make no electricity until in contact with the body; then they make a battery out of the body, for one foot rests on the positive magnet and the other on the negative. So the nerves themselves become the connecting wires, and the blood, nerves and tissues of the body are fed with new vitality, life and power the whole day, and all weakness, pain and disease are banished."

We do not quite understand the process of generating the current and should think the shoe-heel magnets rather diminutive affairs; but nevertheless we are boldly told that they banish "all weakness, pain and disease." If there should be some mistake about this, and we fear there is, it would seem to be a cruel thing to raise false hopes in the minds of the suffering for motives of gain, for pain and disease are very real and very grim to most of us in this old world.

A DECISION of much importance to the electric-railway interests of Indiana has been rendered by the Indiana Railroad Commission in the case of the Farmland Stone Company of Farmland, Ind., against the Big Four Railroad Company and the Indiana Union Traction Company to compel them to interchange traffic at Winchester, about eight miles from Farmland. The evidence showed that the stone company had been getting coal over the Big Four railroad, which was transferred in carload lots to the electric-railway company at Winchester and brought to Farmland to the stone company over the electric road. Recently this exchange of traffic and transfer was stopped, and the stone company was compelled to haul by wagon its coal from Winchester. The stone company petitioned that the previous interchange of freight be resumed.

The railroad company in its answer alleged that the stone company was not entitled to the relief demanded and that the railroad commission had no jurisdiction in the matter, thus attacking the constitutionality of the law passed by the last session of the Legislature giving the commission jurisdiction in cases of this kind. After hearing the evidence the commission ordered the interchange of traffic to be resumed, since it was found that the physical condition of the electric-railway line was amply sufficient to carry the loaded coal cars, while both steam and electric roads were common carriers, belonging to the same class and amenable to the same general rules and regulations.

The case is the first in which an interchange of traffic between the steam and electric roads has been raised in Indiana, and therefore sets a precedent. Chairman Hunt of the Indiana commission stated, however, that this ruling pertained to this particular case only, and that the exchange of such freight depended upon the merits of each case and the physical conditions and capacity of the interurban lines to carry freight turned over to them in carload lots by the steam lines.

The Large San Francisco Gas-engine Electric Power Plant.

[From the San Francisco correspondent of the Western Electrician.]

The California Gas and Electric Corporation—now a subsidiary of the Pacific Gas and Electric Company—has been doing some remarkable pioneer work in the suburbs of San Francisco in the installation and operation of very large electric generating units with direct-connected gas engines to supply current for operating electric cars. Over a year ago the Snow Steam Pump Works of Buffalo erected at the San Mateo power station near San Francisco three horizontal, duplex, double-cylinder gas-engine generator sets. The engine capacity was rated at 5,400 horsepower and the generator capacity at 4,000 kilovolt-amperes for each unit. Each engine has the revolving field of a Crocker-Wheeler three-phase 25-cycle 13,200-volt generator on its main shaft next to its flywheel. At the time the engines were constructed they were the largest gas engines in the world, and the generators were, of course, the largest to be driven by gas engines.

The erection of these engines and the subsequent modifications in the details of operation were under the personal supervision of Mr. Aue, the mechanical expert of the Snow Steam Pump Works, who is still in the city watching the performance of the big plant. His painstaking study of the large units may result in the adoption of some further refinements in gas-engine practice. Before this plant was started there was some uncertainty in the minds of some electrical engineers on the successful operation of three such large gas-engine units when two or more of the big generators were connected in parallel. The test proved that the engines regulated satisfactorily under these conditions.

The plant was intended as a relay station to be held in reserve in case of interruption of the current transmitted 140 miles from Blue Lakes to San Francisco for the operation of the electric cars of the United Railroads of San Francisco under a 20-year contract, commencing with June 1, 1906. The engines were built about two years ago.

The unusual conditions prevailing for some time after the disaster of 1906 had something to do with the delay in the placing of the new gas engines in commission, although the large gas generating plant with its gasholders was completed and undamaged. On account of shortages in the supply of current available for use in San Francisco, it was found necessary to operate the three gas engines regularly during the peak load and at other times early in the year 1907, and they have been in almost continuous operation for a number of months.

The engines are of the twin-tandem double-acting four-cylinder side-crank type, operating on the four-cycle principle. The 5,400-brake-horsepower rating of the engine is only on an overload of 35 per cent. The usual overload rating is 15 per cent. for brief periods. The engine delivers 4,600 horsepower at this rating, but normally the engine will deliver 4,000 brake horsepower.

The cylinders are made in two parts, with a circumferential joint in the center, which is covered by the removable part of the water jacket. The water jackets are cast solid with the ends of the cylinders. The explosion chamber is cast to one side of the cylinder, this making very strong construction.

The pistons are made of cast-iron and bolted together on a circumferential joint. Six concentric cast-iron piston rings without keepers are used. Both the piston rods are 15 inches in diameter and made of two parts—the sleeves, made of nickel steel, and the bolt which extends through the whole length of piston and sleeves. The piston rods are hollow and conduct water to the pistons for cooling purposes.

The cylinders are supported on the bedplate in such a way that they can slide in grooved guides in the longitudinal direction only to allow for expansion or contraction caused by changes in temperature. The bedplates are held down to the foundation with foundation bolts running clear through to the top of the bed. The weight of the crank shaft is 99,734 pounds. Its diameter at the rotor fit is 37 inches, with a journal bearing 30 inches in diameter by four feet eight inches long. The crank-pin bearing is 19 by 19 inches. The wrist-pin is 17 inches in diameter and 18 inches in length.

The design follows the steam-engine practice by using two overhung crank pins, thus avoiding the trouble of keeping more than two main journals on one engine in line. The crank arms are provided with heavy counterweights to partly counterbalance the momentum of the heavy reciprocating parts.

The 23-foot flywheel weighs 97,000 pounds—a rather small weight for such a large engine, but the weight of the rotor has been considered. Although the weight is less than some electrical for mulae would give, it has been found that lighter wheels, when their weight was chosen correctly, have given better results. When the wheel has not the proper weight, parallel operation becomes difficult.

The weight of the main engine frame is 170,000 pounds. It contains the bored guides for the main cross-head and the main bearing.

For ignition, the electric make-and-break spark is used in connection with a storage battery, discharging at about 10 volts and one ampere. Each igniter is supplied with a spark-coil indicator. This indicator will indicate constantly the condition of each circuit. When the indicator swings with the igniter, the igniter is in order; when it stays drawn up against the core, the igniter is short-circuited.

The engines are started by compressed air, through valves which are operated from the cam shaft in such a way that the air enters behind the piston, which is starting on its expansion stroke, acting in the same way as steam in a steam engine. At the end of the stroke, the exhaust valve opens and the air escapes. Some of the cylinder ends, during this time, take in a charge, and, when this is ignited, the pressure holds the check valve closed so that the air cannot enter the cylinder. After a few explosions the air is shut off and the engine soon reaches its full speed.

The valves, all of which are located on the same side of cylinder, have a positive motion, imparted through cams, vertical rods and rocker arms from a common lay-shaft geared to the main shaft. There is, of course, an inlet valve and an exhaust valve at each end of each cylinder. The valves are water-cooled.

The speed of the engine is regulated by the governor working on the compression and also on the mixture. A Lombard governor regulates indirectly, with the aid of pistons, moved by oil under pressure. This governor is very powerful, yet still very sensitive, and can be easily adjusted to give a slow regulation, which is suitable for parallel operation.

Oiling systems facilitate the lubrication of crank-bearing, crank and cross-head. The oil is fed to the bearing through sight feeds. It then runs through filters and is pumped up to the storage tank. The cylinder oil is necessarily of a different quality from the oil used in a steam cylinder. The oil must have a high flash point, and must not carbonize. The oil is forced into the cylinder on the inhalation stroke, when the oil hole is covered by the piston, and is forced on the piston between the rings. The oiling of the gas-engine cylinder is not nearly as difficult as it appears, because the piston is cooled by water. Too much oil is detrimental and causes carbon deposits.

The total weight of each twin engine is 600 tons, of which 186 tons represents the weight of the two main-frame castings. The frame carries the main-bearing block and the slides for the large main crosshead. The floor space occupied by each engine is 35 by 74 feet, which is not very large, considering that there are four double-acting cylinders of 42 inches diameter and 60 inches stroke.

These engines have been started and gotten up to speed in the short time of from 55 seconds to two minutes. This means the time required to bring the engine fully up to service from a standing condition, carrying any quantity of load, and synchronized with other engines and hydro-electric plants. This also includes the time required to turn on air, gas, electric current for the igniter, and synchronizing at 88 revolutions per minute.

The three engines have been running about eight months, driving three 25-cycle three-phase generators. The fourth unit, which is under construction, will be installed in the same station, to generate 60-cycle three-phase current, which is the standard on the California Gas and Electric Corporation's transmission lines. It is of practically the same design as the other machines, but the flywheel weighs 19 tons more, and the speed will be two revolutions greater, or 90 revolutions per minute. It is the intention to increase the installation, in time, to six units, aggregating over 24,000 kilowatts in capacity. It has also been planned to install one 4,000-kilowatt 60-cycle gas-engine generating unit in the company's Oakland power station.

Turning to the generator, the stator frame, which is approximately 26 feet in diameter, is of cast-iron, provided with ventilating openings to allow a free circulation of air around the ends of the windings and through the ventilating spaces in the core. It supports the stator laminations and winding. It is of the box-girder type, designed so as to be strong enough to prevent distortion due to its own weight and the magnetic pull. The laminations of the stator are securely clamped together by end flanges and provided with a sufficient number of ventilating ducts to insure a uniform and low temperature throughout the core.

Each slot of the stator is lined with a tube of insulating material possessing high dielectric and mechanical strength. There is, the usual ventilated type of shield to protect the ends of the coils of the windings. The rotor, which is designed for great strength and simplicity, is of cast-steel, made in two sections and bolted together. The pole and pole shoe are cast in one piece and bolted to the rim. There are 34 poles.

The rotor coils consist of strip copper wound on edge, each turn being properly insulated from the others, and the whole coil is compressed and baked into a compact unit. The oblong coils have no sharp corners and are held securely in position by the pole-shoes.

The exciting current is conducted to the field windings through carbon brushes. The collector rings are supported on a cast iron hub, from which they are very thoroughly insulated.

Although the Crocker-Wheeler Company had built no alternating-current generators prior to 1904, the engineering corps secured the benefit of the data and experience of Brown, Boveri & Co., who had made an enviable record in three-phase work in Europe. The California Gas and Electric Corporation accepted and paid for the three Crocker-Wheeler machines in full several months ago, showing complete satisfaction with their performance.

The Stanley Electric Manufacturing Company furnished the special exciter sets, which include several different motor-generator sets, of various types and capacities. One of the exciters has a capacity of about 340 kilowatts. This flexible system of independent excitation is so designed that quite a wide range of voltages and wattages can be supplied to the main field circuits, according to the varying conditions under which the large generators are to be operated.

The Stanley company also built two large frequency changers for this station, which take the 60-cycle high-tension current from the 142-mile transmission line of the California Gas and Electric Corporation, and, in turn, supply 13,200-volt current at 25 cycles for the use of the United Railroads. While this apparatus is installed in the same power station, it is operated independently when the gas-engine generators are not running.

Under the original plans the current for the electric railroad was to be supplied from the transmission line extending from the hydro-electric power station at Electra, and the gas-engine units were to be held in reserve in case of emergency. Since the gas engines were placed in commission the demand for power has exceeded the capacity of the company's other plants, so that it has been necessary to run the gas engines almost continuously.

A prominent engineer recently said that he had rarely seen large generators operate so well in parallel as these gas-engine-driven Crocker-Wheeler machines.

The gas plant, which was built especially to supply these gas engines, produces gas of a quality high enough for illuminating purposes. The surplus gas is turned into mains connected with the city lighting system of San Francisco and used whenever needed. There are two standard gas-generating units, each having a capacity of 400,000 cubic feet per day, constructed in accordance with the Lowe crude-oil, water-gas system. The gasholders, which are located within a few hundred feet of the power station, include, one with a capacity of 1,000,000 cubic feet, and two holding 200,000 cubic feet each. Mains of ample size furnish connection with the gas engines.

This gas contains from 45 to 55 per cent. of free hydrogen. Its heat value averages about 630 British thermal units per cubic foot. In the Lowe crude-oil, water-gas process the crude oil is heated to a temperature of 300 degrees, being vaporized, and is then mixed with superheated steam. The excess of water is taken out and the vapor and steam pass into a hot chamber, being superheated to 600° F. This high temperature turns the mixture into a fixed oil-and-water gas, which is then purified and passed on to the engines.

When the engines were originally designed, the initial pressure of the gas in the main cylinder was estimated at about 150 pounds per square inch.

A.

Industrial Progress in Germany.

Reviewing the commercial and industrial situation at Frankfort-on-the-Main, Consul-general Guenther says that the year 1906 was a continuation of the great industrial activity of the previous year, and was even more marked, although the prices for labor, raw materials, interest on capital, and the cost of living have been almost steadily advancing, which, in spite of the increase of trade in nearly every branch, reduced the profits, since prices could not be obtained for the manufactured articles commensurate with the advance in the cost of production.

Another considerable increase was witnessed in the production of the electrical industry, although the previous year had been remarkable in this respect. Prices, however, could not be raised in proportion to the enhanced cost of manufacture. The chemical industry was very lively during 1906, and in some instances the demand was so enormous that it could not be met. Copper has not been as high in forty years, and although the production has been largely increased, consumption of this metal has been even larger. Frankfort is a center of the German metal trade, and its prosperous condition has resulted in the establishment of a mining and metal bank with a capital of $9,520,000.

Single-phase Catenary Line Construction.[1]

By G. D. Nicholl.

The object of this paper is merely to promote a general discussion of the characteristics of catenary construction for the operation of high-voltage electric railways. While there are some high-voltage direct-current railways under construction, I believe none is in commercial operation at the present time, and these remarks will bear particularly on line construction for alternating-current railways.

The introduction of the single-phase alternating-current railway motor brought about the possibility of delivering energy to the car equipments at high voltages and decreasing the investment necessary in copper for the distributing system.

It has also been a problem to collect the current for heavy equipments at high speeds with the ordinary type of wheel trolley, and considerable experimental work has been done to develop a current collector of the sliding type.

There is a difference of opinion among engineers as to whether the current collector should be of the underrunning type or make contact with the conductor on the side or top. In this country, however, the general practice has been to use the underrunning type of current collector, with the trolley wire over the center of the track. In order to operate the sliding current collector successfully at high speeds it is necessary that the trolley wire have a practically smooth and even surface, free from kinks that might cause the sliding current collector to break contact.

Various types of catenary construction have been proposed for different classes of railway service. For trunk-line railroads having two or more tracks the double catenary will undoubtedly be used, the messenger wires being supported from steel bridges spanning the tracks. This class of construction has two messenger wires spreading at the points of support and converging at the center of the span, the trolley wire being supported from both messenger wires by means of hangers of various lengths; a tie also being used between the messenger wires at each trolley support. This type of construction has been used by the New York, New Haven and Hartford Railroad on its electrification near New York city.

This type of construction is expensive, and the cost of it is not warranted for the average interurban line of the Middle West.

Single catenary consists of a single messenger wire with the trolley supported directly underneath by means of hangers of various lengths. Different engineers have different ideas as to the best method of supporting the trolley wire from the messenger wire, also as to the number and length of hangers used. The lines of the Indianapolis and Cincinnati Traction Company, with which the writer is particularly familiar, have single catenary construction. The line from Indianapolis to Rushville was built in the fall and winter of 1904-5 and was, I believe, the first single-phase alternating-current railway in commercial operation using the catenary trolley construction and the bow or sliding trolley.

On the portion of the line from Indianapolis to Rushville the trolley poles are spaced 100 feet apart. From the experience gained on this portion of the line, it was decided to increase the distance between the trolley poles, so that on that portion of the line constructed during the year 1906 the spacing of the trolley poles was increased to 120 feet on tangent track, the distance between poles on curves depending on the degree of curvature. The shortest curve being of three degrees radius, the poles are spaced 50 feet apart, the center of the poles being located seven feet from the center of the track.

The trolley brackets are made of 2 by 2½ by ¼-inch angle iron, the outer end of the bracket being drawn into a loop to form a support for the messenger-wire insulator.

The loop in the trolley bracket is 16 inches long, allowing an adjustment of eight inches on each side of the center line of the track for staggering the messenger and trolley wires and for aligning the trolley wire due to the unevenness of pole diameters and adjustment of messenger wire on curves. The inner or pole end of the bracket arm is bent at right angles to the arm and is fastened to the pole by two through bolts, the outer end of the bracket arm being supported by a ⅝-inch brace rod.

The messenger wire is supported on an especially designed porcelain insulator, the insulator being cemented into a cast-iron base which is fastened to the bracket arm by means of four hook bolts. The messenger wire, which is composed of seven-strand steel cable having outside diameter of 7-16 inch, is supported in the groove of the porcelain insulator and tied to it by a steel tie wire.

The trolley wire, which is of the No. 000 grooved section, is supported from the messenger wire by steel hangers spaced 10 feet apart. Five different lengths of hangers are used, 12 hangers being used between two poles on a 120-foot span, as follows: Two of 11-inch, two of 9 inch, two of 7¾-inch, two of 6¾-inch and four of 6-inch. The hangers are fastened to the messenger wire by means of a "U" clamp and a through bolt, and to the trolley wire by a clamp that fits into the groove, this clamp being held by screws. On curves the trolley wire is held directly under the messenger wire by means of steady strains, one end of the steady strain being clamped to the bracket arm and the other end to the trolley wire; these steady strains are made of treated hickory.

The messenger wire is anchored every mile, a pole being set on the opposite side of the track from the trolley poles and well anchored. A 7-16-inch steel cable is stretched diagonally across the track and securely fastened to the messenger wire. Extra heavy wood strain insulators are placed in this anchor wire to insulate it from the poles, and the ends made up into turnbuckles so the anchor cable can be easily adjusted.

Section insulators are installed about every 11 miles; these section insulators are made of treated hickory. Connection is made to the trolley wire at each end of these section insulators by a knife-blade switch. Normally, this switch is open, but in case of trouble it can be closed, and two sections of the line fed from one transformer station.

In towns span-wire construction is used, extra heavy wood break insulators being placed in the span wires. The messenger wire is fastened to the span wire by special clamps that permit of easy adjustment for aligning the messenger wire with the track, the same style and length of hangers being used on span construction as on bracket arm construction.

Lightning arresters are installed three to the mile, the ground connection being made to a galvanized iron pipe driven 10 feet into the ground.

On private right-of-way the trolley wire is supported approximately 18 feet from top of rails.

In building this line both messenger and trolley wires were run out at the same time and both pulled to the same tension, an equalizer being used between the two wires.

With the length of hangers noted above the trolley wire is supported at an almost uniform distance above the track rails, the successful use of the bow or sliding trolley at high speeds requiring this type of construction.

The insulation of these lines was designed to withstand 3,300 volts of alternating current, and no trouble has been experienced with this voltage. On several occasions the lines have been covered with sleet and wet snow but no trouble developed.

The operation of the bow trolley has proved very satisfactory with this type of construction, there being no difficulty in collecting current at speeds of 65 miles an hour.

1 A paper read before the Central Electric Railway Association at Columbus, Ohio, on September 26, 1907. The author is electrical and mechanical engineer of the Indianapolis and Cincinnati Traction Company at Rushville, Ind.

The Street-railway Conventions.

The American Street and Interurban Railway Association, with the allied bodies of street-railway accountants, engineers and claim agents, will hold its annual convention in Atlantic City on October 14th to 18th, inclusive. The Central Passenger Association has granted a uniform rate of two cents a mile in its territory; the Western Passenger Association grants special one-way rates to its eastern terminals and the Southwestern Passenger Bureau grants reduced one-way rates to St. Louis. Some of the eastern passenger associations have made rates of a fare-and-a-third. The railroad arrangements are somewhat complicated, and persons in doubt should address Mr. B. V. Swenson, secretary of the association, 29 West Thirty-ninth Street, New York city, at once, for full particulars. From Chicago the Pennsylvania Railroad announces that it will run a special train leaving the Union Station at noon on Sunday, October 13th, arriving in Atlantic City about noon the next day. C. L. Kimball of No. 2 Sherman Street, Chicago, can give further information in relation to this train.

The convention meetings and exhibition will be held on the Steel Pier. Hotel headquarters will be as follows: American and Manufacturers' associations, Marlborough-Blenheim; Accountants, Chalfonte; Engineers, the Dennis; Claim Agents, St. Charles.

The exhibit of the Manufacturers' Association on the Steel Pier promises to be larger and more comprehensive than ever before. More than two-hundred different exhibitors have been assigned space.

In general outline, the Engineers and Claim Agents' convention will be begun on Monday afternoon, October 14th, and last through Wednesday afternoon. The Accountants will begin on Tuesday morning and last through Thursday morning. The American or parent association will begin its sessions on Wednesday morning and conclude on Friday morning. On Wednesday morning there will be a joint session of all associations. There will be no banquet. There will be sessions on Monday afternoon; morning and afternoon of Tuesday; morning and afternoon of Wednesday; morning of Thursday and morning of Friday.

More detailed reference to the programme will be made in the Western Electrician next week.

Chicago Street-railway Situation.

As planned, default was made this week by the receiver of the Chicago Union Traction Company on the semi-annual interest due to holders of the $1,614,000 North Chicago Street Railroad refunding bonds. Interest on the bonds, at 4½ per cent., is due April 1st and October 1st, in equal amounts. This makes the amount defaulted $36,315, which, under the promise of Receiver Sampsell to the city when the extension of time for reorganization to February 1, 1908, was secured, will be applied to rehabilitation expenses. Formal protest may follow from trustees of the bonds that get no interest.

The Chicago City Railway Company has made a statement of earnings since the lines came under the new settlement ordinances. The gross earnings from passengers, rent, sale of power, etc., was $4,057,336. Operating expenses and maintenance amounted to $2,840,135, leaving an excess of $1,217,201. Fixed charges, such as taxes and interest, being deducted left the net earnings for the six months, $503,566. This amount is divisible on the basis of 45 per cent. to the company and 55 per cent. to the city, the amounts being $226,605 to the company and $276,961 to the city. Interest on bank deposits amounting to $1,257 is deducted from the company's share and goes to the city.

The Chicago City Railway Company is planning a new system of car dispatching from a central headquarters on each line. This system, which will be tried first on the Cottage Grove line, will, it is said, not only permit of the supervisors notifying the dispatcher and receiving instructions from him in case of trouble or delay, but will also enable the dispatcher by signal to call one or all of the supervisors to the signal telephones located upon the street, so the whole movement of the cars may be intelligently governed by one mind, which directs the movements of the subordinates.

A summary of the recent report of the board of supervising engineers to Mayor Busse, giving the progress of traction rehabilitation work, shows that the Chicago City Company has spent $3,500,000 and the Union Traction Company $1,500.000. The latter company has promised to spend $1,000,000 more before January 1st and the former will add $4,000,000 more if the weather permits late fall work. An estimated total of $10,000,000 for both for the year's work.

The Chicago City Company will have delivered to it within two months 300 new cars. If the experiment is found to work they will be operated on the "Montreal plan" of having the conductor collect the fares when the passengers enter the car, and allow no one to enter after the car is comfortably filled. The company now has 100 more new cars of a similar type, 205 cars of a trifle larger size, of which 90 have been remodeled to conform to the standard, and the remainder will be remodeled shortly, and 110 single-truck cars for cross-town work.

The Union Traction Company has 118 new cars and has contracts for 400 more.

If the weather permits, 62½ miles of new track will be laid this year, 39⅛ by the Chicago City company, and 23⅜ by the Union Traction. With bad weather it is expected at least 50 miles will be completed.

Western Electrical Inspectors' Meeting.

The third annual meeting of the Western Association of Electrical Inspectors will be held in St. Paul, Minn., on October 22d, 23d and 24th. The sessions will be held in the assembly room of the Hotel Ryan. An instructive programme has been prepared for the meeting, and there will be six trips of inspection for those desiring to see up-to-date installations of wiring.

Tuesday, the 22d, besides the president's address and the transaction of preliminary business, will be devoted to reports on uniformity in ruling, National Electrical Code, outside wiring, and theater wiring and show equipment. On Wednesday there will be addresses on the following-named subjects: "Approved Electrical Fittings," by Dana Pierce, Chicago; "Joint-construction Pole Lines," by H. B. Gear, Chicago; "Electrical Inspection from the Viewpoint of the Central Station," by Paul Doty, St. Paul; "Electrical Inspection from the Viewpoint of the Telephone Exchange," by C. M. Manseau, Minneapolis; "Flexible Cord for Pendants," by Hugh T. Wreaks, New York. In the evening there will be a discussion of difficulties arising in electrical inspection work by members.

Thursday will be devoted to hearing reports of committees on these subjects: Grounding of conductors for safety construction and installation of electric signs; show-window and display lighting; instructions to the public concerning the safe operation and maintenance of electric wiring and apparatus; underground systems; installation and operation of induction motors; wiring for electric cranes; laws and ordinances; architects' specifications.

Mr. Waldemar Michaelsen of Omaha, Neb., is president of the association and Mr. William S. Boyd, 382 Ohio Street, Chicago, is secretary.

ELEMENTS OF ELECTRICAL ENGINEERING.

By Geo. R. Metcalfe.

XXXVI. Electric Railways.

Multiple-unit Control.

The types of controllers described in the previous chapter are generally used where cars are operated singly, but where a number of cars are connected together and operated as a train some method of control must be employed in which the train can be operated from the front end of the forward car. Moreover, when very large quantities of current are to be handled it necessitates the use of a very large controller if the K or L type of controller is used, and a very large controller is undesirable on account of the great muscular effort required to operate it.

In the multiple-unit systems the main control switches are placed under the car, or under the car seats, and the master controller which the motorman handles is comparatively small, as it handles only a small amount of current necessary for the electrical operation of the main controller.

There are two general methods of multiple-unit control, one of which is purely electrical and the other electro-pneumatic. One feature is common to both, namely, each car of a train carries its complete equipment of remote-control switches which open and close in various sequences which are determined by the position of the master controller. The main switches operate to produce the same combinations of the motors and resistance as is effected by the type K controllers, that is to say, the first step puts all the resistance and the motors in series, and the last step puts the motors in parallel, with the resistance all cut out. Each car is also supplied with a master controller on each platform, and all the master controllers on a train are connected together in multiple by means of a train line, which is connected from car to car by means of jumpers. In this manner each car is a complete and independent unit whose switches, however, can be operated from any master controller on the train.

The purely electrical system of multiple control is known as the type-M control. The switches which govern the combinations of the motors are electrically operated switches and are called contactors. These contactors can be placed below the car floor in any convenient position, and all of them taken together constitute a series-parallel controller. The different combinations of the contactors are indicated by the positions of the master-controller handle. The contactors consist of a removable arm with a renewable copper contact at one end, which makes contact with a similar fixed contact piece, and a magnet coil, which actuates the movable arm when energized by current from the master controller.

In addition to the contactors, each car is equipped with an electrically operated reversing switch, called a reverser, and a cut-out switch, by means of which all of the control-operating circuits on the car may be cut out. The contactors are provided with a blow-out coil, which prevents arcing when the switches open. In their closed position the contactor contacts are held together by the action of an electromagnet, and when the energizing current is cut off the contacts on the movable arm fall by gravity, cutting off the current supply to the motor.

The master controller is a drum-type switch somewhat similar to the ordinary car controller, but smaller, and is provided with magnetic blowouts. It also has separate handles for the power and the reverser. The power handle is generally provided with a push-button, which must be held closed by the motorman all the time the car is in operation. This attachment is known as a "dead man's handle," for the reason that if the motorman should fall dead or faint or remove his hand from the push-button for any reason the current would be at once shut off from the motors, no matter what the position of the master-controller handle.

From what has been said, it is evident that there are two principal circuits on each car equipped with multiple-unit control. First, there is a pilot circuit, so called, which passes from the line through the master controller which happens to be in use. This circuit carries a comparatively small current, which is only used to energize the contactors. Second, there is the main circuit, which passes from the line to the contactors and thence through the motors. This main current does not pass through the master controllers, and therefore the latter can be made of relatively small size. The master-controller handle has a number of different positions similar to those of the type K controller, and each position corresponds to a certain combination of contactors.

With this system of control each car can be run alone, or any number of motor cars and trail cars can be coupled together and operated as a train, and the cars can be connected together in any order. Where trail cars are placed between motor cars it is necessary to provide them with a train line for connecting the master controllers and reversers throughout the train. The trail cars can also be provided with master controllers from which the train can be operated if desired.

The electro-pneumatically operated system of control is known as the unit-switch system of multiple control and differs in some important respects from the method described above. The main switches in the motor circuit are operated by compressed air, while the valves which govern the admission of compressed air to the main switches are electrically operated. There are thus two entirely distinct circuits on each car.

The operating or control circuit extends throughout the length of the train and receives current from a small storage battery. This is a low-voltage circuit of about 14 volts, and is the only circuit which is brought above the floor of the car.

The motor circuit is confined entirely to each car, and is a 500-volt circuit. This main-motor circuit is located entirely beneath the car floor.

This system, like the one previously described, is designed to operate any combination of motor cars and trailers. The motors throughout the train are operated simultaneously, and each takes its proportionate share of the load. The control is effected from a master controller on the forward platform.

The control apparatus on each motor car comprises the following principal parts: Line switch, switch group, limit switch, reverser, resistance, master controller, plug cut-out, storage battery, battery-charging relay, besides other minor accessories. The functions of these various parts are briefly given below.

The line switch is a circuit-breaker for the protection of the apparatus on the car and is provided with an overload release.

The switch group is a row of unit switches of the same style as the line switch, which are grouped together on a frame forming an air reservoir. Blow-out coils are placed between each of the unit switches.

The limit switch is a solenoid switch operated by the current of one motor. Its function is to give a uniform accelerating current. When the current for which it is adjusted is exceeded, the limit switch opens the operating circuit so that no more unit switches can close until the accelerating current is reduced, when the circuit is again closed.

The reverser is a switch which reverses the armature connections, thereby reversing the direction of the car travel.

The master controller is a small switch located in the motorman's cab, the handle of which has seven positions—the center "off" position and three running positions for each direction of the car. The three positions are "switching," "series" and "parallel." The operation of the master controller will be described later.

The plug cut-out is a plug switch with two sockets. One position of this switch permits the line switch to be closed. The other position resets the overload release of the line switch.

The storage battery is composed of seven cells, and is installed in duplicate on each car, so that one set may be charging while the other is being used.

The battery-charging relay keeps the batteries automatically charged. They are connected in the circuit of the air-compressor motor, and the relay opens the battery circuit except when the battery is being charged.

All of the apparatus is provided with interlocks, so that it is impossible for any of the switches to operate out of their proper sequence. In operating a train, first insert the plug in the cut-out receptacle of the plug cut-out and then move the master-controller handle in the direction corresponding to the desired direction of motion of train. If it is desired to make a slow start, the master controller should be advanced to the switching position only, but this position should not be retained longer than necessary, as it is not a running position. If this does not start the train, or the speed is not high enough, the switch group can be made to advance one switch at a time by repeatedly moving the master controller handle to the series position and returning it promptly to the switching position. In making the ordinary starts in service, throw the master controller handle to the "series" or "multiple" running position, according to the speed desired.

When the handle of the master controller is thrown over without stop to any position, e. g., parallel running, the switches close automatically in such sequence that the car starts and is brought up to full speed at uniform acceleration, until full voltage is applied to the motors.

[*To be continued.*]

Note.—This series of articles, intended to survey, briefly, the whole field of applied electricity for light, power and heat, was begun in the Western Electrician of February 2, 1907.

QUESTIONS AND ANSWERS.

Electric Elevators.

Mr. Harrison W. Craver, technology librarian of the Carnegie Library, Pittsburg, kindly contributes the following:

"In your issue of September 14th, page 201, you inquire concerning books on electric elevators. A search of some extent has not given us anything better in English than the volume on Steam Engines and Elevators in the International Library of Technology. This is published by the International Textbook Company, Scranton, Pa."

Operation of Motor Generators.

P. L., Kenora, Ont.: Is the efficiency of a motor-generator set changed if the direction of rotation is reversed?

Answer.

The efficiency of such a set should not be affected by reversing its direction of rotation, for the efficiency of a motor or generator is independent of that feature, other things being equal. In direct-current machines you must make sure that the angle of brush lead is not changed after reversal, and in any machine connections must be correctly made.

Motor Troubles.

F. M. M., Duluth, Minn.: I recently rewound a Westinghouse alternating fan motor. It is wound with four square-shaped coils of 528 turns of No. 25 double cotton-covered wire. There are also four solid pieces of copper, oblong in shape, placed on one end of the pole-pieces, to give it the direction to rotate. I am sure I have the coils connected right, or rather, I think I have, but I can't make the motor run full speed. If I run it half an hour, the rotor gets very hot and the coils commence to smoke. I also have trouble with two Crocker-Wheeler motor-generator sets. They don't seem to want to carry their full load. I recently rewound the armatures, but it doesn't help any. I'm obliged to replace the brushes every other day. If I roughen the commutator they run away above their voltage. I then cut in resistance in the field and bring it down to normal. But the voltage varies continuously. The brushes seem to me to be very thick for a four-pole machine of five kilowatts, but if I use thinner brushes they spark badly. Could I remedy the trouble by taking the armature core to pieces and anneal the laminations? The machines are not grounded. They are 500 to 110-volt, and I tested them with 1,000 volts; neither is there any short-circuit in the winding.

Answers.

1. If the coils of the fan motor as rewound are identical with the original coils, and if the voltage and frequency of the service are those for which the motor is designed, then the connections between the coils are incorrect.

2. The information is too incomplete for a proper diagnosis of the trouble.

Copper Market.

The copper market continues in an unsettled state. The prices have declined to 15¼ to 15½ cents a pound for Lake copper and 15 to 15¼ for electrolytic. There is no telling whether these are bottom prices or whether a further decline may be expected. These low values are being quoted to stimulate a more brisk demand, but up to the present this has not materialized to the extent that was anticipated. The uncertainties in both the copper and money markets have brought about a more conservative attitude on the part of backers of large new projects and, therefore, of large buyers of copper, with the result that the copper trade is quiet.

SELLING ELECTRICITY.

Under this heading will appear, from time to time, articles, suggestions and examples which will be of assistance in the constant effort to increase the existing demand for electric current and to create new demands.

Electricity as a Factor in Advertising.

At the recent convention of the Pacific Coast Advertising Men's Association at Sacramento Mr. Bury I. Dasent, advertising manager of the Portland (Ore.) Railway, Light and Power Company, gave an address in which he made a strong plea for a greater use of electric signs. Some of his suggestions will be valuable to central-station men in their effort to sell current.

Mr. Dasent said:

The relation of electricity to advertising in its most utilitarian aspect is not intricate, nor does it involve abstruse considerations such as are ever present in the mental processes of the ad-writer in the preparation of copy for even the most simple five-line "want ad;" but it is, however, well worth studying. The science of advertising changes rapidly to meet the varying conditions of supply and demand, of media, of environment, of trade relationships and of exigencies of business requiring immediate and forceful publicity, but the art of employing materials at hand to produce desired results follows lines which are to a very considerable extent subject to fairly well-defined laws which are framed inevitably for appeal to that court of last resort, the human eye. In other words, the fundamental law with respect to all forms of advertisement is based upon its appeal to the vision.

That this deduction is correct is amply proven by the enormous increase in the use of illustration in advertising, as well as the universal recognition by advertisement writers that much depends upon the display, form and effective typographical setting of the advertisement. It will thus be seen that consciously, or unconsciously, the appeal of the writer of advertisement is not primarily to the quality of reason but to the sense of sight, and continuing in sequence still farther along this line of reasoning we find the fundamental bases of all advertising to be optional, physiological, æsthetic and utilitarian. This brings us logically to the illuminated advertisement, par excellence, i. e., the electric sign, the electric lighted show window, the electrically illuminated store and the electric lighted street.

Curiously enough, this selection of the human vision upon which to concentrate the appeal of the advertisement, like most rules of human conduct, finds its justification in a law of nature. It is stated by a German scientist in regard to the sensitiveness of the eye that the persistence of visual impressions tends to form a retinal image which is transferred to the brain centers. Optically, this statement is not of startling novelty, for the eye is an organ that has been developed through ages of evolution, but physiologically it is of deep significance in any consideration of the relation of electric light to advertising.

The ultimate aim of any advertiser is to make the name of his product as nearly standard as possible, so that when you think of that particular article or experience a desire for it you will recollect his brand, the kind he makes—and to attain this end most readily his advertising must be so devised that a retinal image of this particular product, or of its name or brand, is readily transferred to the brain of the public.

What devotee can readily forego the spell cast by the electric time-recording sign with its direct command "Time to Take a Wilson High Ball" when seated in club or cafe, after watching the marvelous working of its electric mechanism and play of light—all-powerful in the formation of a retinal image.

A retinal image is instantly gained by a glance into a brilliantly illuminated show window radiant with electric light. Displayed thus favorably, the merchant's wares take on a new character. Under the well-diffused illumination afforded by electricity the various articles are seen "true to life" as to color, size and shape, while every minute detail of texture and of fabric is revealed in the beautiful, soft, unobtrusive light, sunlight in character and brilliancy, but infinitely more dependable. Here you have the zenith of cumulative visual impression, the absolute perfection of the art and theory of illustrative advertising—the one perfect appeal to the eye, to the senses, to the fancy, to the humor, to the reason!

The enormous increase in the use of electric signs in Portland, and indeed throughout the United States, simply means that merchants have begun to realize their tremendous possibilities as trade-bringers. Frank R. Woodard, director of publicity for the Gunning System of Out-Door Advertising, said in a recent address, "The test of the pudding is in the eating, and there is but little question that of all forms of out-of-door advertising none has stood the test so well as the electric sign. The rapid increase in their use, the comparative low cost of operation and maintenance, has made them exceedingly popular, and the man who is bidding for the public's patronage and fails to use the electric sign is not improving his opportunities. It is [illegible] statement and entirely within reason that [illegible] people see an electric sign at night where one [illegible] sees an ordinary sign in daylight

The business men of Portland who employ electric signs are up-to-date and keenly alive to their opportunities and necessities. Advantageously located in the shopping district, these electric signs are seen by thousands of pairs of eyes during the daylight hours; but it is at night, when the electric current illumines the many lamps of which they are composed, that these silent salesmen accomplish the most good.

Electric signs have assumed such importance in the business-getting plans of progressive merchants that even staid and conservative concerns such as banks have been brought to a realization of their value. A prominent banking institution of Portland last winter broke away from its hide-bound traditions of conservatism and installed an electric sign of the "flasher and chaser" variety, bearing the legend, "We Pay Four Per Cent." It was something unique for an establishment so dignified, but what was the result? The day after its installation a stranger entered the bank and, depositing $10,000, remarked, "I don't reside in your city—but I happened to see your electric sign last night, and was so impressed that I decided to open an account with you."

This sign is a large and expensive one, but I have been assured by an officer of the bank that the profits traced directly to its influence paid for the sign within eight days after its installation. Looking between the letters of the electric sign one always reads "Prosperity."

It must not be forgotten that practical needs must be considered quite as seriously as æsthetic aspirations, especially in a domain of so great and general importance as advertising.

The advertising man must, of all men, be free from the fetters of convention. We are some of us fettered by training, by tradition, by precedent, and venture too little beyond our immediate conditions to be able to rise to the portrayal of images of individual originality. We must not forget that just so long as life lasts and impressionability and plasticity remain, humanity is always adapting itself to its environments and seeking—originality!

Let us be honest with ourselves—with our clients! Throw tradition to the winds and break loose from the fetters of custom. If we find that the electric sign is the best media for our client, let us recommend its use. Nothing can ever replace the newspaper as the logical medium of publicity. Its position is unassailable, but there is a place for the electric sign, a most important place—and one of no mean proportions. We all realize the importance of the selection of the right media to national advertisers.

Is it not significant that the national advertisers have taken up the electric display signs and are rapidly installing them in all the larger cities of the country as well as in their factories and salesrooms? The railroads with all their advantages in the distribution of literature concerning their systems are yet liberal users of electric signs. I tell you seriously that there is absolutely no business, no attraction, that appeals to the public that cannot be intensified, built up and advanced by the proper use of display electric-sign advertising. Even the churches are installing electric signs, as we find in the cities of Brooklyn, N. Y., and Cleveland, Ohio, where electric signs have been installed by houses of worship with gratifying success.

In Denver, Colo., the citizens have erected a great arch, which stands inside the grounds of their Union Railway Station, and which bears a monster electric sign with the word "Welcome"—a perennial smile upon the face of their city, and a blazing salutation to the stranger at their gates. This is municipal advertising of a high order, and the fame of Denver's electric "Welcome" has spread throughout the United States.

In many cities throughout the country enterprising merchants have combined to secure the effective advertising of particular sections and streets by the adoption and installation of an especially efficient scheme of special street illumination, using incandescent lamps of high candlepower. Experience has shown that where a street, formerly dark and unattractive, has been so illuminated a business reanimation has speedily followed. The city of Portland is now experiencing this renaissance of street illumination. The transitional movement in streets and sections so lighted is characterized by an unquestioned business revival, and as a result the Portland Railway, Light and Power Company is now engaged in the installation of these lamps in various sections of the city for business men who are interested in the stimulation of trade and the improving of the lighting in the vicinity of their places of business, and for the further purpose of beautifying and advertising the streets in which their stores are situated. It has been realized by the enterprising business men of Portland that this plan of special illumination forms an advertising feature of tremendous value, and one that is absolutely necessary if they would keep abreast of the times.

The great increase in the use of electric signs, and the ever-widening utilization of electric light for purposes of advertising in Portland is not surprising. Wide-awake communities throughout the United States have all adopted this powerful means of publicity, and the public has come to look upon these messages written in electric light as convincing evidence of the enterprise and up-to-date character of the business houses which utilize them.

Perhaps no feature has contributed more largely to the growing popularity of this means of advertising than the easy adaptability and flexibility of the electric sign in fulfilling the requirements of advertisers, while the low cost which attends even a lavish employment of electric current, for purposes of advertisement, forms an additional reason for its universal use.

The sign of the times in Portland is, beyond doubt, the electric sign. At least that is the impression gained during a stroll through the streets of the business district after nightfall. On every side are seen electric signs of all shapes, sizes and colors, advertising every kind of business, and not only branding their legends upon the brains of the multitude, but proclaiming that here is an up-to-date banking establishment, there a progressive clothier, here a furniture store that has forged to the front, there a business man who believes in modern methods of merchandising.

To the electric sign Portland owes its brilliant thoroughfares, and its air of metropolitan gaiety throughout the hours of the evening. With shops and streets ablaze with electric light many more people venture out at night, and, if anything, the throngs are now greater after nightfall than in the daytime.

The electric illumination of Portland's shopping district constitutes a spectacle that is free for the enjoyment of all, and the great public loves spectacular effects, and will go a long way to see and enjoy them. Until this electric era began the merchant put up his shutters or pulled down his shades when he closed the doors of his store. His expenses—rent, salaries, insurance—all went on, but his business stopped. That was the ancient way. With the modern way—the electric way—business no longer slumbers, for the store keeps glittering eyes open for trade throughout the lingering hours of the night, and whets the desires of the multitude by tempting displays under the glittering rays of the electric lamps.

Trade follows the light, wherever that light may be placed, and the allurements of electric light and electric signs are but the working out of the same natural law that draws the moth to the lighted candle.

Electric signs are all conspicuous in the daytime, but, brilliantly illuminated at night by electric light, they compel the attention of the evening crowds upon the streets.

Why One Man Patronizes the Electric-light Company.

"Tactful relations with customers," as Mr. J. W. Ferguson phrases it, pay. This seems to be shown by the following communication recently printed by the Chicago Daily News:

"Will someone please tell me what scheme the gas company uses to increase the size of the bills of its patrons? Can a 'gas inspector' with a monkeywrench so manipulate a meter as to increase the register to whatever size the company thinks is normal?

"Yesterday my wife was in the basement of our flat building when a gas inspector came in. My wife asked him what he wanted. He said that his company had an idea that the bills for illuminating gas from the flats in the building were not big enough, and for that reason the company feared there was something wrong with the meters. He acknowledged that the readings from the cooking-gas meters were all right.

"My wife then explained that we used electricity for illumination, as did nearly all the tenants in the building, and she went on to explain that they patronized the electric company rather than the gas company principally because the officials and agents of the electric concern were quicker to respond to 'kicks' and were more polite in their treatment of patrons. After confessing that perhaps this was so, the man said that perhaps the falling off in gas consumption would explain why the employes of the company had been granted only one week's vacation this summer.

"Then he set to work with his monkeywrench, and I suppose that next month our bills will be increased to a size that will please the company. But what right has any gas inspector to 'monkey' with the meter?"

Something Doing in The Bronx.

It is not so long ago that tradesmen in The Bronx had to be urged to make great use of electric light in shops and show windows and to use electric signs for the kind of advertising that "keeps everlastingly at it." They seemed to think the outlay high and approached the problem with unusual reluctance. Those unacquainted with The Bronx do not know how different is some of its ways from those of Manhattan.

Each has its own commercial problems, and each its own excellent way of solving them. An increase of 44 per cent. in its electrical development during the last 12 months is one of the ways of The Bronx.—Bulletin of New York Edison Company.

Portable Wattmeter Calibrators.

The importance of calibrating meters in service at regular intervals is recognized by all central station men and a means by which this periodical calibration may be done quickly, without in any way impairing the accuracy of the result, is received with favor. In the type KM 1 calibrator, made by the Fort Wayne Electric Works, and illustrated herewith, no stop watch is required in calibrating meters, except in standardizing the instrument itself, nor is it essential that the load be constant. It is only necessary to observe the revolutions of the meter under test and the pointer indications of the calibrator before and after test, from which, by the use of the proper constants the watt-hours registered by the meter under test and the calibrator may be determined. The calibrator is so designed that it covers the range of most meters in service from light to full load, for either 110 or 220 volts, two or three-wire circuits. This is a very desirable feature in that it saves carrying more than one standard.

The calibrator is enclosed in a mahogany carrying case provided with a carrying strap for use in transportation. The cover is hinged and provided with a lock which prevents tampering by unauthorized persons. The case is of a convenient size, the over-all dimensions being 8 by 8 by 10¼ inches high.

The register is located on the top of the calibrator so that the pointer indications can be read by the operator at a distance if necessary, as in

PORTABLE WATTMETER CALIBRATOR.

checking a meter installed close to the ceiling with the calibrator resting on the floor. The dial is 2¾ inches in diameter and provided with three pointers, the larger of which reads directly in revolutions, being connected directly to the shaft, and which in turn drives the units and tens pointers through the medium of two 10:1 reductions. The periphery of the entire dial constitutes the tenths circle and is divided into ten large divisions which in turn are subdivided into ten smaller divisions so that the pointer indications may be easily read to one-hundredth of a revolution. The units and tens circles are within the large circle, the former reading one revolution per division and the latter reading ten revolutions per division.

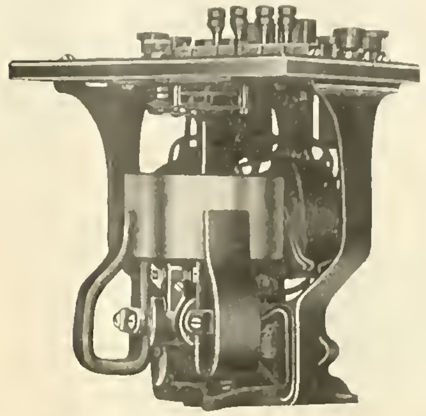
The dial is covered by a suitable glass held in place by a spring brass ring.

Directly in front of the dial is located a small knurled thumb-screw by means of which the rotating element may be raised from the jewel and locked firmly in transportation.

The rear section of the top of the calibrator constitutes the terminal plate to which all connections are made. On this plate are located four current binding posts to which the current coils of the calibrator are connected. On this plate are also located plug switches by means of which the current capacities of the calibrator may be changed. The current coils (two in number) are wound in sections which may be connected in series or series parallel with the plug switches and in parallel with the plug switches in conjunction with the cable connectors on the current leads. Directly behind the plug switches are located the potential receptacles, one for use on 110 volts and the other for use on 220 volts. These receptacles are provided with caps to prevent dust entering the interior of the calibrator when not in use. On this plate are also two one-ampere fuses to protect the one-ampere winding from possible injury due to improper connections.

Each calibrator is furnished with a set of current and potential leads. On one end of each of the current leads is a small punched terminal for connection to the binding posts of the calibrator. The potential leads are provided with a plug at one end for connection to the calibrator. The other ends of these leads have spring clips for connection to the line.

The top bearing is located in the top plate of the register and is easily accessible by removing the glass and pointer over the dial. The top bear



CALIBRATOR REMOVED FROM CASE.

ing may then be readily unscrewed for inspection. The lower bearing consists of a cup diamond jewel mounted in a post set on a carefully selected spring to take up sudden jars which might be caused by setting down the instrument while the pivot rests on the jewel. The lower end of the shaft is provided with a removable pivot in order that the lower bearing may be replaced without replacing the entire shaft.

The entire calibrator may be lifted out of the case by removing the screw under the strap in the bottom of the case. The top plate is made of hard rubber in two sections, all of the connections being made on the rear section. This feature permits the removal of the register and rotating element without interfering with the connections. The shaft is made in three sections: the top bearing pivot, the shaft proper and the jewel pivot.

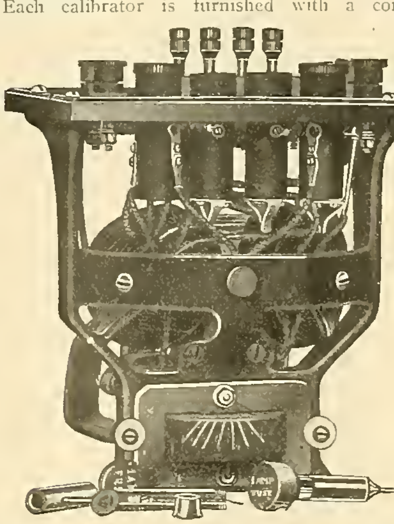
The windings selected as most suitable for meter testing are 1, 2, 5, 10 and 20 amperes and 110 and 220 volts. With these windings meters up to and including 25 amperes, two-wire, either 110 or 220 volts, and up to and including 12½ amperes, three-wire, 220 volts, may be tested. The ampere turns of all the windings are equal, therefore the torque is constant when the meter is operating on a given percentage of full load for any of the different windings.

In checking the calibrator the same rules are followed as in testing standard type K meters with the possible exception of the formula which with the constants furnished with the calibrator becomes:

$$\frac{3{,}600 \times \text{revolution} \times \text{calibrating constant}}{\text{seconds}} =$$

watts registered by calibrator.

Each calibrator is furnished with a complete



BACK VIEW OF CALIBRATOR REMOVED FROM CASE.

list of calibrating constants (reading in watt-hours per revolution) corresponding to the different capacities.

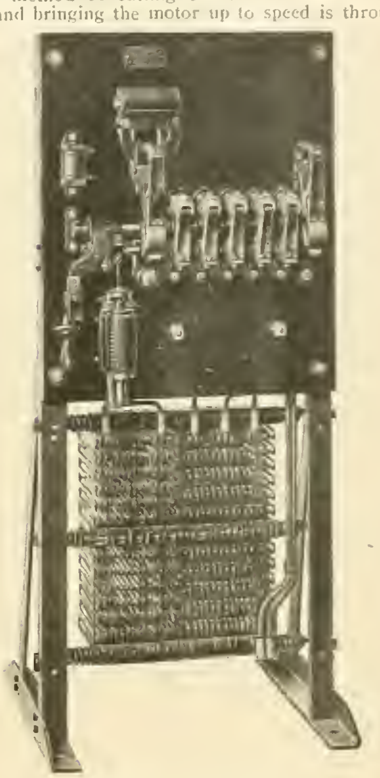
For operation the calibrator is placed in a level position and the rotor is lowered by means of a knurled thumb-screw on the top. The rotor should always be raised in transportation. The current lead terminals stamped A, B, C and D should be connected to correspond with the stamped binding posts on the calibrator, these connections to remain the same for all circuits. The other terminals of the current leads are connected to the meter under test and the line, according to instructions furnished with each calibrator and pasted on the inside of the lid. Different current capacities are obtained by plug switches, which are also fully explained in the instructions.

After making the proper connections for calibrator and meter under test, a reading of the dial should be taken. The calibrator should then be started simultaneously with the counting of the revolutions of the meter under test and stopped after the desired number have been taken. The difference between the first and last reading of the calibrator gives the total number of revolutions. The watt-hours registered by both meters is the product of the revolutions and their respective calibrating constants. These constants being the watt-hours registered per revolution, therefore, the relative accuracy of the meter under test is shown by the ratio of the watt-hours registered by the two meters.

A New Combination Starter.

The J. L. Schureman Company has recently placed on the market a combination starter (type EH), which can be operated automatically or by hand. This has been designed chiefly for the control of motor-driven fire pumps, but will probably be used for a great many other purposes, as the additional charge over that for an ordinary automatic starter is not great.

The method of cutting out the armature resistance and bringing the motor up to speed is through



A NEW COMBINATION STARTER.

a series of cam-operated switches, the shaft on which the cams are mounted being revolved in one case by a solenoid through the medium of a rack and pinion, and in the other case by a hand-operated lever.

An overload device is used which breaks the circuit of the solenoid under an overload condition and also breaks the mechanical connection between the lever and the cam shaft so that the entire bank of resistance is cut into the armature circuit, whichever method of operation is being used. This is of particular value when the apparatus is being started by hand, as it prevents the operator from cutting out the resistance too rapidly and makes the apparatus "fool-proof."

The type EH starter is mounted in panel form, so that all wiring is accessible from the back of the controller. The resistance is ordinarily made of cast-iron grids, and is mounted at the base of the panel and to the rear.

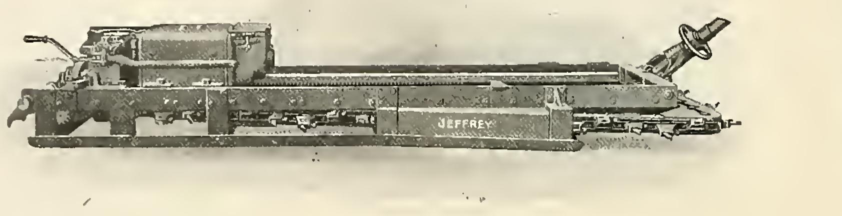
The Chicago City Railway Company has recently placed an order with Yeomans Brothers of Chicago for a fire pump complete with "Schureman" 100-horsepower 550-volt type EH starter for one of its power houses.

The Evansville and Southern Indiana Traction Company in an answer to a suit for damages growing out of an accident to a child during the recent street-railway strike denies all liability, asserting lack of police protection. Strikers and their sympathizers are said to have overpowered the conductor and motorman, and while in possession of the mob the car was run so fast that it left the track, ran into a house and injured a child. At the trial the company expects to show that it is not responsible for the accident.

Electric Coal-mining Machines.

The Jeffrey mining machines with flame-tight motors and starters, shown in the accompanying illustrations, were brought out almost simultaneously with the publication of the British Departmental Committee's report upon the use of electricity in mines. This report, which embodies rules for the use of electricity in mines, recommended the adoption of entirely enclosed motors and auxiliary devices, such as starters, terminals, etc., for all mines coming under general rule No. 8 of the Coal Mines Regulation Act of 1887.

Mining machine motors of necessity have to be designed to be very compact. It is therefore necessary that every advantage be taken of space, so that the motors will not heat excessively under their regular duty. In this country, where the mines are very free from gas, the open type of motor has found favor on account of its accessibility, and on account of the fact that the same motor capacity can be put into smaller space in the open type than in the enclosed type. By careful designing, however, the Jeffrey Manufacturing Company of Columbus, O., says that it has been able to put upon its mining machines motors of the enclosed type which are of equal capacity to those of the open type formerly used, while the enclosed motors occupy practically no more space than those of the open type.



ELECTRIC COAL CUTTER WITH ENCLOSED MOTOR.

Mining-machine service is probably the most severe of any service which electric motors are called upon to perform. The insulation has to withstand both oil and moisture, as well as heat, and infinitely more dirt and less attention than in any other service known. The motors illustrated are provided with self-oiling ring-oiling bearings, which are so arranged that the oil hermetically seals the motor so that any gas which may accumulate about the motor cannot be ignited by sparking at the brushes, or any interior trouble with the motor. Over the commutator of this motor is a plate glass door, protected by a heavy malleable iron lid. Through the plate glass door the brushes may be observed without opening the motor to mine gases.

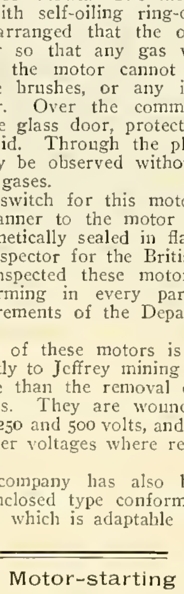
The starting switch for this motor is protected in a similar manner to the motor itself, all contacts being hermetically sealed in flame-tight metal casings. The inspector for the British Government who recently inspected these motors, pronounced them as conforming in every particular to the rules and requirements of the Departmental Committee.

An advantage of these motors is that they can be applied directly to Jeffrey mining machines with no other change than the removal of the existing open-type motors. They are wound for standard voltages of 220, 250 and 500 volts, and may be wound specially for other voltages where requirements demand it.

The Jeffrey company has also brought out a motor of the enclosed type conforming strictly to the mining laws, which is adaptable to low or thin vein machines.

Security Motor-starting Panels.

A new form of motor-starting unit combining all the safeguards required by the National Elec-



SECURITY MOTOR-STARTING PANEL.

trical Code has just been brought out by the F. Bissell Company of Toledo, O. As shown by the accompanying illustration, the Security motor-starting panel is of compact and neat design. The automatic circuit-breaker takes the place of the main switch and fuses, although these are furnished when desired. These units provide protection for both over and underload, and are fire and fool-proof. The panels can be obtained without the starting rheostat when so ordered. This panel has been brought out to meet the demands for an efficient self-contained motor-starting panel.

LEGAL NOTES.

In a case in equity on final hearing before the United States Circuit Court, District of New Jersey, the question presented was whether the defendant (Prudential Insurance Company of America) has infringed complainant's (Westinghouse Electric and Manufacturing Company), patent No. 582,481, dated May 11, 1897. The patent was issued to the complainant as assignee of Edwin E. Nolan, and is entitled "Fastening Means for Core-Plates of Electrical Machines." Judge Lanning says: "In my opinion the complainant's patent is good as to claims 2 and 4 and invalid as to claims 1 and 3, and that the defendant's device is an infringing one as to claims 2 and 4. There will be a decree according to these views."

A suit in equity was brought by the General Electric Company against Corliss-Coon and Company to restrain alleged infringement of the Carl Eickemeyer patent No. 677,308 for an alternating-current motor. Claims 1, 2, 9 and 16 only were at issue, covering what is known as the Eickemeyer squirrel-cage winding. Judge Ray's opinion is that the claims in issue are valid and infringed by the defendant.

In the case known as the self-regulating transformer case involving the Stanley patent No. 469,809, the United States Circuit Court, Southern District of New York, has ordered a preliminary injunction restraining until further notice the defendant, the Wagner Electric Manufacturing Company, from directly or indirectly manufacturing or selling or using any system of electrical distribution or other apparatus containing or employing the inventions or improvements described in the patent named, particularly the first and third claims and that it desist from making alternating-current transformers substantially like those referred to in the complainant's affidavit. The Westinghouse Electric and Manufacturing Company as assignee of William Stanley, Jr., is complainant.

In the United States Circuit Court, District of New Jersey, the General Electric Company was complainant against the Bullock Electric Manufacturing Company, defendant. The complainant is the owner of the Morrow patent No. 504,401 and of the Reist patent No. 559,910, each for an armature for dynamo-electric machines. They are capable of conjoint use. Each patent was issued to the complainant as assignee of the inventor. The defendant was charged with their infringement and the defense set up as to each patent was invalidity of the patent and non-infringement. The final conclusion reached by Judge Lanning is that the complainant is entitled to a decree adjudging the defendant an infringer of Claim 2 of the Morrow patent, but not of the Reist patent, Claim 2 of which is anticipated by Crompton.

A motion for preliminary injunction was brought in the United States Circuit Court for the Middle District of Tennessee by the General Electric Company against the city of Nashville, Tenn., to restrain the city from the further use of some alternating-current generators manufactured by the Bullock Electric Manufacturing Company of Cincinnati, O. These generators have laminated pole pieces attached to the revolving field spider by means of bolts from the spider engaging a transverse bar embedded in the pole piece, a construction said to be covered by the Parcelle Patent No. 463,704, granted November 24, 1891, which has been heretofore sustained by the courts. Judge Clark holds that the defendant has not produced any new matter tending to invalidate the patent and that, therefore, there is no reason why injunction should not issue, this patent having previously been held valid by the Court of Appeals for the Sixth Circuit of Cincinnati.

A Large Roof Sign.

An electric sign 100 feet long by 50 feet high has been placed on the roof of the Colgate factory in Jersey City. Each letter is 10 feet high and the words are in three lines. It is intended to increase the size of the sign to 200 feet long by 50 feet high, when it will contain about 2,500 lamps.

The New Canadian Tariff.

The new Canadian tariff, which went into effect last May, provides for the assessment of three rates of duty: First, the "British preferential," the rates of which apply to goods produced or manufactured in certain-named British possessions, including the United Kingdom; second, the "intermediate," applying to goods of any British or foreign country to which its benefits shall have been extended in a manner prescribed when imported direct from such foreign country or from a British country; and third, the "general tariff," applying to all goods not entitled to admission under either of the foregoing classes. Following are some items of interest to electrical men:

	Br. Pref.	Interme.	General.
Carbons, over 6 inches in circumference	Free	Free	Free
	Pr. Ct.	Pr. Ct.	Pr. Ct.
Electric light carbons and carbon points, of all kinds, not otherwise provided for	22½	32½	35
Incandescent lamp bulbs and glass tubing for use in the manufacture of incandescent lamps	5	7½	10
Wire, single or several, covered with cotton, linen, silk, rubber or other material, including cable so covered	20	27½	30
Electric light fixtures or metal parts thereof	20	27½	30
Motor cars and motor vehicles of all kinds	22½	30	35
Telephone and telegraph instruments, electric and galvanic batteries, electric motors, dynamos, generators, sockets, insulators of all kinds; electric apparatus, not otherwise provided for	15	25	27½
Electric or magnetic machines for separating or concentrating iron ores	Free	Free	Free
Brass caps adapted for use in the manufacture of electric batteries	Free	Free	Free

The Great Proportion of Central Stations in Small Towns.

Mr. J. Robert Crouse of the Co-operative Electrical Development Association has caused to be prepared some interesting statistics of the central stations of the United States, showing the number that give night service only and those that supply 24-hour service. Excluding municipal plants, and classifying the stations by the size of the towns in which they are located, the figures are as follows:

Population of Cities:	Night Service Only.	24-Hour Service.	Total.
1,000 and under	730	554	1,284
1,000 to 5,000	1,158	1,000	2,158
5,000 to 10,000	69	365	434
10,000 to 25,000	21	310	331
25,000 to 50,000	5	119	124
50,000 to 100,000	1	56	57
100,000 to 250,000	6	40	46
250,000 to 500,000	1	23	24
500,000 to 1,000,000	....	13	13
1,000,000 and over	1	14	15
Total	1,992	2,494	4,486

Including municipal plants, the grand total of central stations in the United States is given as 5,577, and of these 1,466 are in places of less than 1,000 population. Of the private-owned central stations 75 per cent. are in towns and villages of less than 5,000 population.

Electric-railway Extension in Northern California.

The filing of incorporation papers of the Northern Electric Railway Company indicates the consolidation of electric-railway interests in Northern California and a plan to extend the system to make it one of the most comprehensive in the state. It is said that the Western Pacific Railroad and the Gould interests are interested. The objects of the company are said to be to acquire the properties of the Northern Electric Company and the Shasta Southern Railway Company, and to build other electric lines in Northern California. The Northern Electric Company, which is to be acquired by the new company, owns the railway running from Chico, Butte County, to Sacramento, by way of Oroville, Yuba City and Marysville. The Southern Railway, whose properties are also to be acquired, operates the electric line from Chico to Hamilton. Lines are to be built by the Northern Electric Railway Company as follows: Chico to Redding, through Red Bluff, 76 miles; Sacramento to Folsom, 20 miles; Sacramento to Hamilton, 108 miles, with a branch 28 miles long from Colusa to Yuba City.

Proposed Code of Ethics.

At a meeting of the board of directors of the American Institute of Electrical Engineers held on August 30th these resolutions were adopted:

"Resolved, That it is the opinion of the board of directors that the American Institute of Electrical Engineers should adopt a code of ethics.

"Resolved, That the draft of the code of ethics as presented at this board meeting be submitted to the membership as the preliminary draft of the proposed code, and that suggestions for alterations or amendments be invited to be sent promptly to the code of ethics committee."

The draft of a code of ethics referred to was presented at the Niagara Falls convention of the Institute last June and was printed in full in the Western Electrician of July 6, 1907.

Statistics of Street-railway Car Manufacture.

The most recent statistics of street-railway car building indicate the large growth in street railways since 1890, since there has been an extraordinary growth in the industries engaged in the construction and repair of street-railway cars. The value of the products of car manufactories has nearly quadrupled during the last fifteen years, increasing from a total value of $6,268,462 in 1890 to $24,281,317 in 1905. The increase from 1890 to 1900 was $10,407,717, or 166 per cent., and that for the five years from 1900 to 1905 was $7,605,138, or 45.6 per cent.

Street cars are manufactured by two classes of shops, one being independent of the street-railway companies, and the other being operated by the companies, and doing repair work.

Of the 100 establishments engaged in the street-car industries at the census of 1905, 80 were street-railway repair shops. Notwithstanding the fact that there were six times as many repair shops as establishments engaged primarily in the manufacture of street-railway cars, the latter represented an investment of $12,975,703, or 50.1 per cent., of the capital employed in the combined industry, and manufactured a product valued at $10,844,196, or 44.7 per cent., of the value of products for the two branches of the industry.

The repair shops employed 11,052 wage-earners and paid in wages $7,012,798, which constituted 70 and 71.2 per cent., respectively, of the totals for the combined industries. Less than five per cent. of the value of the products of the street-railway repair shops resulted from the manufacture of cars. On the other hand, with the car-construction shops 76.6 per cent. of the value of the output was represented in the building of cars.

The number of street-railway cars built during the year 1905 was 4,694. These cars were valued at $9,902,316, and practically all of them were electric. No cable cars were reported, and only 42 were cars for horse lines. Of the electric cars built in the shops independent of the railways, 2,621 were closed, 554 open and 502 were of the combination class, leaving 251 of other varieties.

Ohio was the leading state in the value of products, so far as the independent shops were concerned, furnishing $1,828,326, or 16.9 per cent., of the total value of products for such shops. New York ranked first in the value of the products of the repair shops, with $3,879,933. The other states with products valued at more than $1,000,000 were Pennsylvania, with $1,258,542; California, $1,228,443; Missouri, $1,210,961, and Illinois, $1,142,562.

Canadian Telephone Items.

The Saskatchewan provincial government has decided upon a system of government-owned long-distance telephone lines similar to those now being completed by the province of Alberta and about to be commenced by Manitoba. With the object of ascertaining the feelings of the people on the question, circular letters were sent out to each municipality asking the name and strength of the operating company and for any other information available. Francis Dagger, Regina, Sask., telephone expert for the province, has received replies from 36 towns. It is understood that the Saskatchewan government, in which province all the towns are located, will give every assistance possible to towns and municipalities wishing to install municipal systems, and small Independent companies can be started to advantage in the majority of the towns where there are no telephones.

A Bell Telephone Company's exchange has just been opened at Battleford, Sask., with 135 subscribers.

The Manitoba government will install an automatic telephone system in the provincial buildings, Winnipeg, in the near future. This announcement was made by Hon. J. H. Howden, minister of telephones. The system will include the courthouses, parliament buildings, old and new land titles buildings, jail, etc. There will be between 60 and 70 telephones in the system, and these will be placed in every office connected with the civil service. Work will be commenced shortly and will be completed this winter. The exchange will be in the parliament buildings, and the other buildings will be connected by subways.

All the subways and pipes have been laid south of Portage Avenue in connection with the government telephone system in Winnipeg, Man. The pipes are laid in cement, and cables will be run through from manhole to manhole. Orrin F. French is superintendent of telephone construction, Winnipeg, Man.

The provincial government's telephone lines have been completed in several parts of Alberta, and work is proceeding briskly on the unfinished sections. When the Alberta government promised 500 miles of government line in operation before the end of 1907 there were a number of scoffers, but from the progress made by the various gangs it is evident that some 600 miles will be in working order before the arrival of 1908. It is said that the government mileage will exceed that of the Bell company by at least 200 miles before the end of the year. R.

Indiana Telephone Items.

The Home Telephone Company of Waterloo is preparing to install a modern telephone plant and establish toll line connection with all the surrounding towns and cities, including Fort Wayne and its toll-line connection. The Home Telephone Company has been reorganized.

The citizens of Dale and vicinity, in Spencer County, having grown dissatisfied with the telephone service of the Cumberland and the Home Telephone companies, have organized a mutual company of their own and will install a new plant with the principal exchange in Dale.

The annual meeting of the stockholders of the Lafayette Telephone Company, held recently, resulted in the re-election of all the old officers. The report of the secretary showed that more than 200 telephones were added during the last year. The company has expended over $150,000 in construction and equipment at the new plant, which is valued at $500,000. The new building soon to be occupied is now being installed with a new switchboard by the Sterling company. By November 1st the company will be operating from its new building, which, together with its equipment, will be one of the most modern and complete in the country. William Horn is president and O. B. Friberg, secretary.

At a recent meeting of the directors of the Goshen Telephone Company plans were approved for the erection and equipment of a new exchange building. A new common-battery switchboard, with an ultimate capacity of 3,000 lines and a present equipment of 1,200 lines, will be installed.

R. R. Faulkner, general manager of the Newcastle Telephone Company, denies the truth of the report that the company is to go out of business. On the contrary, he said, the company has decided to extend the city lines, not only in and about the city, but to construct toll lines to Middletown, Anderson and Muncie. The company is now in the market for material for these extensions.

The Central Union Telephone Company of Indianapolis has just issued from its own printing plant a new directory—the most complete ever issued by the company. In addition to the city telephones, suburban telephones in 60 towns within easy access of Indianapolis are listed. The service indexed in the directory includes over 12,000 telephones in the city and 8,500 suburban connections. S.

Telephone News from the Northwest.

The Wisconsin Telephone Company is about to erect an exchange building at Neenah, Wis.

The Turtle River Co-operative Telephone Company of Mekinock, N. D., has filed articles of incorporation with a capitalization of $50,000. A. J. Ulvedal heads the list of stockholders.

The Greaves Telephone Company of Kenmare, N. D., has been incorporated with $150,000 capital.

The Nicollet County Telephone Company's exchange at St. Peter, Minn., was damaged by fire, the loss amounting to about $1,500.

D. N. Tallman of Willmar has been granted a franchise to build a telephone line into Granite Falls, Minn.

E. E. Thompson has resigned as superintendent of the Iowa Telephone Company's exchange at Des Moines.

The King Mutual Telephone Company has incorporated at Thompson, Iowa, with $2,500 capital. F. J. Brooker is president and H. H. Mattison, secretary.

M. M. Head of Jefferson, Iowa, and associates are planning the formation of a company to have control of a system of telephone lines through Nebraska, Iowa, Kansas and Missouri. The company will have its headquarters at Omaha. R.

Important Consolidation of Telephone Companies.

The consolidation of the Bell Telephone Company of Philadelphia, the Pennsylvania Telephone Company and the Chesapeake and Potomac Telephone Company, all licensees of the Bell company, operating in Southern New Jersey, Eastern Pennsylvania, Delaware, Maryland, the District of Columbia, Northern Virginia and West Virginia, was announced recently at the offices of the Chesapeake and Potomac Company in Washington, D. C. The companies involved operate more than 300,000 telephones, but are not competitors, as they do not operate paralleling lines. The authorized stock of the new company will be $60,000,000, which is less than the combined capital and outstanding indebtedness of the old companies.

GENERAL TELEPHONE NEWS

The Del Rio Telephone Company of Del Rio, Tex., has been incorporated with a capital stock of $30,000.

The Edmond (Okla.) Southwestern Telephone Company has been incorporated by F. M. Pettigrew and others.

The Norfolk (Neb.) Long-distance Telephone Company has been incorporated with a capital of $200,000, of which $50,000 is paid up.

CORRESPONDENCE.

Continental Europe.

Paris, September 18.—One of the most important of the electrical contracting firms of Paris, the Giros and Toucher Company, has lately founded a syndicate whose field of operations will be quite extensive. This firm has already installed a number of hydro-electric stations of considerable size in different parts of France. The object of the present syndicate is stated to be the operation of central stations in general, as well as the erection of hydraulic plants or steam plants, and in general all enterprises having for their object the production and distribution of current in different forms for commercial purposes. Owing to the well-established reputation of the founders, there is no doubt that the new syndicate will rank among the most extensive commercial enterprises of Paris.

While passing through Bordeaux not long since I had occasion to visit the new city electric plant which is now being erected. This large station is located in the suburbs just outside the city and covers an extensive tract of ground lying upon the Garonne River. It is built by the Bordeaux Gas and Electric Light Company and will give a supply of current which has been needed for some time, owing to the small capacity of the present plant, which is situated in the center of town. The new station will rank among the largest in France, and owing to the large amount of ground which the company possesses adjoining the gas works the buildings can be disposed in the best possible manner. Coal is to be brought at present by the line of railroad which now supplies the gas works, but at the same time arrangements are being made so that it can be brought by river and unloaded from barges upon the company's ground. The main building of the station comprises a boiler room of large surface, with a dynamo hall adjoining it. At present the boilers are being erected, along with feed-water heaters, pumps, etc. In the dynamo room there are three main alternator groups, which are now being set up. These groups consist of cross-compound engines of 1,500 horsepower each, built by the Carels firm of Ghent, such as are used to a considerable extent in France. On each engine shaft will be mounted an alternator. The latter machines are furnished by the Havre works of the Westinghouse Electric Company.

Professor Mora of the Milan University lately made a comparison between the high-voltage direct-current and the three-phase system as regards efficiency and cost for long-distance power transmission. The direct-current method is now used on a number of power lines on the Continent which are operated on the constant-current system, with generators connected in series, and it is found to work very successfully. The Geneva Electric Company has been one of the most active in promoting the direct-current system. Professor Mora compares the two methods, taking as a base a 40,000 horsepower transmission line, covering a distance of 90 miles from a hydro-electric station. According to his calculations, the three-phase system has a certain advantage from the standpoint of efficiency, this being about three per cent. in its favor, but, on the other hand, the first cost of the plant on the direct-current plan is found to be 1.6 per cent. lower. Using the direct current, the cost of erection is estimated at $2,000,000 comprising $600,000 for the power line and $1,400,000 for the machines. As to the three-phase system, the total plant will cost $2,032,000, counting $1,282,000 for the line and $750,000 for the machines.

Among the new companies which have been formed at Paris are to be noted the Paz and Silva Company, especially devoted to electric wiring, signs and special illumination; also the International Patents Company and the Economic Lighting and Heating Company. At Marseilles the Continental Electric Company is of recent formation.

Great Britain.

London, September 21.—The British Thomson-Houston Company, agent here for the Curtis turbine, recently supplied a 1,000-kilowatt turbo-alternator of this class to the Lancashire United Tramways Company. Tests of the turbine were carried out by Prof. E. Wilson, F. R. S., head of the Siemens laboratory at Kings College, London (which post he succeeded to after the lamentable death of Dr. John Hopkinson in the Alps some few years ago), on behalf of the Thomson-Houston Company, and by Mr. J. P. Salter, chief engineer to the tramway company. The speed of the set was 1,500 revolutions per minute, the alternator being two-phase and giving 1,000 kilowatts with 80 per cent. power factor. The voltage was 7,500 volts and the periodicity 50 cycles per second. The full-load figures worked out to 18.5 pounds of steam per kilowatt-hour, or four per cent. better than the guarantee. The tests are in every way absolutely reliable, all the electrical measuring instruments being calibrated by the Board of Trade after the tests. The regulation was well within the specified limits, while the temperature rise was even more so. Wave forms obtained with an ondograph show that the deviation from a sine curve is not beyond the limit given in the specification.

An inquiry is being conducted into the boiler explosion which took place early this year at a London electric power house, where, as the result of an explosion, the end of a thermal storage drum was blown a considerable distance away.

The adoption of the Griffiths-Bedell surface-contact system by the London County Council in the East End of London, as I reported a few weeks ago, has been the subject of a memorial to the Board of Trade by several tramway authorities outside London working the trolley system, who wish to secure intercommunication by the line of least resistance. Having received the memorials, the board is asking for the comments of all interested. The London County Council and the Poplar Borough Council, two of the partners in the scheme, are willing to adopt the overhead system, but the Stepney Borough Council, thanks to a foolish parliamentary agreement by the London County Council a few years ago, refuses and is able to defy even the Board of Trade. If, in view of the strong expression of opinion by the outside authorities, the Board of Trade deems it expedient to withhold its consent to the adoption of the surface-contact system, the only remedy is for the London County Council to go to Parliament for permission to use the overhead system, and this will delay matters for quite 18 months.

The government, through the Irish Board of Works, is about to erect a new wireless station in Cork Harbor.

Workmen's unions are very keen just now on the question of fair-wages clause in municipal contracts. Both the British Westinghouse Company and the British Insulated and Helsby Cables Company have come under the ban recently in connection with contracts at Manchester and St. Helens, respectively. In the case of the former, the allegation is denied and in the latter instance the reply of the company has not yet been received.

Advices from South Africa indicate considerable activity in electrical circles there. Large extensions are contemplated to the municipal electrical plants at Johannesburg and Pretoria, while extensions of some magnitude will shortly take place in several other towns. Harbor extension works are also to be made at Laurenco Marques.

The general adoption of the common-battery system of telephony throughout the provinces has called forth such an amount of criticism and comment on the part of the local papers that, if it were taken seriously, it would almost hold the British nation open to ridicule. Unfortunately the spirit of the comments has been to a certain extent upheld and fostered by an exceedingly lengthy, and at times far from courteous, discussion in almost every paper, except the electrical journals, between two well-known telephone men. The purport of this is difficult to conceive, remembering the fact that the government is bound to take over the National company in 1911, and that meanwhile the system of the company is being developed in cooperation between the technical officers of the company and the Postoffice. I do not think the user is so much concerned with the technical side of the question as with the financial. The new measured-rate system will bring a host of small users over to the telephone, while the larger existing users will have to pay more than usual when the unlimited-service rate is abolished. Times change, and we not always with them, but that is no argument for continuing a system which is hopelessly out of date. G.

Dominion of Canada.

Winnipeg, Man., September 28.—The system of inspection of houses by the city electrician's department of Winnipeg proves very unpopular. Under the existing by-laws an electrician is obliged to take out a permit before installing fixtures. Upon completion of the work it has to be inspected, and the inspector often causes a delay of several days when people are anxiously waiting the turning on of their lights.

F. E. Cambridge, city electrician of Winnipeg, has issued his annual report, which shows that the use of the street-railway power for only four months has cut down the expenses of lighting for the year. By the moonlight schedule the cost per lamp for street lighting was $57.06, against $75.65 for the previous year. The cost per light on the all-night schedule amounted to $73.40, against $91.88 last year.

The City Council of Port Arthur, Ont., has decided to offer the electric street railway to the sister town of Fort William for $250,000. The people of the latter town consider this figure to be just twice the value of the street railway, and will make an offer of $125,000. The system operates in the two towns.

A limited company has been formed at Kenora, Ont., for the purpose of building an electric street-railway system from that town to Keewatin, a distance of about seven miles, and from thence to the Grand Trunk Pacific Railroad. The route to be taken will be along the Winnipeg River, and application has already been made to the government for the necessary land. As a commencement the municipal power of Kenora will be used, and if the traffic warrants the outlay, power will be developed along the Winnipeg River, where there are several excellent power sites.

The Edmonton City Council has been negotiating with the sister town, Strathcona, Alberta, for electrical power. At a meeting of the Strathcona Council it was decided to sell Edmonton power at seven cents per kilowatt-hour, the latter city to provide transmission.

F. E. Cambridge, city electrician of Winnipeg, does not approve the rail bonding done by the Winnipeg Electric Company. He presents a long report to the council, with figures prepared by a special inspector, and shows that a large amount of damage has been done to the city water mains through electrolysis, and in places the pipes are so badly damaged that they will have to be replaced. R.

New England.

Boston, September 28.—The Minneapolis, St. Paul, Rochester and Dubuque Electric Traction Company has been organized in Portland, Me. It has an authorized capital of $25,000,000 and it proposes to build and operate electric railways in Minnesota and Iowa. Eben W. Freeman of Portland, Me., is president, and M. H. Boutelle of Minneapolis, Minn., is secretary.

The statement of the earnings of the Boston Suburban Electric Companies for the quarter to end September 30th (this month's earnings estimated) has been made public. It is as follows: Income from subsidiary companies, $110,801; expenses, $13,591; net, $97,210; dividend, preferred, $35,339; surplus, $61,871; previous surplus, $40,101; total surplus, $101,972.

The Meriden Light and Equipment Company of Meriden has been organized to manufacture and deal in electrical supplies. The capital stock is $25,000.

The Loomis-Pettibone Company of Hartford, Conn., has been incorporated under the laws of Connecticut. It is authorized to construct and operate railways and telegraph lines. It is capitalized at $100,000. The incorporators are Burdett Loomis of West Hartford, Hawley Pettibone of New Rochelle, N. Y., and Harrison B. Freeman, Jr., of Hartford.

The statement of earnings of the American Telephone and Telegraph Company for the nine months ending September 30, 1907, has been made public. It is as follows: Balance earned for dividends, $10,960,000; increase over same period of last year, $1,385,000; dividends paid, $7,893,000; increase, $329,000; surplus, $3,067,000; increase, $1,056,000; outstanding stock, $142,514,000; increase, $10,962,600.

A new schedule of wages has been prepared by electrical workers in Boston. They ask that after October 1st their pay shall be 50 cents an hour for 44 hours a week. Under such a scheme they would work eight hours a day with a half-holiday on Saturday.

The selectmen of Great Barrington have imposed a peculiar restriction on the Berkshire Street Railway as a condition for allowing that company to act as a common carrier in the town. They require that the company shall carry packages of less than 25 pounds anywhere in the town for five cents and that the cars of the company shall take up and deliver trunks and other baggage along the line wherever signaled by passengers. These restrictions will have to be approved by the railroad commissioners. The company has asked for this approval. Besides asking for the local rights in Great Barrington, the company has also asked the commissioners to approve its location through Lee to the town of Becket boundary. B.

New York.

New York City, September 28.—Overwhelmed by obligations amounting to millions, which it was unable to meet, the New York City Railway Company, the Manhattan and Bronx surface-line end of the Belmont-Ryan "traction trust," has gone into the hands of a receiver. Similar action is expected on the part of the Metropolitan and Third Avenue companies, which are controlled by the New York City company. It is alleged that the present receivership was due to the investigation of the Public Utilities Commission, through its counsel, William H. Ivins. The appointment of a receiver will relieve the commission of a large amount of the burden of looking into the financial relations existing between the three companies.

The construction of a new electric-traction system on Staten Island is projected by New Yorkers, who plan to build and operate a standard-gauge line in a section of the island which is now being served by stages. The line will be known as the Richmond and Tottenville Railway and it will connect Richmond, Rossville, Kreischerville, and Tottenville. It will be about 10 miles long. The overhead trolley will be used, and the cost of the construction of the line and equipment will be about $400,000. Among those interested are Thomas B. McGovern of the firm of McGovern & Donnell and Cornelius G. Kolff, 50 Broadway, city.

Columbia University's 154th year was begun on Wednesday, the 25th, by exercises held in the gymnasium on Morningside Heights. This promises to be the largest year in the history of the institution. Already the registration shows an increase of 150 over last year and the total enrollment in the university will be over 5,000. President Butler has adopted the preceptorial system similar to that in force at Princeton and other universities. It consists in assigning each student to some professor, who becomes a sort of "father confessor." To him the student must come and plan out his course of study. This gives a chance for closer relations and for the personal element to enter largely into the instruction. A number of the older professors are retired and are replaced by younger men who will come into closer touch with the students.

The Electrical Show to be held at Madison Square Garden will be opened at 7 p. m. on September 30th. Already the work of putting the different booths in shape preparatory to opening is well along. E. H. S.

Ohio.

Toledo, September 28.—Local conditions are somewhat improved the last week or two. A number of lettings have been made for structures recently, carrying with them electrical equipment, and building business generally is on the advance. It now looks as if the late fall building operations will be fairly active. While the local conditions have not been all that might have been desired this summer, the large electrical concerns have not suffered materially, as their business has not been limited to the local field. There are a number of concerns which do a handsome business all over the United States, and these have not felt the depression of local conditions. The smaller concerns and the local electrical workers are feeling much elated by the present promise of improved conditions in the near future.

The Citizens' Lighting and Heating Company will ask the council of Toledo for a franchise to do a general lighting and heating business in the city. Its present franchise is limited to a small territory.

The sum of $1,021,755 was added to the appraisement of the interurban railroads of the state by the board of equalization at Columbus on Tuesday of this week. The total appraisement now amounts to $12,605,796.

An ordinance has been introduced into the Dayton City Council providing for a bond issue of $500,000 for the purpose of building an electric lighting plant for the city.

The Seaman Bell Telephone Company has been incorporated at Seaman, Ohio, with a capital stock of $5,000. The incorporators are L. W. Sprague, C. E. Kirkpatrick, J. O. Wickersham, Frank G. Young and W. H. McCreight.

The Radio Telephone Company has arranged for a test of its wireless system between Toledo and Fremont, Ohio, using the top of the smokestack of the Yaryan power house for its mechanism at Fremont, which will be the first test between inland cities. The passenger steamer Greyhound, plying between Toledo and Detroit, is being equipped with this service.

The Toledo, Ann Arbor and Detroit electric railway, which is partially constructed, was offered at sheriff's sale recently. The Ohio and Michigan ends were offered separately, but not a bidder could be found for either end. It will be re-advertised.

Thirty-five electrical contractors, supply dealers and sign builders in the territory of the Canton Electrical Company were entertained at a banquet given by that company at the Courtland Hotel, Canton, recently. An elaborate and interesting programme was carried out.

The main building of the Power Electric Company at Canton is fast nearing completion. It will be 53 feet by 260 feet. The machinery is ready for installation, and the plant will be in operation in October.

The Ohio Manufacturing Company of Upper Sandusky will remove to Columbus about November 1st. A rush order for 200 motors detained the company in its old location longer than was intended.

Charles E. Ashley, W. B. Walbridge, G. W. Kinney, J. F. Shaufelt and J. W. McMahon constitute the incorporators of the Citizens' Lighting and Heating Company of Toledo, recently organized with an authorized capital of $200,000.

The Delta Electric Light Company has made application for a franchise to put in a waterworks plant for the city of Delta, Ohio, asking the town to take 25 plugs at $40 each per year for five years.

A franchise has been granted to the Toledo and Delphos electric railway to use the streets of Neapolis and cross county roads in Lucas County. When completed this line will give Toledo trolley communication with Fort Wayne.

A new ordinance in Toledo requires all street cars, interurbans or locals, to stop on signal at all street crossings. In blocks more than 500 feet long cars must stop in the middle of the block. H. G. S.

Indiana.

Indianapolis, September 28.—The Evansville, Petersburg and Vincennes Railroad Company has filed articles of incorporation. The company proposes to construct an electric railroad from Evansville through Vanderburg, Warrick, Gibson and Pike counties to Petersburg. It also proposes to furnish light and power to the inhabitants along the line.

By unanimous vote the City Council of Terre Haute killed the interurban franchise that the Mc-

Gowan syndicate has been seeking to obtain for six months. The proposed franchise gave the traction syndicate the right to occupy every street and alley in the entire city for interurban purposes. The demand of the people was that the city receive pay for the use of its streets in the same manner as Indianapolis and other cities.

The Indianapolis, Huntington, Columbia City and Northwestern Railroad Company is in hard straits. According to the report of the appraisers, Charles L. Henry and Edward Hawkins, the property is worth, as it stands today, a little less than $10,000. One mile of line ready for operation has been leased to the Syracuse and Milford Railroad Company. The property has been ordered sold by the receiver.

The City Council of Seymour, Ind., is advertising for propositions from any corporation, person or firm to furnish the city and its inhabitants with artificial gas for light and fuel and electric light for street lighting and for private use, and also electric power for persons desiring it. The proposition will remain open for 60 days from September 2d.

The Clay City Lighting Company has been incorporated with a capital stock of $10,000. This company proposes to build and equip a plant for electric-lighting and power purposes in Clay City, Ind. The directors are B. M. and W. H. Guirl, J. M. Long and H. R. Vandever.

The Citizens' Electric Light and Power Company of Lebanon has been incorporated, to construct and operate an electric-light plant for use of the citizens of Lebanon and surrounding country and towns. The capitalization is $25,000. Richard A. Edwards, M. A. Edwards and George R. Chamberlain are directors.

The International Engineering Company of Fort Wayne has been incorporated with a capital stock of $200,000. According to the articles of incorporation, the company proposes to manufacture machinery and mechanical and electrical appliances. The incorporators are F. L. Jones, Charles H. Doebler and George H. Loesch. S. S.

Illinois.

Peoria, September 28.—The Hinsdale Electrical Supply Company of Hinsdale has been incorporated with a capital of $2,500 to manufacture electrical devices. The incorporators are Arthur W. Morrow, John B. Hess and E. I. La Plant.

The Warner Electrical Engineering Company of Rockford has been incorporated to manufacture and deal in electrical instruments and machinery. The capital stock is $5,000 and the incorporators are Romaine Warner, E. M. St. John, Carl Spalding.

Work has been begun on the steam-heating system of the Canton plant of the People's Gas and Electric Company. Mains are to be laid to the business section this fall, and if the idea proves all that is expected of it the mains will be extended next summer.

Gasoline motor cars are in use on the Aurora, De Kalb and Rockford interurban railway. The motor car weighs about ten tons and is equipped with a four-cylinder four-cycle 60-horsepower engine with 7 by 7-inch cylinders. It is 36 feet over all, with a seating capacity of 32 persons.

The Illinois Traction Company is replacing the insulators it first put up on the long-distance transmission lines. The new ones are much larger and heavier and of the triple-petticoat variety, and will withstand the voltage of 33,000 now in use. The line between here and Bloomington is equipped with them, and so far they have given no trouble. In all the company will change about 70,000. Four new refrigerator cars are expected this week and will be put on as soon as received.

The ordinance now before the City Council of Springfield for the electric plant to be constructed by John Brinkerhoff has been reported back to the council for certain changes, the principal of which are that the company should pay to the city five per cent. of the gross proceeds, ordinance to expire in 1927 instead of 1937; that the wires be placed underground, work to be commenced as soon as the franchise is passed, and that the maximum rate to be charge be named. V. N.

Northwestern States.

Minneapolis, September 28.—The Great Northern Power Company has completed its work on the St. Louis River near Duluth, Minn., and is now supplying electric power for commercial purposes at the head of the lakes. The company is in a position to generate 40,000 horsepower and is already furnishing power for the Duluth-Superior Traction Company, the Duluth Edison Company and other large concerns.

A company is being formed for the purpose of building a trolley line from Superior to Ashland, Wis. It is proposed to have the road financed by people along the line, which will be about 100 miles long.

A franchise has been granted at Prentice, Wis., to the Prentice Light, Water and Power Company. A. F. Zeigler is president of the company. Plans are being prepared for a plant. It will be completed by November 1st.

The Burkhardt Milling and Electric Company of Hudson, Wis., has incorporated with a capital of $50,000. C. Burkhardt heads the list of incorporators.

The electric light plant at Waterloo, Wis., may be sold to the village.

The Osage (Iowa) Electric Light and Power Company has asked for permission to raise its dam on the Cedar River.

It is reported that Robert Thompson will take up the project of building an interurban line between Grand Forks and Carrington, N. D.

The Mankato (Minn.) Gas and Electric Light Company has ordered new machinery for its plant to enable it to furnish power for the new street railway system.

The City Council at Eveleth, Minn., has finally granted a franchise to the Mesaba Traction Company.

A 20-year franchise has been granted at Northfield, Minn., to the Northfield Light, Heat and Power Company.

A franchise for an electric-light plant has been granted at Northome, Minn., to E. E. Bigham of Minneapolis.

The Fort Madison (Iowa) Street Railway Company has sold its system to the Mississippi Valley Electric Railway Company.

Fire destroyed the car barns at Waterloo, Iowa, of the Waterloo, Cedar Falls and Northern Railway Company, the loss being $20,000, which is covered by insurance.

It is proposed to issue $25,000 worth of bonds for the purpose of building a municipal light plant at West Bend, Wis.

The proposition to vote bonds for a municipal electric-light plant at Ashland, Wis., has been defeated and the matter will be abandoned. R.

Pacific Slope.

San Francisco, September 25.—There is some friction between the electric companies of which Sam. Naphtaly of San Francisco is manager and the union electricians, and a vote is now being taken by the members of the union to decide whether or not a strike shall be declared. The companies concerned are the City Electric Company, the Truckee River General Electric Company, the Reno Water Light and Power Company, the Central Traction Company and the American River Electric Company.

The rumor is current here that the plant of the City Electric Company in San Francisco, which has been completed at a cost of about $1,000,000, will be bought by the Pacific Gas and Electric Company for $1,500,000. The management of the City Electric Company announces that it will be ready to begin operations about October 1st.

J. Downey Harvey, president of the Ocean Shore Railroad, states that it is now doubtful whether the company will be able to commence the operation of its road within the coming year, as much difficulty is experienced in floating the bonds of the company. A small portion of the line is already in operation, and through service could be given in a short time if the bonds were taken.

Richard Phelan of Sierra County, Cal., is planning to run an electric power line into Reno, Nev., from several points in California, where he is erecting large power plants run by water. He states that he intends to cut the rates of the present companies which are supplying Reno.

The question of a municipal lighting plant is occupying much attention at present in San Jose, Cal. The contract for lighting the streets has been held for some years by the United Gas and Electric Company, but the contract expires next June, and there is much discussion in regard to the expense of lighting under the terms of the contract. The city council has been strongly urged to make appropriations for a municipal plant, and, while no action has yet been taken upon the matter, a favorable opinion has been expressed by members of the council. The mayor has appointed an engineer to make an estimate of the cost of a plant.

The supervisors of Ventura, Cal., have received an application from J. P. Jones and F. M. Packard of Los Angeles for a franchise to build and operate an electric railway from Ventura to Nordhoff, Cal.

The electric train service between San Rafael and San Anselmo, Cal., will be greatly improved within the next few months, according to the statement of the North Shore Electric Company. The electric cars from Sausalito will extend their runs to Fairfax. The trains between San Anselmo and San Rafael will be run at much greater speed and will be better lighted. Over $30,000 will be spent in providing new machinery and enlarging the power plant, and the storage batteries at San Anselmo will be abandoned for two 500-kilowatt motor-generators. The latter will develop the same potential as the power house. Trains will be operated by electricity as far as Fairfax as soon as the generators are installed and the necessary rolling stock arrives. Four additional motor cars will be provided.

The Central California Traction Company wishes to get certain new franchises in Stockton, Cal., to enable it to land its passengers at the depots of the Southern Pacific and Western Pacific railroads.

The railroad from San Diego, Cal., to La Jolla is to be operated by electricity soon. The plant of the Los Angeles-Pacific system at Sherman has already been purchased and, with new machinery, will be set up in San Diego.

A special meeting of the Pacific Gas and Electric Company is to be held in San Francisco on November 20th to take action on a proposition to increase the bonded indebtedness of the company from $10,350,000 to $14,350,000.

The City Council of Los Angeles, Cal., has amended an ordinance granting to the Los Angeles Pacific Railway Company (electric) permission to construct a brick and concrete subway under private property on Hill and Temple streets. The subway shall not be more than 28 feet in width and 24 feet in height.

The Northern California Power Company has begun work on its new power plant on Battle Creek near Red Bluff, Cal.

The Tejunga Water and Power Company has been incorporated in Los Angeles by C. F. Hunter and others with a capital stock of $250,000.

The California Gas and Electric Company will shortly erect a transformer house at its works in Santa Rosa, Cal.

An electric light and power franchise has been advertised for sale in the first township of San Mateo County, Cal.

The Huntington-Kerchoff syndicate will put its lighting wires underground in the business district of Fresno, Cal.

The town of Placerville, Cal., is planning to install a municipal electric-light plant. The cost is estimated at about $20,000. A.

PERSONAL.

Mr. H. McCullough has accepted a position as electrical engineer for the Pittsburg and Montana Copper Company of Butte, Mont.

O. R. Sturinger of Toledo, Ohio, has been appointed superintendent of the Toledo, Port Clinton and Lakeside Railway, to succeed H. C. Warren, resigned.

Edward W. Clark, for five years in the employment of the Boise Electric Company of Boise, Idaho, has accepted the position of superintendent of the electric-light plant at Ellensburg, Idaho.

Mr. H. S. Rush has left the testing department of the General Electric Company, Schenectady, N. Y., and is now in the inspection department of the North Shore Electric Company at Evanston, Ill.

Jere T. Burke of the Southern Pacific Railroad Company has been elected president of the Peninsula Electric Railway, running between Mayfield and Los Gatos, Cal. Mr. Burke succeeds the late O. A. Hale of San Jose.

Mr. E. J. Cook has been appointed general manager of the Rochester Railway Company, Rochester, N. Y. Mr. Cook is a graduate of Stevens Institute of Technology, and has been chief engineer of the Consolidated Street Railway properties in Cleveland, Ohio, since 1903.

A. J. Campbell, treasurer of the territory of Hawaii, has come to the mainland to float over $300,000 worth of bonds issued by Hawaii for public improvements, a large part of which will be the completion of the Nuuanu dam, which will furnish waterpower for the generation of electricity for the city of Honolulu.

Andrew Boughan, 77 years old, who is said to have helped to construct the first telegraph line from Chicago toward the Pacific Coast, died in Chicago on September 25th. Mr. Boughan was for 44 years in the continuous employment of the Western Union Telegraph Company. When he retired four years ago he was a department manager. He worked for the old Illinois and Mississippi Telegraph Company before the Western Union was formed. He leaves a widow and five children.

Mr. Arthur S. Merrill, who has been identified in the electrical business for the last ten years, most of the time in New York city, and who has been assistant western sales agent for Pass & Seymour, Solvay, N. Y., with headquarters at 130 West Jackson Boulevard, Chicago, for over a year, has tendered his resignation in order to carry out plans which he has had in mind for some time. He is a brother of Mr. Wm. W. Merrill, secretary of the Chicago Fuse Wire and Manufacturing Company, Chicago.

ELECTRIC LIGHTING.

The city of Blackshear, Ga., contemplates building an electric-light plant.

W. L. Underwood and others have been granted an electric-light franchise in Childress, Tex.

The Texhoma (Okla.) Electric Light, Water and Ice Company has been incorporated with a capital stock of $15,000.

The E. S. Cowie Electric Company of Kansas City, Mo., has been incorporated with a capital of $10,000 by Ernest S. Cowie and others.

The Sacramento Power Company of Alamogordo, N. M., has been formed with a capital stock of $1,000,000, to operate power and electric-light plants.

The McVeytown (Pa.) Electric Light, Heat and Power Company has been incorporated to build and operate a plant. The incorporators are J. E. Rupert, James and George Macklin, J. S. Lefford, J. T. Rogers, McVeytown, and William Atkinson, Mattawana.

By a decisive vote the citizens of Canton, Ga., voted for the issue of bonds for the establishment of electric lights, waterworks and a sewerage system in the town.

The Cottonwood Water and Light Company has been incorporated at Cottonwood, Idaho, with a capital stock of $20,000 by H. Huxoll, W. H. Schiller, Samuel Goldstone and A. L. Creelman.

The Mt. Union Light and Power Company, of Mt. Union, Huntingdon County, Pa., has been granted a charter. Thomas N. Kurtz, Scott Dibert and John L. Dickson of Mt. Union are identified with it.

The state of Pennsylvania will soon ask bids through its Board of Public Grounds and Buildings for changing electrical work so that the library and other buildings as well as the Capital Park in Harrisburg can be lighted from the power plant in the state capitol.

A lamp-renewal plan has been adopted by the municipal electric-lighting system of Lansing, Mich., to go into effect October 1, 1907. The first installation of lamps must be purchased by the consumer. Incandescent lamps of 2 to 24 candlepower will be sold for 20 cents each; 24 to 32 candlepower lamps will cost 25 cents each. All burned-out lamps will be exchanged, but broken bulbs will not be replaced without payment.

San Antonio and Southwest Texas men will build a plant at the Rio Grande coal mines to furnish motive power for irrigating several thousand acres of land between the mines and Laredo, Tex., 26 miles distant. It is planned to construct an electric transmission line to Laredo, where a substation will be built for furnishing the city with electric lights. About $100,000 will be expended. Construction work will begin within two months under the supervision of Samuel Kahn, chief engineer of the San Antonio Traction Company, San Antonio, Tex.

ELECTRIC RAILWAYS.

The Tulsa (I. T.) Electric Light Company has been incorporated for $15,000 by R. D. Campbell and D. M. Martindale of Tulsa and H. F. Burt of Oklahoma City.

The city of Findlay, O., is advertising for bidders to construct, maintain and operate a street railway over certain of its streets. Particulars can be obtained from J. E. Edie, city clerk, Findlay, O., and proposals must reach him by noon on October 26, 1907.

The Oklahoma City Street Railway Company has increased its capital stock from $1,000,000 to $3,000,000 for the purpose of extending the interurban line to Guthrie and adding several local lines. A new terminal station will also be erected as soon as the location has been secured.

The little town of Dover, Ark., has raised a bonus of over $5,000 to secure the building of the interurban line from Russellville to that place. It is said that considerably over $15,000 has been raised in different quarters as a bonus to help out this line and that the prospects for its construction are very good.

Seven companies controlling the electric lines in and near York, Pa., were merged on September 26th into a single corporation, which will be known as the York Railways Company. The capitalization of the new corporation is $3,397,000. Of this amount a large proportion will be available for improvements and extensions.

The recently incorporated Norwich, Colchester and Hartford Traction Company of Connecticut has organized with Costello Lippitt as president, Lucian Brown, secretary, and H. W. Tibbits, treasurer, all of Norwich, Conn. The company has a capital stock of $1,000,000 and is empowered to construct an interurban line from Norwich to Hartford, Conn. The length of the proposed road is 38 miles, which is 11 miles shorter than the steam railroad now connecting these cities.

The Brooklyn Union Elevated Railroad Company has sought permission from the New York Public Service Commission for the issuance of $20,000,000 of bonds. Recent improvements costing $7,000,000 are to be paid for and $8,000,000 is to be used for constructing an elevated extension on Flatbush Avenue, to bring the road to the terminal of the new Manhattan Bridge. About $2,500,000 will be needed for new rolling stock and the balance of the bond issue for general improvement. The application will be granted.

The city of Little Rock, Ark., has for some time sought to purchase West End Park from the Little Rock Railway and Electric Company, but refused to pay the sum of $40,000 which the company demanded. The company has now made an offer to give the city immediate possession of the property on condition that the annual compensation the company must pay the city be withheld till it aggregates $40,000, when the city will be given the full title to the park. This proposition will probably be accepted, as no city funds will be required and no interest called for.

POWER TRANSMISSION.

The Altoona Construction Company has been given the contract for the big dam of the Roystown Power Company which will be built on the Juniata River in Central Pennsylvania.

Messrs. Wallace Wilson and W. P. Woods, who have been taking out Pennsylvania charters for various towns in the Juniata Valley which can be reached from several of the proposed big power dams, have secured a franchise for the Mapleton Electric Company of Mapleton.

The North Georgia Electric Company has been placed in the hands of a receiver. Samuel C. Dunlap of Gainesville, Ga., was appointed to act in that capacity temporarily. The company has a 50,000 horsepower hydro-electric plant on the Chattahoochee River and sells its power in and about Atlanta, Ga. The authorized capital stock is $7,500,000, of which $1,000,000 has been issued.

The German Transatlantic Electric Company is said to have a concession to erect a hydro-electric power and lighting plant on the River Maipo, above Santiago, Chile, at an estimated cost of $4,015,000 United States gold, of which about $1,295,040 will be for materials and machinery that must be imported. It is estimated that it will take about five years to complete the undertaking. The company has petitioned the government of Chile for the free entry of its machinery and material for a period of five years.

PUBLICATIONS.

A little pamphlet published by Harvey Hubbell, Inc., Bridgeport, Conn., tells of the simplicity and economy of the Hubbell Guard for incandescent lamps.

The H. W. Johns-Manville Company has undertaken the exclusive sale of Morris' Metallic Packing and has just published a booklet describing this packing for rotary-valve stems and reciprocating rods.

The National Battery Company, Buffalo, N. Y., has published a new bulletin on "Storage Batteries for Isolated Plants," wherein it offers complete generating units for this service, including gas, gasoline or alcohol engines, dynamos, switchboards and storage batteries of the Unit Accumulator type manufactured by this company.

The Gail-Webb Manufacturing Company of Buffalo, N. Y., is sending out literature descriptive of some of its products of interest to users of incandescent electric lamps. Among the articles to which it calls attention are the Gail-Webb lamp guard, adjustable wall fixture, adjustable electric portable, adjustable ceiling fixture and the Universal electric-light holders.

A convenient and serviceable catalogue, No. 2, has just been issued by the Pringle Electrical Manufacturing Company, 1906-08 North Sixth Street, Philadelphia. A thumb index enables the reader quickly to turn to switches, panel boards, iron and wood boxes, switchboards, accessories, receptacles, specialties, etc. The book is profusely illustrated and in the back are given a number of handy tables of various kinds. A copy will be sent to anyone upon request to the company.

SOCIETIES AND SCHOOLS.

The next meeting of the American Institute of Electrical Engineers to be held in New York city will be at the Engineering Societies Building on the evening of October 11th.

A number of new subjects have been added to the course in electrical engineering at Armour Institute of Technology, Chicago. The junior students are now required to make a study of illumination in the first semester and the senior students will add electric railways to their programme in the second semester. Additional quarters for drafting rooms, physical laboratories, and student organizations have been opened. The evening classes were begun on September 30th with an attendance much larger than ever. A new feature of this evening work is the addition of college preparatory courses. The total number of evening courses offered at the Institute is now over 70. A bulletin describing them can be had by writing to Dean H. M. Raymond, Armour Institute of Technology, Chicago.

The American Society of Mechanical Engineers will hold the first monthly meeting this fall on Tuesday evening, October 8th, in the main auditorium of the Engineering Societies Building at 29 West Thirty-ninth Street, New York. The subject will be "Industrial Education." The college technical courses and the student apprenticeship courses will be discused at length by men who have been in charge of theoretical and practical institutions. Prof. John Price Jackson has written a paper on the college technical courses and apprenticeship courses offered by manufacturing establishments. He gives data in the form of letters from several of the largest manufacturing establishments in America in which they outline the courses offered by the factories and explains the manner of conducting the same. Dr. Henry S. Pritchett and Prof. Dugald C. Jackson will deliver short addresses. Manufacturers have been invited to speak informally at the meeting of their experiences, and altogether it is expected that the meeting will prove interesting and instructive.

MISCELLANEOUS.

Prof. G. M. Minchin, observing with a selenium cell of special design at the Daramona Observatory, Westmeath, Ireland, has reported that the electromotive force generated by starlight was sufficient for observation in stars of the first and second magnitudes.

A new textile factory is to be erected by Oscar Heineman, a silk manufacturer of Chicago, along the most modern lines. All the machinery will be electrically driven. The new plant will be located on the Northwest Side and will cover an entire city block. The building will be a three-story structure, with saw-tooth roof, and is estimated to cost $135,000. Paul Gerhardt, 109 Randolph Street, Chicago, is the architect.

The St. Louis, Iron Mountain and Southern Railway Company will establish a power plant to furnish heat and light for the Union Station at Little Rock, now under construction, light for passenger yards, heat for passenger equipment and compressed air for cleaning and brake testing. Building will be of brick. Equipment to be installed consists of two 240-horsepower water-tube boilers, two 75-kilowatt direct-connected generators, two exciters, one small generator and one air compressor. E. F. Mitchell of St. Louis is engineer of construction.

TRADE NEWS.

The London office of the Western Electric Company announces the removal on September 30th to its new address—Norfolk House, Victoria Embankment, W. C.

Manager of Sales Frank Warren of the Warren Electric Manufacturing Company of Sandusky, Ohio, was in Chicago last week. The Warren company is now very busy, as it is increasing its line of apparatus.

At a meeting of stockholders of the Johnston Electric Machine Company of Charleston, W. Va., the capital stock was raised from $20,000 to $100,000 to permit enlargement of the plant to a capacity sufficient to meet the demand for the electric coal-mining machinery that the company manufactures.

The entire business of the Beck Flaming Lamp Company of 30 Greenwich Avenue, New York city, including manufacturing and selling, is now conducted in the name of that company, the selling organization known as the New York Beck Lamp Company being no longer in existence. The company has an extensive exhibit at the New York electrical show, and in addition the New York Edison Company has adopted the Beck flaming lamp exclusively for the illumination of the interior and exterior of Madison Square Garden.

Syles R. Fralick, whose offices are located at 161-163 South Canal Street, Chicago, has taken the agency for the Premo and Star knife switches made by the Barkelew Electric Manufacturing Company, Middletown, Ohio. He also represents the Clark Electric and Manufacturing Company of New York city, manufacturer of insulator clamps for insulated wires; W. J. Jackman of Lima, Ohio, maker of the Jack guy anchor; Blake Signal and Manufacturing Company of Boston, Mass., manufacturer of saddle staples and solder flux; Horton-Morehouse Company, knife switches, and the Chance Manufacturing Company, manufacturer of the Sky-rocket lightning arrester.

Mr. Charles Blizard, third vice-president of the Electric Storage Battery Company of Philadelphia, says that the demand for storage batteries is, within certain limits, independent of extensions in the electrical field. During periods when the lighting and railway companies are postponing enlargements of their plants batteries are largely used to provide for immediate demands for increased power; the batteries are bought with a view of being later fitted in with the new plants or extensions. For this reason the business of the company during the current year has been uniform and satisfactory, and the indications point to a material growth as soon as funds become more plentiful.

Eugene Munsell & Co., well-known dealers in mica, and the Mica Insulator Company, manufacturer of micanite and other high-grade electrical insulators, for many years located at 218 Water Street, New York, have removed to 68 Church Street, corner of Vesey Street. Owing to the increase in business, more commodious quarters were required. The new location is one of the most central in the downtown business district, being only one block west of Broadway and within five minutes' walk of the principal railways and ferries. Four floors are used, the second floor being devoted entirely to offices, while the other three are used for stock and shipping departments, for the preparation and assorting of mica and for the manufacture of mica specialties.

Sealed bids will be received by the secretary of the Board of Public Works of Los Angeles, Cal., up to October 7th, for furnishing hydraulic and electrical machinery and material for equipping one hydro-electric generating plant and 90 miles of 30,000-volt transmission line and transformers, bidders to state the earliest date on which delivery can be guaranteed. This apparatus is to be used in connection with the building of the Owens River aqueduct.

Referring to the outlook for fall trade, V. R. Lansingh, general manager of the Holophane Company, New York, says: "On the whole, it seems to me that the electrical business this fall will be very good. There has been, generally speaking, a little tightening up along the lines of credit, but on the whole the industry is growing so rapidly that the demand for good articles will, in our opinion, increase rather than decrease. If we should judge the outlook by the increase in the Holophane business, we would hardly get a fair comparison, inasmuch as this business is growing remarkably, the increase this year being 79 per cent. over the corresponding period of last year. On the whole, we look for an increase in electrical business this fall, with, however, a little more care with reference to credits."

BUSINESS.

The Bristol Company, Waterbury, Conn., announces that it is about to erect another addition to its present plant. The addition, which will be 53 by 170 feet, three stories high, is made necessary by the increased demand for Bristol's recorders and Bristol's patent steel belt lacing.

The Nernst Lamp Company, Pittsburg, says that the increasing demand for Nernst lamps, coupled with the closing of several large contracts during the last few weeks, necessitates its appealing to customers to anticipate their requirements for lamps and renewals for the lighting season, to avoid delays in delivery. Delivery of material is assured by sending requisitions through the district offices, or direct to Pittsburg, marking on same date of shipment desired and spreading same over a period of several months, if preferred.

In the purchase of a spark coil that will give good results, it is necessary to have a coil giving a hot, bright spark which will never fail to ignite the explosive mixture in the combustion chamber and never cause the motor to miss an explosion. A low internal resistance requiring a comparatively small amount of current is necessary. The Edison spark coil in connection with the Edison primary battery is said to require less than half the current used by many other coils. Three times as much copper wire is put into them as in many in general use, the company says, and the high ampere power is not wasted by unnecessary resistance in parts of the circuit other than the spark [illegible] Manufacturing Company of 10 Fifth Avenue, New York, making both battery and coil, has an interesting little booklet, "Battery Sparks," which goes deeply into the details of its product. On receipt of a postal the company will forward this to any address.

The Electric Storage Battery Company of Philadelphia will have an interesting exhibit at the convention of the American Street and Interurban Railway Association at Atlantic City, beginning October 14th. Among other material will be shown one element of type 71-R in a containing tank sufficiently large to hold 83 plates of this type, the tank showing the standard method of reinforcement used on cells at the end of rows. A 12-pole carbon regulator, recording hydrometer, recording and signaling hydrometer, automatic cell filler and compensating hydrometer will be shown, with examples of positive and negative plates of the different types. The representatives who will be present are Messrs. Charles Blizard, third vice-president; Albert Taylor, manager New York office; G. H. Atkin, manager Chicago office; E. L. Reynolds, manager Pennsylvania sales office; H. B. Gay, manager Cleveland office, and Robert C. Hull, district engineer. A cordial invitation is extended to members of the association to visit the booth, where a number of recent publications of the company of interest to railway officials will be distributed.

ILLUSTRATED ELECTRICAL PATENT RECORD.

Issued (United States Patent Office) September 24, 1907.

866,618. Electric Water Filter. Melvin A. Brannon, Grand Forks, N. D. Application filed April 11, 1906.

This filter has two chambers, one above the other with the filtering medium between. This consists of a sand tray and an unglazed earthenware partition on one side of which lies a layer of zinc fragments and on the other is supported a similar layer of copper turnings, the two metals forming a short-circuited electric couple that is acted on by the salt content of the water passing through the partition.

866,631. Sparking Plug for Explosive Engines. William Diebel, Philadelphia, Pa. Application filed July 13, 1906.

A cylindrical casing has a small aperture at one end into which extends a small sparking point from the casing wall. A porcelain insulator fits into the bore and has an asbestos washer at its end and a conductor with the other sparking point passing through its center.

866,636. Vibrator. Charles R. Elliott, Rochester, N. Y. Application filed February 11, 1907.

The particular feature of this patent is that the vibrator has a flexible coiled wire handle through which the wires pass to the electric motor in the casing.

866,639. Automatic Telephone Release. Edward D. Fales, Chicago, Ill., assignor to the Automatic Electric Company, Chicago, Ill. Application filed February 9, 1907.

In this automatic telephone system, there is in combination with the selector switches, a set of trunk lines and trunking switches, a connector and a trunk release circuit controlled at the connector and extending through all of the trunking switches.

866,643. Pressure Controller. James H. Glenn and Michael Reule, Lafayette, Ind. Application filed April 10, 1907.

This device is intended to work in connection with an electrically driven air compressor. A cylinder is connected with the receiver of the compressor. A plunger in this cylinder has a stem, whose motion is governed by a set of springs, and which carries a circuit closing device at its end.

866,645. Anti-hummer for Telephone and Telegraph Lines. Nels O. Hagen, Pekin, N. D., assignor of one-half to Ole O. Forde, Pekin, N. D. Application filed May 4, 1907.

A pliable tube is bent about a support to a form like the letter J. The line wire is wrapped about, and fastened to the longer stem of the tube. The house wire is connected to the line wire and then passes through the tube, which has a stopper with a hole in each end.

866,646. Contact Device. Clarence J. Harter, Ilion, N. Y. Application filed December 3, 1906.

This is a trolley wire contact shoe. It is supported in a contact head at the top of the trolley pole and is provided with an adjustable hanger adapted to engage the guy wire of the trolley wire or cable.

866,667. Means for Fastening Collector Leads. Emil Mattman, Norwood, Ohio, assignor to the Allis-Chalmers Company and the Bullock Electric Manufacturing Company. Application filed January 31, 1907.

The shaft of a dynamo-electric-machine has a cone-shaped portion over which fits a collector ring. The collector lead has a wedge-shaped terminal fitting into a slot between the collector and shaft.

866,709. Support for Electric Conductors. William W. Benson, Philadelphia, Pa. Application filed August 14, 1905.

The body has a section like molding, the channels of which have corrugated sides for holding the conductor. A groove makes one of the sides flexible so it can be sprung for the insertion of the wire. A cap fits over the channels.

866,714. Telephone System. Henry P. Clausen, Chicago, Ill., assignor to the American Electric Telephone Company, Chicago, Ill. Application filed October 25, 1901.

This patent has 158 claims. One of the features of the common-battery system covered is a normally open low-resistance connection across the terminals of the subscriber's line at the exchange, which short-circuits the line and lights a signal lamp, when the subscriber calls.

866,716. Manufacture of Enclosed Fuses. Robert C. Cole, Hartford, Conn., assignor to the Johns-Pratt Company, Hartford, Conn. Application filed June 23, 1906.

The fuse is provided with an indicator wire which is fastened to the ferrules at the end of the case independently of the terminal contacts.

866,729. Trolley. William Moeckel, Jersey City, N. J. Application filed June 12, 1907.

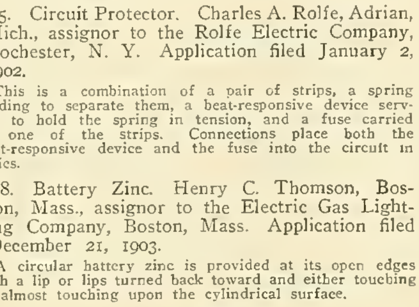
On each end of the shaft of the main trolley wheel is pivoted a U-shaped side frame carrying a vertical spindle on which revolves a guide wheel engaging the side of the trolley wire. These lateral guide wheels are held to the wire by a spring, but can be freed from it by pulling a rope.

866,735. Circuit Protector. Charles A. Rolfe, Adrian, Mich., assignor to the Rolfe Electric Company, Rochester, N. Y. Application filed January 2, 1902.

This is a combination of a pair of strips, a spring tending to separate them, a heat-responsive device serving to hold the spring in tension, and a fuse carried by one of the strips. Connections place both the heat-responsive device and the fuse into the circuit in series.

866,748. Battery Zinc. Henry C. Thomson, Boston, Mass., assignor to the Electric Gas Lighting Company, Boston, Mass. Application filed December 21, 1903.

A circular battery zinc is provided at its open edges with a lip or lips turned back toward and either touching or almost touching upon the cylindrical surface.



NO. 866,751.—METHOD OF EXHAUSTING INCANDESCENT BULBS.

866,751. Method of Exhausting Incandescent-lamp Bulbs. Frank L. O. Wadsworth, Pittsburg, Pa. Application filed February 28, 1906.

This method of exhausting bulbs consists in causing the flow of a liquid under the action of pressure to control in succession the several steps in the operation. (See cut.)

866,760. Polarized Ringer Magnet. Francis H. Whitman, Cambridge, Mass. Application filed December 31, 1906.

Two electromagnets have cores which project at one end of the magnets, the projecting ends being formed with transverse grooves to engage and be clamped to a yoke having slotted ends. An armature is supported by a bridge which has adjustable means for securing it to the yoke, whereby the bridge may be adjusted to vary the distance between the armature and the magnet cores.

866,770. Electric-conductor Molding. Sidney M. Burk, Philadelphia, Pa. Application filed February 9, 1906.

This molding has thin grooves adjacent to the sides of the conductor channels. The tongues left between these grooves and the channels thus make flexible sides for the latter.

866,781. Trolley. George R. Forster, Fithian, Ill. Application filed April 27, 1907.

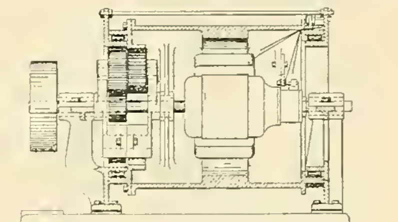
A mechanism is provided at the base of the trolley pole which automatically lowers the pole when the trolley wheel leaves the wire. The mechanism comprises a cylinder with fluid operated piston, trip devices and springs.

866,794. Intercommunicating Telephone. Charles E. Lee, Chicago, Ill., assignor to the Electric Goods Manufacturing Company, Boston, Mass. Application filed February 28, 1906.

This patent covers a special form of hook switch for a local telephone system. It consists of a set of circuit springs, a push-button in connection therewith, and a latch at the end of the hook arm for engaging the springs when the receiver is removed.

866,810. Electric Laundry Iron. Earl H. Richardson, Ontario, Cal. Application filed October 10, 1906.

The body of the iron has resistance wire wound into a recess in its top. A detachable cover lined with heat insulating material is provided with binding posts and fuses that connect with the terminals of the resistance wire.



NO. 866,820.—ELEVATOR MACHINE.

866,820. Elevator Machine. George L. Smith, Chicago, Ill. Application filed August 11, 1906. Renewed July 12, 1907.

This machine has a drum revolving on roller bearings. The motor is mounted within the drum on the central shaft and is geared to the drum. (See cut.)

866,838. Apparatus for Firing Explosives in Wells. Luke H. Broadwater, Findlay, Ohio, assignor to the E. I. du Pont de Nemours Powder Company, Wilmington, Del. Application filed June 24, 1907.

The apparatus consists of a chamber containing the firing fuse and a chamber containing an explosive, there being a space between these chambers. Firing wires, adapted to be ruptured by the explosive, are provided with an electrical connection between the firing wires and the fuse and explosive.

866,846. Electric Locomotive Controller. Charles O. Dayton, Washington, Iowa. Application filed October 8, 1906.

This is an electric block signaling system for railroads. The locomotive engages road-bed contacts at the ends of each block. A step by step controller is arranged in each block and this opens the circuit in the block which the train is approaching and thus operates an electromagnetic signal in that block.

866,849. Method and Process for the Recovery of Copper and Other Metals from Their Ores. Charles H. Ehrenfeld and Jacob R. Grove, York, Pa. Application filed September 7, 1906.

This process is particularly adapted to sulphide ores of copper. The ore is first heated in the presence of a limited supply of oxygen to expel the sulphur and convert the copper of the ore into the lower oxides of copper. The metal is then dissolved out by electrolysis into an aqueous solution of ammonium chloride, and finally electrically deposited therefrom.

866,858. Apparatus for Depositing Metals. Wilbur A. Hendryx, Denver, Colo. Application filed June 30, 1905.

Any apparatus for recovering metals has a tank and a depositing cell therein, the cell comprising electrodes adapted for connection to an external source of current and a filtering medium.

866,859. Apparatus for Depositing Metals. Wilbur A. Hendryx, Denver, Colo. Application filed June 30, 1905.

This apparatus for precipitating metals consists of an anode separated by a filtering medium from a cathode. The latter is composed of an amalgam of mercury and zinc, and is supported by a permeable casing surrounding the anode.

866,920. Perforating Machine. Lewis B. Doman, Elbridge, N. Y., assignor to William C. Ranney, trustee, Elbridge, N. Y. Application filed March 7, 1899.

Punches are arranged on opposite sides of the path of the article to be perforated. Electromagnets are arranged so as to control the operation of the punches.

866,945. Electric Signaling on Railways. William J. MacKenzie, Dunmurry, Ireland. Application filed December 13, 1905.

This system requires one or two insulated conductors laid between the rails on the track. Trolleys on the engine make contact on these conductors and enable signals to be transmitted from the engine man to the signal tower man or the reverse.

866,959. Electroplating Apparatus. Louis Potthoff, Flushing, N. Y. Application filed May 1, 1906.

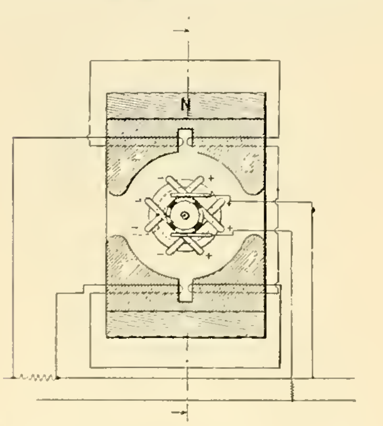
A galvanizing tank is arranged in the form of a tumbling barrel for shaking the material while being galvanized. Connections for the anode and cathode are brought into the barrel through the shaft bearings. Means are provided whereby the material is retained within the barrel when it is rotated in one direction, but discharged from the barrel into a washing tank, when the barrel is rotated in the other direction.

866,977. Cut-out. Joseph G. Swallow, New York, N. Y., assignor of one-half to Frank W. Smith, New York, N. Y. Application filed April 4, 1907.

The base of this cut-out has a receptacle for a fuse plug. The cover has a hole through which the fuse plug may be inserted. When the cover is turned about, the fuse plug and the electrical connections are entirely covered.

866,983. Railway Switch. Guy M. Thompson, Seattle, Wash., assignor of one-fourth to Charles S. Follett, Seattle, Wash., and one-eighth to Samuel E. Lancaster and one-eighth to Jacob A. Meyer, Le Claire, Iowa. Application filed November 26, 1906.

This is an electrically operated track switch. On each side of the switch are arranged casings containing electromagnets, the cores of which are connected to a bar fastened to the movable tongue of the switch.



NO. 866,990.—ELECTRICAL MEASURING INSTRUMENT

866,990. Electrical Measuring Instrument. Thomas W. Varley, New York, N. Y. Application filed September 7, 1905.

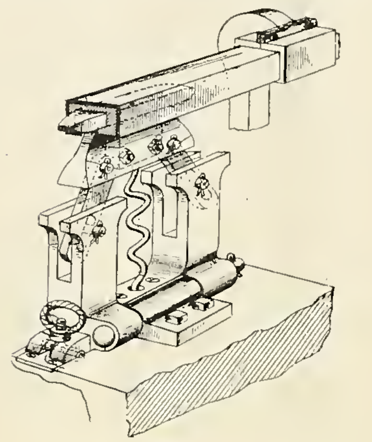
A wattmeter has a permanent magnet with pole pieces. The pressure coil is wound so as to form a two-pole armature rotatable within the pole pieces, but remains balanced when the permanent magnet's field alone is acting. The series coil is wound around the pole pieces and its current tends to distort the magnetic field in a diagonal direction and thereby cause rotation of the pressure coil. (See cut.)

867,014. Telephone-exchange System. Edward E. Clement, Washington, D. C. Application filed December 10, 1904.

This patent relates to a common-battery system having a signal relay normally connected to the line, a cut-off relay controlling the connection of the signal relay and means controlled by the latter for connecting the cut-off relay. Further means are provided for energizing the cut-off r[illegible] circuit.

867,021. Electric Contact Rail and Shoe. George Drawert, Chicago, Ill. Application filed May 14, 1906.

The rail has an undercut groove along the lower surface, in which fits a contact shoe flexibly mounted over, and connected to, a car running under the contact rail. (See cut.)



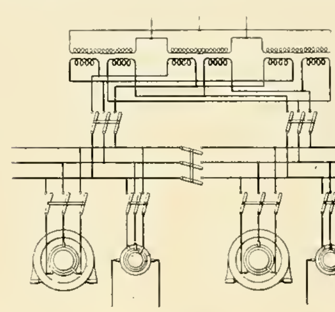
NO. 867,021.—CONTACT RAIL AND SHOE.

867,046. Electro-metallurgical Process for Extracting Copper from Its Ores. Lucien Jumau, Paris, France. Application filed December 29, 1905.

The ores are first roasted to drive off the sulphur and to reduce the metal to oxide. This is next leached with an ammoniacal solution to dissolve out the copper. Sulphur dioxide gas is then passed into the solution to reduce cupric to cuprous salts, which are finally electrolyzed.

867,065. System of Electrical Distribution. Louis C. Marburg, Norwood, Ohio, assignor to the Bullock Electric Manufacturing Company, Cincinnati, Ohio. Application filed August 30, 1905.

This system consists of a plurality of independent alternating-current generators, a transformer having a high-tension winding and a plurality of low-tension windings, means for connecting each of the generators to one of the low-tension windings, a plurality of converters, and means for connecting each of the converters to one of the generators. (See cut.)



NO. 867,065.—SYSTEM OF ELECTRICAL DISTRIBUTION.

867,085. Fare-register Attachment. John R. Scott, Oakland, Cal. Application filed December 12, 1906.

The operating lever of the register when moved in one direction closes a switch in the lighting circuit and lights up a lamp near the register. When ringing up fares of another denomination, the lever is turned in the other direction which does not affect the lamp.

867,095. Circuit Closer. Thomas A. Bemus, Boston, Mass., assignor to the T. Alton Bemus Company, Incorporated, Boston, Mass. Application filed March 2, 1905.

A casing with a circumferential wall has contact plates on the inner face of the wall. A rotary shaft passes through the center of the casing and carries a contact brush with a ball at its end.

867,125. Trolley-wheel Support. George W. Grisdale, Jr., Philadelphia, Pa. Application filed March 5, 1906.

A hinged sleeve at the top of the trolley pole contains a shaft with a forked head carrying the journals of the trolley wheel. In the sleeve there is also a spring acting at nearly right angles to the trolley wire to hold the wheel tightly against the wire.

867,140. Molding for Electric Wiring. William H. G. Kirkpatrick, Philadelphia, Pa., assignor to the Kirkpatrick Manufacturing Company, Philadelphia, Pa. Application filed April 27, 1906.

This molding has a number of dovetailed grooves diagonally crossing the partition between the main channels. In these grooves are keepers that can be moved either way a distance equal to one-half the width of the main channels.

867,147. Rail Magnetic Brake. Victor L. Ochoa, New York, N. Y., assignor of one-half to Benjamin A. Jackson, New York, N. Y. Application filed January 5, 1907.

A magnet core consists of a tube, divided longitudinally at one side and having projecting poles. A longitudinal winding of exciting wire is placed within and without the tube which is suspended from a car in close proximity to the rail.

867,150 to 867,152. Railway Signaling Apparatus. Vincent L. Raven, Darlington, England. Application filed April 18 and 23, 1907.

These three patents relate to a system that makes audible and visual signals on the moving vehicle, which are under the control of the signal man. The vehicle carries means for contacting on bars along the track that are electrically connected with the signal tower where duplicate signals appear.

867,154. System of Motor Control. Walter J. Richards, Norwood, Ohio, assignor to Allis-Chalmers Company, Milwaukee, Wis. Application filed September 29, 1906.

This system has a separate generator supplying current to the armature of the motor to be controlled. The fields of these machines are energized by two separate exciters, the fields of which are parallel and connected across one of the leads running from the generator to the motor. The exciter fields are adjusted inversely by rheostats and are reversible.

867,155. Motor-control System. Walter J. Richards, Norwood, Ohio, assignor to Allis-Chalmers Company, Milwaukee, Wis. Application filed March 1, 1907.

This patent relates to a controller in the armature circuit of a motor, the controller contact arm being operated from a number of distant points through a set of levers connected by a rod to it. This mechanism is governed by a dash pot and springs causing a slow movement "on" and a rapid movement "off."

867,168. Controller Regulator. Emmett W. Stull, Norwood, Ohio, assignor to Allis-Chalmers Company and the Bullock Electric Manufacturing Company, jointly. Application filed March 30, 1907.

The controller handle carries a pawl which engages a notched ring on top of the controller box when the handle is moved forward, but releases when the forward pressure on the handle is relieved. This is accomplished by a shifting of the center of gravity of the pawl and results in permitting a forward movement of intermittent character only.

867,180. Vehicle-controlling Apparatus. Granville T. Woods, New York, N. Y. Application filed September 23, 1899.

This is a system wherein a number of electrically driven vehicles are run in a contest on separate tracks and individually controlled by a master controller.

867,197. Block-signal System for Electric Railways. Clayton W. Hamm, York, Pa., assignor of two-fifths to Robert S. Beard, York, Pa. Application filed December 19, 1906.

A rotary switch controls the signal circuit. This switch is moved by oppositely disposed ratchet wheels on its shaft and a pawl on each wheel, the pawls being actuated by electromagnets that are energized by the passage of a car.

867,211. Circuit Making and Breaking Device. Andrew L. Riker, Bridgeport, Conn., assignor to the Locomobile Company of America, New York, N. Y. Application filed January 18, 1904.

This device contains a contact member and a resiliently mounted armature member having a vibratory movement on either side of its normal position. Impact means are provided for forcibly making and breaking the circuit.

867,212. Electrical Circuit Protector. Charles A. Rolfe, Rochester, N. Y., assignor to the Rolfe Electric Company, Rochester, N. Y. Application filed September 18, 1905.

A pair of metallic supporting strips holds a heat cartridge which is provided with self-soldering circuit-opening mechanism, and means extending through the cartridge for returning the mechanism to normal position.

867,220. Circuit-closer for Door Alarms. Louis E. L. Themke, Strathcona, Alberta, Canada. Application filed March 14, 1907.

The door carries a battery concealed in a recess. The stem of the door knob is provided with a contact, closing the battery circuit and sounding the alarm, when the knob is turned.

PATENTS THAT HAVE EXPIRED.

Following is a list of electrical patents (issued by the United States Patent Office) that expired September 30, 1907:

437,183. Electric Meter. R. N. Dyer, East Orange, N. J.
437,210. Electric Street Car. L. H. Leber, Pittsburg, Pa.
437,226. Electric Illuminated Sign. J. A. McEntee, Chicago, Ill.
437,272. Distribution and Regulation of Electric Currents. F. Wilking, Berlin, and H. Muller, Nuremberg, Germany.
437,293. Coin-operated Telephone Attachment. H. F. Dugan, San Francisco, Cal.
437,307. Automatic Telegraphy. D. Kuihardt, Aachen, Germany.
437,311. Artificial Ground and Compound Metallic-circuit System. C. E. McClure, Richmond, Va.
437,324. Electric Cut-out. E. E. Bailer, Everett, and G. J. Galbraith, Boston, Mass.
437,352. Electric Hand Switch. J. W. Battershall, Attleborough, Mass.
437,358. Electric Railway System. C. K. Harding, Atlantic, Iowa.
437,359. Electric Snap Switch. W. Hochhausen, Brooklyn, N. Y.
437,360. Dynamo-electric Machine. W. Hochhausen, Brooklyn, N. Y.
437,362. Electric Cut-out. W. J. Jenks, Nyack, N. Y.
437,363. Lightning Arrester. H. M. Kalbach, Ashland, Pa.
437,369. Electric Alarm. A. Tschira, Freiburg, Germany.
437,393. Galvanic Battery. E. H. Crosby, Boston, Mass.
437,422. Telegraphy. T. A. Edison, Menlo Park, N. J.
437,428. Propelling Device for Electric Cars. T. A. Edison, Menlo Park, N. J.
437,469. Galvanic Battery. G. A. Liebig and C. Willms, Baltimore, Md.
437,512. System of Electrical Distribution. F. B. Rae, Chicago, Ill.
437,513. Electric Switch. F. B. Rae, Detroit, Mich.
437,570. Welding Metals Electrically. C. J. Coffin, Detroit, Mich.
437,654. Electric Forging Apparatus. G. Lauder and J. H. Simpson, Pittsburg, Pa.
437,662. Automatic Switch for Stationary Motors. F. B. Rae, Detroit, Mich.
437,663. Armature for Dynamo-electric Machines and Motors. F. B. Rae, Detroit, Mich.
437,668. Fire-alarm-signal Box. J. Young, Chicago, Ill.

WESTERN ELECTRICIAN

EVERY SATURDAY

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An Aerial Electrically Operated Tramway Over Lake Michigan.

Aerial tramways, electrically operated, while not common, are in use for various purposes in this and other countries. Akin to them are the suspended electric railways, of which notable examples exist in Germany. A similar project for a passenger cableway for hanging cars has been talked of in New York and Long Island City for some time.

An interesting and novel application of the aerial tramway, although only for temporary use, is to be found in Chicago, where, for the first time, such a line is being operated over water for such a considerable distance as a mile and a half. In constructing what is to be known as the southwest land and lake tunnel, which is to furnish from Lake Michigan the water supply for a large area in Chicago, some means had to be supplied for conveying construction material to, and later excavated material from, the site of the new crib and shaft far out in the lake.

After careful consideration Mr. George W. Jackson, the well-known contractor and engineer, who has the contract for driving the tunnel, decided that the work could be done to great advantage by the aid of an aerial tramway, instead of by boats. Plans were at once made for the steel tower line and cableway shown in the accompanying pictures.

The tunnel, as stated, is to be for water supply, and will extend from the end of the steel tower line, about a mile and a half from shore, to a considerable distance inland. It will be built in three sections, two on land and the present lake section, No. 3. The terminal of the aerial railway, where operations for the construction of this section of the tunnel are carried on, is at the corner of Seventy-third Street and Bond Avenue. At this point and located about 50 feet inland from the tower shown in Fig. 5 is being completed a three-story frame structure known as the terminal building. Here is to be found the electric motor and mechanism for operating the aerial tramway, also "side track" space for the traveling buckets and cars.

In Fig. 1 is given a good general view of the tramway structure. The two heavy cables at the top are the carrying cables on which the cars travel, suspended as shown in Fig. 5. These cables are 1⅜ inches in diameter and are capable of supporting cars as fast as they can be loaded and sent out. The cable to the right in the picture carries the inbound cars and the one to the left the outbound.

On the lower cross-arm will be noted another set of cables, which, however, is one continous cable for pulling the cars. This steel traction rope is always moving, being driven by a large beveled gear sheave in the terminal house and revolving on a plain sheave at the crib end. The traction sheave is driven from a shaft belt-connected through reduction gearing to a 25-horsepower induction motor—a 60-cycle, 35-ampere, 440-volt machine—revolving at 600 revolutions per minute. Current for the motor is taken from the Edison mains.

Two kinds of cars are in use, the workmen's and material type shown in Fig. 3 and the bucket type shown in Fig. 4. A good idea of the carrying and pulling operations may be gained from Fig. 5, showing a workmen's car returning from the crib.

At each end of the line the carrying cables terminate in steel tracks like those shown in Figs. 3 and 4. When a load is to be sent over the tramway the car is pushed by hand from its position on the main steel track or side track to a point near the flush connection of the track with the cable, at the exit of the terminal, where a clutch on the car is automatically thrown, gripping the traction rope. The traveling mechanism of the cars is simple and is clearly shown in the pictures When no cars are in transit for a considerable distance the traction cable is permitted to drop into a series of guides on the lower cross-arms of the towers.

The tower line, while for temporary use, is of substantial construction. The towers, 26 in number, are of steel, 30 feet high, and set on steel piles of the kind designed and used for various purposes by Mr. Jackson. The details of the towers are clearly shown in Figs. 1, 2 and 5.

A feature of this new application of the aerial tramway lies in the building of the foundations and placing of the towers. That efficient and safe operation of the cars might be assured it was necessary that the towers be in perfect alignment. To accomplish this result over water required considerable engineering skill, and several methods were tried. Finally an elevated platform was built on shore and from this the piles for the first six towers were driven and the towers erected by a transit line. The platform was then moved to the last completed tower and the next six were built by the same method. In the next shift six more were constructed, and eight in the last shift. This method naturally consumed much time, as progress could be made only when the lake was smooth, giving no motion to the vessel from which the work of placing the towers was conducted. Frequently it was necessary to be idle several days at a time, but every calm was promptly utilized. That the line is true and the work well done is apparent from the picture.

The crib, shown floating to the right in Fig. 1, was built at South Chicago and towed to its destination at the end of the tower line. Here a

FIG. 1. AERIAL TRAMWAY OVER LAKE MICHIGAN, USED IN CONSTRUCTING SOUTHWEST LAND AND LAKE TUNNEL.

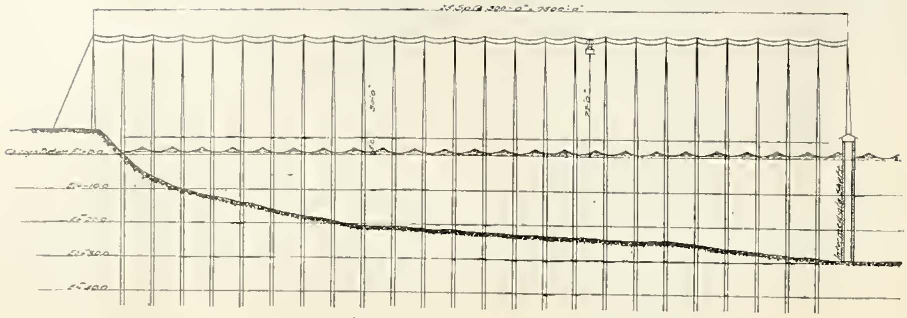


FIG. 2. PROFILE OF AERIAL TRAMWAY OVER LAKE MICHIGAN.

deep shaft is to be sunk, from which the work of driving the tunnel will be begun. Through this shaft also compressed air will be supplied as the tunnel work progresses.

It may be said that the towers will also support the pipes from the compressor plant to the shaft. These pipes are now being suspended from the towers. Telephone wires and electric-light wires for crib, shaft and tunnel service are also carried on the towers.

The diagram, Fig. 2, shows the conditions met

FIG. 3. PASSENGER CAR OF AERIAL TRAMWAY, SHOWING METHOD OF OPERATION.

with in building. The towers reach 30 feet above the waterline and are spaced 300 feet apart, making the aerial tramway over the water nearly 1½ miles long. The last tower is in 30 feet of water.

This enterprise, aside from the aerial tramway, will consume considerable electric current in the shops and compressor plant located directly across the street from the terminal building at Seventy-third and Bond streets. Here a large building has been erected to accommodate the temporary shops and air compressor plant.

Three Ingersoll-Rand air compressor units are being installed. The compressors are belt-connected to three 150-horsepower induction motors taking current from the Edison mains. There is also a motor-generator set for supplying direct current for various uses in the machine and blacksmith shops. This set consists of a 360-horsepower three-phase synchronous motor direct-connected to a 250-kilowatt direct-current generator. A substantial slate switchboard for controlling the current throughout the plant has been erected.

FIG. 4. VIEW IN TERMINAL STATION OF AERIAL TRAMWAY, SHOWING TRAVELING BUCKETS.

Applied Electrochemistry in France.

Consul William H. Hunt, in a report from St. Etienne, states that the electrochemical industries of France can be divided into three classes, which he names and describes: First, industries utilizing electrolysis; second, industries utilizing the heat produced by the current, either from the arc or from a conductor; third, industries utilizing the electric spark.

To the first class belongs galvanoplasty, used for coating metals with silver, gold or nickel, and is employed all through France. An important application of this industry is the electrolytic refining of copper, of which there are several examples in France, and notably at Eguilles, near Sorgues, in Vaucluse, belonging to the Société de Cuivre de France, producing two tons a day, and at Givet, in Ardennes, with a production of seven tons daily. There are also several minor factories. All these factories produce copper in a very pure state, but it has to be always melted on account of its physical conditions. At Dives, in Calvados, however, this operation is rendered unnecessary by the Emore process, producing directly plates and tubes of copper by electrolysis 12 tons daily.

The decomposing of water into hydrogen and oxygen is exploited by several concerns. The establishment of St. Vrain, near Ballancourt, employs the Hazard-Flamand process, and produces 200 cubic meters (one cubic meter = 35.3 feet) of hydrogen, and 100 cubic meters of oxygen per day. La Société Oxydrique Française utilizes in its factories at St. André, near Lille, and Villeurbanne, near Lyon, the Garuti process, in which the cathodic and anodic compartments are separated by an iron partition pierced with a multitude of small holes. The daily production of these works is about 400 cubic meters of hydrogen and 200 cubic meters of oxygen.

The Electrochemical Company furnishes hydride of lime (CaH), which gives off hydrogen in contact with water. This body, which sells at present at $1.93 per kilo (2.2 pounds), is commercially known under the name of "hydrolith."

In the manufacture of soda by the electric process, the Volta Company, whose works are situated near Moutiers, utilizes the Outhenin-Chalandre process, and turns out 800 tons of soda and 2,000 tons of chloride of lime per year. About 4,000 tons of caustic soda are manufactured annually by this method in France. Chlorate of potash is manufactured at St. Michel de Maurienne by the Gall process, and at Chedde, near Chamonix, by the Corbin and Lederlin method. The total production is about 7,000 tons annually.

Aluminum is produced principally by three companies. The total annual production is estimated at 6,000 tons.

Carbide of calcium is already manufactured on a very large scale in France. It furnishes not only acetylene gas, but also cyanide of calcium, much spoken of today as a fertilizer and as an agent for producing ammonia.

Numerous companies employ electricity in the production of ozone, used as an oxydant in the preparation of certain organic products—vanaline, heliotropine, essence of hawthorn, etc.

It may be said in concluding that the electrochemical industry has developed considerably within the last few years in France, and the amount of horsepower used in the different manufactories is estimated at 100,000.

Single-phase Operation on the Rochester Division of the Erie Railroad.

By W. N. Smith.

One of the most important electric-railway developments of the present year is the change from steam to electric motive power on a portion of the Rochester division of the Erie Railroad, which took place on June 18, 1907. This is the first installation of a single-phase alternating system of electrical motive power upon a steam railroad to go into commercial operation.

This electrification can justly claim the priority of application of several important features which are of interest in connection with the discussion now prevailing upon systems best suited for steam-railroad electrification. This line was the first to operate electric cars on the single-phase system over the tracks of an operating steam railroad; the first to use 11,000 volts working pressure commercially on a trolley in this country, and the first instance of a heavy electric traction system receiving power from the 60,000-volt transmission line.

FIG. 5. TOWER AND CABLE CONSTRUCTION OF AERIAL TRAMWAY.—FIRST CAR RETURNING FROM THE LAKE.

All of the construction described below, except that of the 60,000-volt power transmission line and the car bodies and trucks, was designed, executed and placed in operative condition by Westinghouse, Church, Kerr & Co., engineers, through whose courtesy the photographs were furnished which illustrate the article.

The section of track equipped is 34 miles long, extending from Rochester, N. Y., over the main line of the Rochester division to Avon, a distance of about 19 miles, thence 15 miles over the Mount Morris branch. The railroad is entirely single track, with sidings at way stations averaging three to four miles apart. The grades are light, and the curvature for the most part quite easy, the line being relatively quite straight.

The line was originally laid with 68-pound rails, but was relaid with 80-pound rails taken from another division just prior to the electrification. The roadbed is ballasted with gravel, and the joints are of the Weber type. A single No. 00 protected rail bond is applied to each rail joint under the plate, one of the advantages of the high-tension single-phase system being that the relatively small current, combined with the high impedance of the main circuits, renders it unnecessary to resort to heavy bonding.

The line crosses a number of bridges, the longest one, that over the Genesee River, about a mile and a half south of Rochester, being 780 feet long, comprising seven spans. There are also through truss bridges at Rush and at Canaseraga Creek, near Mount Morris, and a stone arch bridge over Conesus Creek, a short distance south of Avon.

The electric service is devoted solely to passenger traffic, which is of the local interurban type. The freight service is handled exclusively by steam as heretofore, as are also the through trains operating between Rochester and Corning, over the main line of the Rochester division, a distance of about 94 miles. Instead of three round trips a day, the electric service has introduced six complete round trips between Rochester and Mount Morris, and three more between Avon and Mount Morris.

Four-car Elect ic Train at Avon, N. Y.

SINGLE-PHASE OPERATION ON ROCHESTER DIVISION OF ERIE RAILROAD.

Power Supply.

The power is generated at Niagara Falls, in the plant of the Ontario Power Company, and is transmitted at 60,000 volts, three-phase, over the lines of the Niagara, Lockport and Ontario Power Company. The Iroquois Construction Company constructed a branch line from Mortimer, a little over four miles south of Rochester, to Avon. The pole construction used upon this branch transmission line is of the A-frame type, using two 40-foot cypress poles, set abreast of each other, and inclined so that their tops are framed together, the butts being joined by horizontal plank braces underground. The insulator pins are grounded by copper wire. The conductors are of No. 4 hard-drawn, stranded copper cable. The standard length of span between poles is 220 feet, which is shortened at curves where necessary.

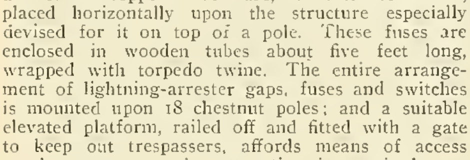
Sub-station.

The sub-station building is located in the Y formed by the railroad tracks at Avon, and, together with the car shed, is adjacent to the roundhouse and division repair shop. The building is absolutely fireproof, the doors and windows being of kalomein construction, and fitted with wire glass. In the basement are located one of the transformer oil tanks and the oil pump. The main floor is divided into three rooms, the main transformer room being 43 by 17 feet, and extending the full height of the structure to allow room for the high-tension bus-bars, which are carried over the transformers. The remaining space on the main floor is divided into a high-tension room (through which the 60,000-volt wires enter, and which is the location of the high-tension circuit-breakers, 16 feet 8 inches by 19 feet 8 inches), and the operating room, where is located all the 11,000-volt switching apparatus and the measuring instruments.

Directly over the operating room is a mezzanine floor, reached by an iron staircase, in which are located the 11,000-volt lightning arresters, the 60,000-volt choke coils, and the 60,000-volt series coils. The high-tension connections enter through the high-tension room, which runs from floor to floor, and pass through the choke coils and series coils, on the mezzanine floor, and then turn through a wide opening in the wall to the 60,000-volt bus bars, which are located in the upper portion of the transformer room.

The transmission line terminates at the lightning-arrester yard in the rear of the sub-station. The arrangement of the 60,000-volt lightning arresters consists of three horn gaps, arranged one behind the other, on each of the three conductors, the first gap being 4¾ inches across, the second five, and the third six inches. A concrete column is in series with the first gap, an electrolytic arrester in series with the second, and a five-foot fuse of No. 18 copper wire in series with the third, that is to say, between one horn and the ground. Both horns of each gap are of one-half-inch round iron. Between the line and the first arrester there is a hook-type knife switch, and between the last arrester and the lead into the sub-station, there is a No. 18 copper wire fuse, in each conductor, placed horizontally upon the structure especially devised for it on top of a pole. These fuses are enclosed in wooden tubes about five feet long, wrapped with torpedo twine. The entire arrangement of lightning-arrester gaps, fuses and switches is mounted upon 18 chestnut poles; and a suitable elevated platform, railed off and fitted with a gate to keep out trespassers, affords means of access to the apparatus when attention is required.

Within the sub-station the wires first pass through three 60,000-volt stick-type circuit-breakers, mounted directly inside of the rear wall. Thence, over bare copper conductors, to the three oil-insulated choke coils, situated on the mezzanine floor, thence to three oil-insulated series transformers, also on the mezzanine floor, from which connections are taken to the power measuring instruments in the operating room. The main connections finally terminate upon a set of copper bus-bars in the transformer room, which are run upon porcelain insulators mounted on wooden cross-arms and placed at a convenient height directly over the line of transformers.



100-HORSEPOWER SINGLE-PHASE RAILWAY MOTOR.

The 60,000 three-phase current is rendered available for single-phase distribution by means of three transformers of the Westinghouse oil-insulated water-cooled type, each of 750 kilowatts capacity. For the present installation, two transformers only are used at one time, the third being a spare. The low-tension windings can be so connected that either 11,000 volts or 22,000 volts can be obtained, so that in case it should ever be desired to transmit railway current for an extension of 40 or 50 miles, to another sub-station, it could readily be done without adding transformers to this equipment.

One end of each low-tension winding is directly grounded to the boiler iron case, which in turn is, by means of a No. 0000 stranded copper cable, directly connected to the track-return circuit.

The necessary transformation from three-phase to two-phase fits in very well with the natural subdivision of the electrified line, into two sections, one of which is about 19 miles in length, north of Avon, the other, about 15 miles in length, being to the south of Avon. The connections were therefore laid out to operate the sections upon separate phases of the two-phase secondary system. Either the T or V connection can be used, the latter method being employed at present. Each one of the active transformers therefore feeds a separate section.

The low-tension bus-bars run along the wall of the operating room, and directly beneath them are three type E Westinghouse automatic oil circuit-breakers, one on each of the two trolley feeders, the third breaker, which is situated between the other two, being a spare. One pole of each of the three oil breakers is connected to the center pole of a double-throw hook-type knife switch, by means of which it is thrown upon either bus bar. The other pole of the oil breaker runs directly to the feeder. The outgoing lead from the middle or spare circuit-breaker can be thrown upon either one of the feeders, should the breaker usually controlling that feeder be temporarily disabled. The system of connections is simple, compact and flexible, and has admirably fulfilled the conditions for which it is intended.

The outgoing 11,000-volt feeders run up to the mezzanine floor directly over the operating room, where they emerge from the building through perforated glass disks.

The station itself does not require the continuous presence of an attendant, which is needed in the case of a rotary-converter sub-station. The working force is so organized that the car-repair men are always available for manipulating the sub-station circuit-breakers, and the cost of attendance is thereby reduced to a minimum.

Catenary Trolley Construction.

The overhead trolley construction is in many respects unique. It was the first of all catenary installations to operate regularly at 11,000 volts. There were very few precedents to follow; many of the details of the overhead work are entirely original, and nearly all of them were specially designed for this installation by the engineers who planned the work.

The poles are of chestnut, averaging 25 inches in circumference at the top and about 42 inches at the butt. Most of them are about 35 feet long, but 40-foot poles were used where the embankments were narrow and steep, and in span construction. Nearly all of the construction is of the bracket type, except at the railroad yards at Rochester, Avon and Mount Morris, and for some distance at Mortimer, where there is a siding on each side of the main track, which prevented the use of bracket construction there.

The insulator is of the R. Thomas & Sons manufacture, 6⅞ inches in diameter, and 6 inches high, made in two parts, but of the three-petticoat type, and known as the No. 3029. It was designed by the engineers especially for this installation.

The messenger wire is of "extra high-strength" steel, furnished by the American Steel and Wire Company. It is of seven strands, and is seven-sixteenths inch in diameter. The trolley wire is No. 000 grooved copper, the lengths being spliced with the usual type of soldered splicing sleeve.

The spans on the straight-line track are 120 feet in length, and as much shorter than this on curves as required by the radius of the curvature. The maximum deflection from the center line of the track on curves is seven inches each way.

The Rochester yard was a different piece of construction, on account of the distance between supports (which reaches a maximum of 94 feet, where spanning seven tracks, four of which are electrified), and also on account of the uncertain nature of the soil, which on the bank of the Genesee River is filled in with gravel and cinders. For these long spans, where it was impossible to use guys of the usual type (the river bank being on one side and the main high highway which gives teams access for loading and unloading of freight cars on the other side), it became necessary to use self-supporting span construction, and this was done by using the "tripartite" type of steel pole, set in concrete. This type of pole being constructed of rerolled Bessemer steel rails, is less subject to rust, and consequently more durable than any other available type of metal pole, and all of its surfaces are always open and easy of inspection.

The span wires consist of the regular messenger cable, fitted with cable sockets sweated on at each end, the same being fastened to turnbuckles and pole collars at the tops of the poles. There are two span cables at each pair of poles, the upper one being used to carry the weight, the lower one acting to steady the arrangement and also to act as a relay in case of an accident to the upper span. Similar construction was also used at Avon, where guying of side poles was not always possible.

Nearly all the telephone and telegraph wires which cross over the 11,000-volt trolley wire have been put underground, particularly in the case of the leads composed of only a few wires; but where the line is crossed by heavy telephone trunk lines they have been protected by the basket type of construction, so designed as to effectually prevent a broken telephone wire from falling across the messenger or trolley wire.

Lightning protection for high-tension single-phase railway lines not having as yet been standardized, only a part of the line was equipped with line lightning arresters, which are of a swinging-fuse-gap type of construction, made by the Westinghouse Electric and Manufacturing Company. On the other half of the line lightning arresters were not installed. During the summer two of the poles were struck by lightning, but the metal work of the brackets and truss rods being entirely grounded, these poles were not damaged below the topmost point of attachment of the truss rods, which is generally not over 18 inches from the top of the pole. In a number of instances the lightning-arrester fuses have blown, but it is not known how many of them have blown simultaneously. Although the extent to which this type of arrester is fully protective is hardly established as yet, it can be stated that at no time since regular operation started has any injury to the car equipment resulted from lightning, though there were several severe storms during June and July.

The conditions of electric traction upon this line are such that no feeder is necessary besides the trolley wire, and consequently there is no necessity for feeding the seven sections separately.

Overhead Construction at Rochester Terminal.
SINGLE-PHASE OPERATION ON ROCHESTER DIVISION OF ERIE RAILROAD.

Rolling Stock.

The cars equipped with electric apparatus are six in number, and, together with their trucks, were furnished by the St. Louis Car Company. The electrical apparatus was installed upon the cars and trucks by the engineers at the railroad company's car shops in Buffalo, N. Y. The cars are 51 feet 4 inches over bumpers, 43 feet over corner posts and 29 feet 4 inches between truck centers. They are 8 feet 9 inches wide over sheathing, and 13 feet 8⅝ inches in height above the rail. Four of the six have two passenger compartments, the other two having a baggage compartment about 14 feet long, and a small smoking compartment with six seats, besides the regular passenger compartment.

The trucks are both alike, wheel base being 6 feet 8 inches. The axles are 6½ inches in diameter. The trucks are of the standard M. C. B. swing bolster type, with heavy framing. The brake shoes are inside-hung.

The heating equipment consists of 32 of the Consolidated Car Heating Company's electric heaters of the truss plank type, 450 watts capacity each in the main portion of the car, and two "No. 192 M. S." heaters in each cab.

Electrical Equipment of Cars.

The electrical equipment of the cars consists of four No. 132-A Westinghouse single-phase railway motors, with a nominal rating of 100 horsepower each, the gear ratio being 20:63. The suspension is of the nose type, and solid gears are pressed upon the axles.

The control system is of the Westinghouse electro-pneumatic type and includes three distinct circuits—the high potential, the low potential and the control circuit.

The high-potential circuit includes the pantagraph trolley, line switch and the transformer. The pantagraph trolley mechanism is operated by a pair of springs and by an air cylinder. The trolley is raised and held against the wires by means of springs against its own weight, and it is lowered by the application of air pressure to pistons working in cylinders that form part of its base. When down it is automatically locked, and the latch of this lock can only be withdrawn by applying air pressure to another small piston which then unlocks the pantagraph, allowing the springs to raise it. This trolley mechanism is so connected with the control circuit through the line relay that any interruption in the supply of high-tension current through opening of the line switch or main circuit-breaker immediately causes the trolley to be lowered by applying the air to the main cylinders in the trolley base.

The control circuit includes a master controller in each vestibule, the train-line wires and their connections to the valve magnets and interlocks a storage battery supplying current for these wires, and a motor generator set, which is used either to charge the batteries or to actuate the control system. The master controller makes the proper connections by means of which the 15-volt storage battery actuates the valve magnets which control the action of the air-operated main contactors in the switch group and the reversers. The controller handle is normally held in a vertical central position by springs unless it is moved to one of the running points by the motorman. When released from the grasp of the hand it flies to the vertical position, cutting off the power and enabling the emergency application of the brakes by means of a brake relay valve alongside of it.

In one vestibule there is located in an asbestos-lined compartment enclosed with steel doors, a slate switchboard panel upon which are carried all the switches and fuses for the control of the battery and motor-generator set, the lighting circuits and heaters, and also the main connection from the low-tension side of the transformers to the auxiliaries.

Operation.

The equipments above described were intended to be sufficient for operating single-car trains with one stop per mile over the entire road at an average schedule speed of 24 miles an hour, or to haul one trailer making stops about 2½ miles apart at the same schedule speed. The company has furnished shelters where the public highways cross the line, there being 22 of these flag stations besides the regular intermediate way stations at which steam trains stop, six in all, or a total of 28 stations at which electric cars may be required to stop. A single passenger coach is frequently attached to a motor car, and on some trains baggage, milk or postal cars are required, making a four-car train, as shown in an accompanying picture. The service has proved immensely popular throughout the Genesee Valley, through which it passes, and it is intended to increase the number of motor cars in order to handle the business a little more comfortably next season. It is found that the electric trains on their 34 miles of line can be depended on to keep to their running time rather better than the steam passenger and freight trains operating over the main line.

Telegraph and Telephone.

As is well known, the single-phase trolley system causes interference with telegraph lines along the right of way, and unless both the electrostatic and electromagnetic induction are properly compensated there is always danger of telegraphic communication being seriously affected. The static effect is particularly annoying, as it is absolutely continuous as long as the trolley line is charged, whether or not there are any cars moving. Various means were proposed and tried by the Western Union Telegraph Company for the elimination of the "static," which always causes the telegraphic relays to chatter, but the most successful thus far known is that due to the inventive genius of Mr. E. W. Applegate, quadruplex expert for the Western Union Telegraph Company, who has developed a very simple means for overcoming static interference. Mr. Applegate worked upon the theory that it was useless to try to compensate for the static, and that the thing to do was to "pacify" the instrument by additional devices. The Applegate "static pickup," for which a patent has been applied, comprises a back contact relay and a high-resistance shunt. By this arrangement all the telegraph wires are "singled," and metallic circuits, the necessity for which was at one time pending, were discontinued. The repeater service which they necessitated was also discontinued, and there is now a spare wire between Rochester and Mt. Morris through the entire zone of static interruption.

Speech over the telephone line along the road is very clear and distinct, and although the wires and instruments have a heavy static charge a few simple precautions enable it to be of great use to the operating department. It is intended to carry portable telephones upon the cars.

Organization.

The single-phase system was recommended for the electrification of this division by the Electric Traction Commission of the Erie Railroad, and after authorization by the company was installed under the general direction of Mr. J. M. Graham, vice-president and head of the construction department of the Erie. The engineering work and the construction work were carried out and the system brought into operative condition by Westinghouse, Church, Kerr & Co., who designed and erected the buildings and the catenary trolley construction, bonded the track and installed the electrical apparatus in the sub-station and on the cars. The adjustment of the telegraph system was carried out jointly by the Western Union Telegraph Company and the telegraph department of the railroad company.

The Erie is one of the oldest steam railroads in the country, but that it is also one of the most progressive is demonstrated by its policy of giving a thorough trial to a system of electric traction whose characteristics of simplicity in construction and economy in operation make it so eminently fitted to replace steam motive power wherever the economic conditions point to the desirability of its substitution for the betterment of either passenger or freight service.

A Case of Fruit-stand Lighting.

The ordinary Italian or Greek fruit stand offers an excellent field for the sale of central-station current on a small scale. The load is not large, of course, but it is good for at least a dollar or two a month if properly handled in most cases. In the summer the electric fan finds almost continuous use at a fruit stand, but in the winter the lighting demand of a number of stands is a most desirable load, being of the long-hour variety. It ought not to be difficult to drive the gasoline torch out of business in this field, for the electric lamp of high efficiency is much cleaner and also cheaper to operate. In one case a Greek fruit vender stated that in the darkest winter months his maximum bill for operating a single-glower Nernst lamp at a point nine feet above his fruit display and out of doors came to $2.58 a month, whereas it cost him formerly using gasoline at least $3 per month, with the added disadvantage of oily drippings on his fruit. The central station supplied the lamp, which easily gave the best out-of-door illumination in the block where several other stands were situated. The gasoline torch burned five gallons of gasoline per week at a cost of 15 cents per gallon.

Extension of Wichita's "White Way."

Mr. H. Almert, consulting engineer for the Edison Light and Power Company of Wichita, Kan., announces that by November 1st Wichita's "White Way" will be extended so as to include eight city blocks. At the present time the "White Way" consists of one block on North Main Street brilliantly lighted by arc lamps. The extension will be from First to Second streets on North Main and from Main to Santa Fe on Douglas Avenue. In these seven blocks there will be placed 359 additional 2,000-candlepower arc lamps. They will be operated, as the present ones are now, every evening till 10:30 o'clock except Saturday, and till midnight on that day. Mr. Almert, who has charge of the work, declares that, when completed, these streets will be the best lighted in the world. The citizens of Wichita, and business men particularly, are taking an active interest in the project.

Employes' Lecture Course of New York Edison Company.

For the benefit of its employes the New York Edison Company has inaugurated a course of lectures on electrical engineering to be delivered weekly at its auditorium, 44 West Twenty-seventh Street, throughout the coming fall and winter. The first lecture was given on Tuesday evening, October 1st, to an interested audience which taxed to the utmost the seating capacity of the spacious auditorium.

Mr. Alexander Maxwell, chairman of the lecture committee, called the meeting to order and introduced Mr. John W. Lieb, Jr., who spoke on behalf of the management of the New York Edison Company. Mr. Lieb, in his opening remarks, dwelt especially on the deep interest manifested by the company in the educational welfare of its employes, describing the successive steps in its welfare work, such as the building of the auditorium, the equipment of an employes' library, and the institution of these experimental lectures.

Prof. Sydney V. Ashe was then presented as the lecturer conducting the course. In his address he emphasized the fact that there is an imperative demand for technical training in preparing to enter the engineering profession today. The subject of his lecture was "Magnetism," and dealt with the fundamental principles governing the magnetic properties of iron. He laid great stress upon the necessity for a thorough knowledge of these peculiar characteristics of iron in order that the effect upon the growth of the electrical industry may be comprehensively grasped by the student. Lantern slides and numerous experiments illustrated the particular points of the lecture, which terminated at 10 o'clock. Professor Ashe was assisted by Mr. C. S. Kern of the Brooklyn Polytechnic Institute.

Electrical Exports for August.

Electrical exports from the United States for the month of August, 1907, were the largest of any month this year except June, and show an increase of $371,714 over August, 1906. The total value of such exports for August, 1907, was $1,740,793. There was an increase over the corresponding month of 1906 both in electrical appliances and electrical machinery, as shown by the following figures: Electrical appliances—August, 1906, $744,775; August, 1907, $810,301. Electrical machinery—August, 1906, $624,304; August, 1907, $930,492.

Following are the countries which made the largest purchases of electrical goods from the United States in August, 1907, the value of the goods being given:

Electrical appliances (including telephone and telegraph instruments)—Brazil, $167,869; British North America, $162,495; United Kingdom, $135,873; Germany, $47,806; Japan, $44,440; Mexico, $37,133; Cuba, $36,483; Argentina, $23,462; Central American States and British Honduras, $21,713; British Australasia, $11,120; Belgium, $8,763; British Africa, $7,415; France, $5,102; West Indies and Bermuda, $3,718; Philippine Islands, $2,051; other South Africa, $79,259.

Electrical Machinery.—Brazil, $210,670; Mexico, $162,196; British North America, $151,406; Japan, $121,407; United Kingdom, $86,140; British Australasia, $82,863; Argentina, $29,878; France, $28,991; British East Indies, $12,624; British Africa, $9,957; Cuba, $8,056; Central American States and British Honduras, $6,320; Germany, $2,435; Philippine Islands, $1,166.

Is Wireless Power Transmission Possible?

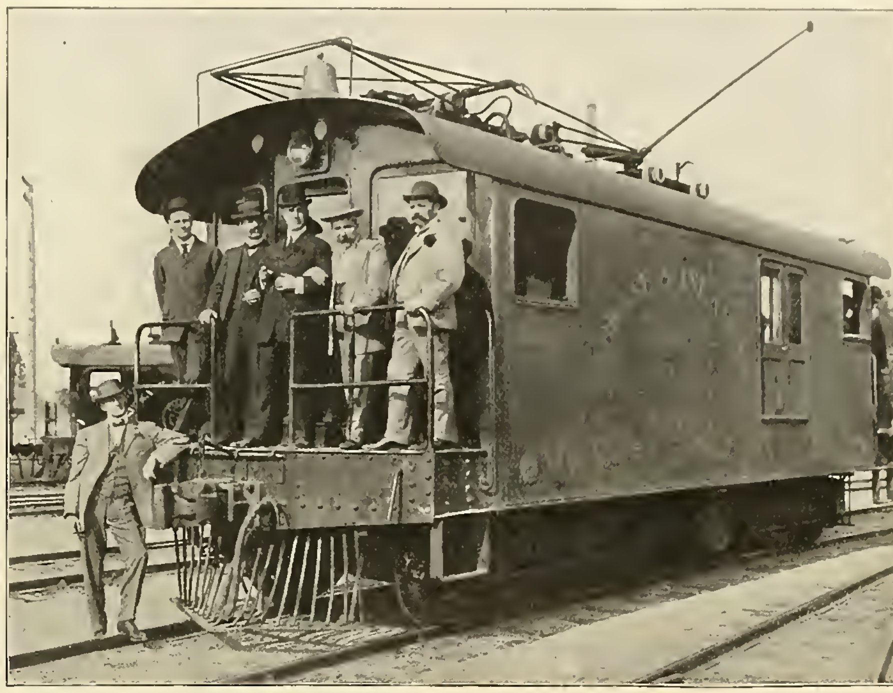
A cable dispatch from Paris of September 26th announces that "Mr. Young, a Lyons scientist," has conducted some experiments in the transmission of electric power without wires. These experiments were carried out in the grounds of the Chateau du Cret, belonging to Auguste Villy, a Lyons manufacturer. It is said that a miniature car was run a distance of 200 yards along rails without any tangible connection with the stationary electric transmitter or source of power. The details are withheld. According to the account, patents were applied for and a syndicate of bankers formed to promote the scheme.

What credence is to be given to this statement it is too early to say. At present it belongs to the "important-if-true" class. In view of the fact that radio-telegraphy on land is not as successful as over water, the probability is that radio-power transmission (if that term is permissible), if ever used, will be more successful as an aid in navigation of the air and water than for transmitting large amounts of power over land. Further, it is not at all likely that the power transmission and electric trolley lines of the present day are doomed to an early disappearance as was stated by some newspapers in considering the results of these French experiments.

German Electric-railway Commissioners in Spokane.

By August Wolf.

That was an interesting and significant announcement in Spokane, Wash., by Geheimrath Wittfeld, confidential adviser and counsellor to the German government, heading a royal commission appointed by Kaiser Wilhelm of Germany, when he said that the single-phase alternating-current system will be employed in electrifying 400 miles of railroad in the German empire. The commission, composed of Frederich Jordan, director of the Felton-Guilleaume Company; Emmerich Frischmuth, director of the Siemens-Schuckert Company, and Philip Pforr, director of the Allgemeine Company, engineers connected with three electrical manufacturing concerns employing 65,000 men, and Dr. Ing. Walter Reichel, engineer and professor of electricity in the Berlin Polytechnic school, inspected the Spokane and Inland Empire Railroad Company's system of 200 miles the last week in September and expressed themselves satisfied with what they had seen on this important single-phase railroad.



Reading from left to right: J. B. Ingersoll (on the ground), manager of the Inland Emp're System; M. R. Randall, local agent for the Westinghouse Company; Director Frederich Jordan, member of the German imperial commission; William F. Zimmerman, hydraulic engineer for Spokane and Inland; Geheimrath Wittfeld, head of commission and adviser of the kaiser, and Director Philip Pforr, member of the commission.

GERMAN ELECTRIC-RAILWAY COMMISSIONERS IN SPOKANE.

Mr. Wittfeld said in the course of a conversation that the royal commission was appointed to examine and report on all single-phase electric railroads in the country with the view of determining whether this system should be used for equipping the Berliner Stadtbahn railway lines, which have between 300 and 400 miles of road, owned by the government. The undertaking of electrifying the road, he added, means an expenditure of 200,000,000 marks, and for this reason a nonpartisan commission was named to make a thorough inspection. Before coming to Spokane the party investigated the New York, New Haven & Hartford and the Erie railroads in the East, and after leaving Spokane the Pacific Coast's systems will be visited. Speaking for the commissioners, he added:

"We were very agreeably surprised in Spokane and the surrounding country. It seems almost incredible that all these fine buildings could have been built and the city grown to nearly 100,000 population in twenty-five years. We have read much about the success of the new Spokane and Inland railroad, the articles appearing in the American technical journals being widely commented upon by the German press, and what we have seen here has more than repaid us for coming across the continent. The substantial and permanent construction of the road, especially the overhead work, and the completeness of detail in the frequency of sub-stations is also a surprise to our party. Taken altogether, the Spokane and Inland is undoubtedly the best equipped electric railroad of equal mileage in the world."

While in Spokane the commissioners were entertained by A. L. White, second vice-president of the Spokane and Inland Empire Railroad Company; J. B. Ingersoll, manager of the system, and F. H. Shepard, special representative of the Westinghouse Company. The party was taken in President Jay P. Graves' special car forty miles south to Spring Valley Junction, the round trip being made in a little more than two hours. Upon the return the visitors inspected the Inland's 50 and 72-ton electric freight locomotives, which have a capacity of from 500 to 700 horsepower each. A train of fifteen standard freight cars was attached to one of the electric locomotives and taken as far south as Moran Prairie on a two per cent. grade. Several stops were made and the members of the commission expressed surprise at the ability of the locomotive to stand the heavy overload without the least strain on the apparatus. The party also visited the big power plant now being constructed at Nine Mile Bridge, where apparatus is being installed to develop 20,000 horsepower.

Radio-telegraphy in France.

In regard to wireless telegraphy in France the following information is transmitted by the French director of posts and telegraphs: "We possess actually two stations for wireless telegraphy, one at Ouessant and one at Porquerolles. These two stations are prepared to handle private messages, to which may be added the station at Dieppe, which belongs to the Western Railway Company. Two other stations are about to be opened, one at Saintes-Maries-de-la-Mer (near Marseille) and the other in the environs of Algiers. It has been at last determined, according to an agreement reached between the interested departments of the government, to establish stations at Boulogne, Havre, St. Nazaire, La Coubre, Nice and Cape Corsica. This programme has been established tentatively and is susceptible of modifications."

A Wireless Police Patrol Signal System.

According to report, Assistant City Electrician Charles N. Farmenter of Berkeley, Cal., has invented a system of wireless telegraphy for transmitting signals to patrolmen while on their rounds. The plan consists in the erection of an antenna at or near the station house and furnishing each policeman with a small portable wireless receiver, so that signals can be given by the sergeant on duty for any particular patrolman to report to the nearest police telephone for instructions. It is reported that police commissioners in other cities are much interested in the invention.

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CONTENTS OF THIS NUMBER.

DEPARTMENTS.

DATES AHEAD.

American Street and Interurban Railway Association and affiliated societies (annual convention), Atlantic City, N. J., October 14th to 18th.

Western Association of Electrical Inspectors (annual meeting), Hotel Ryan, St. Paul, Minn., October 22d, 23d and 24th.

ATLANTIC CITY will witness the meeting of the electric-railway clans next week, and there is no doubt that the attendance will run up into the thousands, with a display of appliances of unequaled magnitude.

CHANGING TIMES demand new conditions, as somebody has said before. In the telephone field the altered situation has brought about the unusually interesting announcement, made last week, that the Bell interests will now sell telephone apparatus to all buyers, irrespective of previous condition of opposition. Hitherto this privilege has been strictly restricted to companies operating under license from the American Bell Telephone Company or its successor, but now, it seems, anyone with the price can buy Bell telephones as easily as he can a push-button. This is indeed a significant change. It may be viewed in several ways, and is no doubt a shrewd business move; but in any case there seems to be a somewhat formal recognition of the importance of buyers of telephone appliances who are not Bell licensees.

MUNICIPAL OWNERSHIP appears not to be very successful in Indiana, particularly when applied to electric-light plants in the smaller cities. Thus the municipal lighting plant of English was sold for 35 per cent. of its cost because of financial loss to the city. The depreciation of the plant was 13 per cent. a year. The plant at Linton was sold to private persons, the city management having resulted in a cost to taxpayers of from $200 to $500 a month more than the income. The plant as now operated by a private corporation is said to be making money and giving good service. Dunkirk tried the experiment for a time, and unloaded the plant at a considerable loss to the city. The city of Washington is about to vote, or has just voted, on the proposition either to sell the municipal plant or to expend a considerable sum in improvement and re-equipment. These examples speak for themselves. A system that provides for a reasonable reward for private enterprise, with honest and efficient municipal regulation for the public good, is best.

AN IMPORTANT educational movement of the last decade is the engineering apprenticeship courses of great industrial companies in the United States, and particularly of the larger electrical manufacturing companies. It is the link, in many cases, between the technical schools and the industries. In his recent paper before the American Society of Mechanical Engineers, entitled "College and Apprentice Training," Prof. J. P. Jackson of State College, Pennsylvania, considers these apprenticeship courses for students, and he finds them to be decidedly beneficial. Indeed, the author speaks of this connecting link in technical training as probably the greatest advance in useful education which the world has ever seen accomplished in the same space of time. "In the old days the boy who graduated from a literary or classical college and who found himself unfitted for the learned professions was apt to become a pauper and a burden upon the community, and even the technical graduate had great difficulty at first in making himself useful and valuable. Today, on account of this new type of post-graduate industrial education, every young man who has received his bachelor's degree, and who has a fair modicum of brains and common sense, has fields innumerable open to him which lead, possibly by slow steps, but surely, to positions of responsibility and usefulness which carry with them in the end excellent rewards to men who give energetic and studious service."

These student-engineer courses extend over two years usually. The students are paid for their work, beginning at perhaps 15 cents an hour, the rate of pay being advanced as experience warrants. The young men are not asked to enter into contract to remain with the company for any specified time, although it is rather expected that the students will not withdraw until they have finished the course. However, it usually happens that no opposition is made in the case of a man who has an opportunity to secure a good position outside if he has been with the company a reasonable length of time. As one employer of students expressed it, "We are just as anxious to have good men with our customers [say, electric-lighting and railway companies] as we are to retain them in our employment." The courses are laid out by practical men for the purpose of training the young graduates for positions of responsibility. The movement is not philanthropic, and it seems to achieve the desired end with a great degree of success.

AS WAS to be expected, the Board of Supervising Engineers, Chicago Traction, has begun its important task of directing the rehabilitation of the street railways of Chicago with an intelligence, comprehensiveness and energy which are worthy of praise. The work is being laid out on broad lines and is in thoroughly competent hands. Moreover, the traction settlement provided or will provide sufficient funds so that, with the judicious expenditure which may be looked for, there will undoubtedly be sufficient money to build a really first-class system of electric street railways (including eventually a system of subways) for the city of Chicago. The prospect is a pleasing one. Perhaps the Board will make mistakes, but at any rate the enterprise is in the hands of men who are honest, who have the requisite engineering and administrative ability and who have also the "Chicago spirit."

NEW YORK has a street-railway "situation" which threatens to become almost as complicated as that in Chicago. In both cities "high finance" has figured conspicuously in the management of street-railway properties with rather unfortunate results. The era of mergers, of floating new bond and stock issues and of "underlying securities" has been succeeded in each case by receiverships and the assemblage of eminent legal counsel, with satisfactory retainers, summoned to the unraveling of the skein. One result of the condition of affairs in New York has been the resignation of Mr. H. H. Vreeland from the operating management of the Metropolitan company. Mr. Vreeland is a former president of the American Street Railway Association, as it then was, and is known throughout the country as a street-railway man of ability and prominence. He began at the bottom of the ladder, but attracted the attention of the late William C. Whitney, who recognized his executive capacity, and thereafter his advancement to the presidency of the most important surface street-railway system in the country was rapid.

AN INTERESTING plan to facilitate the securing of new business has been put in effect at Minneapolis in connection with the starting of the Taylor's Falls electric transmission plant. As noted by a contributor, the Minneapolis General Electric Company made a careful canvass of the manufacturing districts prior to the completion of the first 12,500-horsepower installation at Taylor's Falls, securing data as to the hours of work and horsepower utilized. This information was then classified and maps were made showing the location of the different plants and the company's power lines. Letters were then sent to different firms on the distribution system asking them to allow the company to make power tests on their premises without cost with the object of being able to supply these houses with electricity at a lower cost than obtained with their existing equipment.

Upon receiving permission to make the tests, complete data of the installation were recorded, giving all the particulars of the machinery, location and use, size and arrangement of shafting. All engines were tested and the total and friction loads obtained. Four indicator cards per hour were taken for the full time of daily operation. The maximum load of the plant, with all machines running at full output, and the minimum friction load, with all machines running empty, also the friction load of the line shafting alone, were taken. In some cases the larger machines were taken individually with the rest of the plant shut down. Coal and water records were taken in the longer runs. The returns showed where motors could be used to advantage, and while somewhat expensive to secure, enabled the agents of the company to talk much more intelligently about the conditions, and resulted in a large addition to the connected load on the system.

New York Electrical Show.

By Edwin H. Seaman.

New York, October 5.—The first annual New York Electrical Show is now being held at Madison Square, as already announced in the columns of the Western Electrician. This show differs from all the previous shows which have been held in New York in that the exhibits there displayed well illustrate the hold that electricity is obtaining upon the commercial world. The exhibits of the Edison Illuminating Company of Brooklyn, the New York Edison Company and the United Electric Light and Power Company, the three largest electric-light and power supply companies in New York, in their displays of the uses to which electricity may be applied in the purely domestic affairs of the home, are surprising to those not familiar with the art.

In connection with the extensive advertising campaign, which it is now carrying on, the Brooklyn Edison Company fitted up a model apartment exhibit, consisting of six rooms, the decorations being furnished by Abraham & Straus of Brooklyn. In the kitchen and laundry we find a small electrically driven refrigerating machine, supplying to the apartment sanitary refrigeration and hygienic ice. A clothes-washing machine, consisting of a tub, in which the wash is placed, and driven electrically by a special mechanism, which gives to the tub a half rotating motion, is to be seen and also a dish-washing machine, in which the finest china may be placed without the least fear of its being broken. Water, boiled by the heat derived from a set of coils, supplied with electricity, is circulated through the china by means of a small circulating pump, also driven by an electric motor. An electric range, provided with utensils, including broiler, griddle, pots and warming plate, is of great attraction, and is without question the acme of convenience in cooking, and of course sanitary, reliable and instantaneous. There are four positions indicated on the snap switch—"off," "low," "medium" and "full." Electric grinders, either for coffee or meats, polishing and buffing machines are also displayed.

In the dining room, artistically arranged, are to be seen coffee percolator, tea kettle, chafing dish, small plate warmer and vacuum cleaner, all operated by electricity. The lighting of each of the rooms was planned by V. R. Lansingh, with the double purpose of securing economy and efficiency. In the parlor the "smelly" gas-log is superseded by the cheerful electric grate. A piano, operated by a telelectric piano player, gives music for any occasion. In the bedroom electric heating pads, radiator, baby milk warmer and massage outfit are displayed, and in the office an electric fountain, sewing machine, sterilizer, cigar lighter and many other useful articles make this exhibit one of the most attractive to be found at the Garden.

A general view of the Garden, taken from the rear promenade, is here shown.

The exhibits of the General Electric Company and of the Roger Williams and Simplex apparatus, in their displays of the uses of electricity for heating and cooking, occupy spaces in the center at the east end of the arena. On the left of these exhibits the Electric Testing Laboratories have their booth. Here may be seen exhibited meters of all kinds, oscillograph, potentiometers, frequency indicator, standard resistances, conductivity bridge, cable testing sets, photometers and many other interesting features to show the extent of the work which their laboratories are prepared to undertake. Between the hours of 2 and 6 p. m. voltmeters, ammeters and wattmeters will be checked up free of charge. Also lamps will be compared at these hours, gratis.

Just beyond are the exhibits of the New York Edison Company, or rather, the exhibits of the several manufacturing companies, whose apparatus (direct-current only) can be used on the Edison mains. Among the most attractive are portable electric-driven centrifugal pump for contractors, also for hotel and apartment-house use, electric-driven printing press, proof press, sweating machine, electric and electro-pneumatic tools, hoists, vacuum cleaners, dough mixer, surfacing machines, adding and sorting machine, beer pumps, air pumps and many of the other appliances shown in the exhibits of the Brooklyn Edison Company. Through the courtesy of the New York Edison Company the spaces of the Roger Williams Company, Sibley & Pitman, Consolidated Telegraph and Electrical Subways Company, and many others were supplied with electricity.

In the Consolidated Subways' exhibit were shown a typical manhole, with its high and low-tension cables, service wires and the development of the splices on each illustrated. Specimens of relics found in excavating in New York were shown in a case close by.

Directly next comes the exhibit of the General Electric Company. This, as shown in the accompanying picture, is laid out with a main booth roofed with an arched canopy, forming a galaxy of light, and two open wings on each end. The front wing is devoted to the motor, household and culinary applications and electric ironing. The visitor can demonstrate personally the advantages of the electric-driven sewing machine, potato peeler, the ice-cream freezer; and observe the clothes both washed and ironed. Of particular interest is the electric carpet renovator, in which a motor drives a cylindrical brush, and a centrifugal fan, which produces a suction at the brush and delivers the dust into a receptacle; absolutely no dust escapes into the room. There are also on exhibit in this wing motor-driven dough mixers, coffee grinders and meat choppers. To heighten the interest in this wing a moving picture machine has been placed there, illustrating graphically the recent race between the General Electric Company's electric locomotive and a New York Central flyer, running 70 miles per hour. There is also an electrically operated Regina music box.

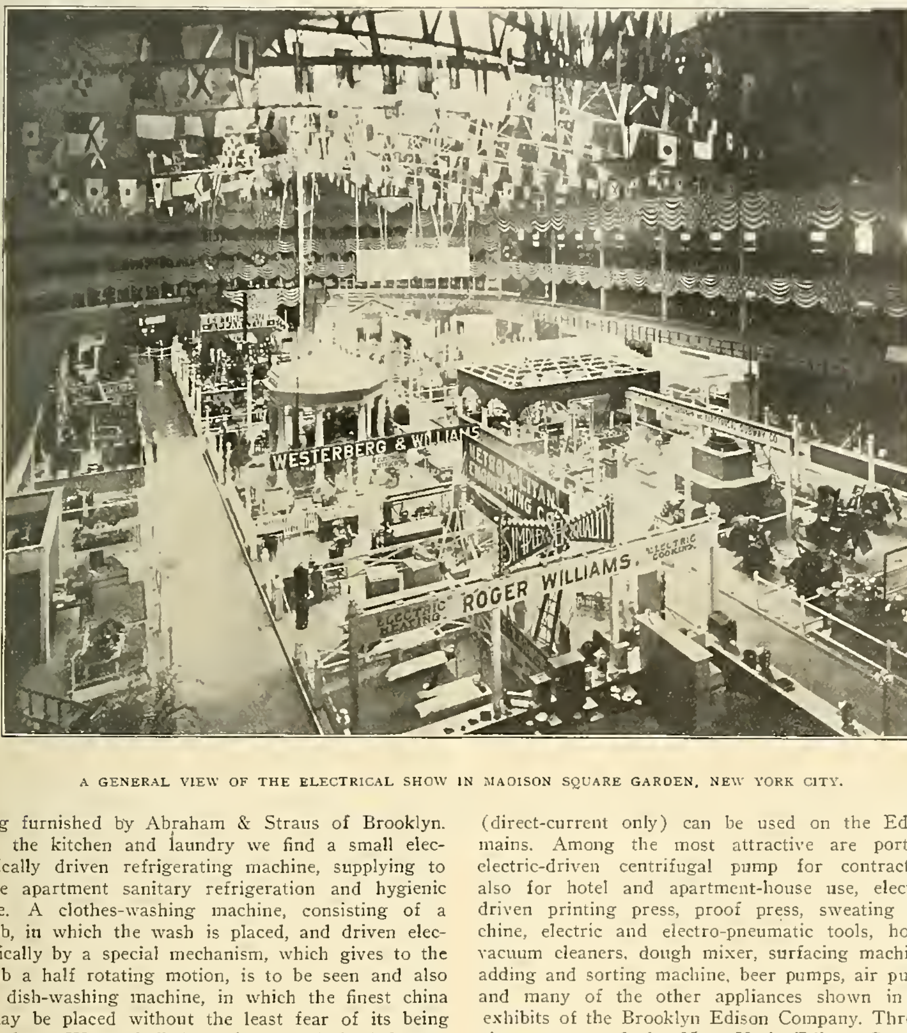
The main General Electric booth is devoted to a model dining room and a model kitchen. The former is furnished in "Mission." Over the table hangs an ornate shell dome in which is a 40-candlepower tantalum meridian lamp. The electric cigar lighter and the corn popper on the table are suggestive dining room conveniences, the electrically wired side table on which are an electric chafing dish and percolator, indicate the best way to provide for these modern necessities. The electric fan is not omitted. The model kitchen exhibits the electric kitchen cabinets, large and small size, in which busy demonstrators are preparing delicious biscuits, fudge, rarebits and other delicacies. A counter along the side is stocked with a complete assortment of electric heating and cooking appliances, many in operation, for examination by the curious and interested. Perhaps the article on this counter attracting the most attention and exciting the greatest comment is the electric luminous radiator. Already the inquiries regarding this device have resulted in many sales.

The end wing of this exhibit is devoted to industrial applications. Attracting considerable attention, partly on account of its noise, is an Ingersoll-Temple rock drill in operation. A three-horsepower motor drives an air compressor and pulsator, the energy being transmitted to the drill through the medium of compressed air. It is a machine which combines both the advantages of the pneumatic and purely electrical drills. A one-horsepower motor drives a cabinetmaker's circular miter saw. The greatest interest on the part of the general public is probably evinced in connection with the mercury arc rectifier automobile-charging set, which is in operation, with switchboard equipment. Of special mention, however, is a 30-kilowatt four-cylinder direct-connected gasoline generator set which the General Electric Company is just placing on the market. A new electrically driven floor sander in which a two-horsepower motor drives a 15-inch sanding drum is in use for demonstrating. A 20-kilowatt Curtis turbine steam generator set, used for train lighting, and a disassembled turbine, showing the advantages of construction, with a Bridgeport double 12-inch emery planer driven by a two-horsepower induction motor, and numerous small motors for various applications complete the exhibit in this wing.

On the left side of the main booth a color booth of four sections has been placed, each section being lighted by a standard illuminant, viz., enclosed arc, Welsbach gas, incandescent electric and Nernst electric. This color-comparison exhibit is an educational feature for the purpose of illustrating the effect of artificial illuminants on colors; for instance, blue appears green when viewed under some illuminants, such as gas and incandescent electric lamps.

The crowds were so great and the interest manifested in the General Electric Company's exhibit so intense that a large portion of the New York office force had to be pressed into service to answer inquiries, there being 12 or 15 men present. The exhibit is in immediate charge of Mr. W. J. Canning, who is in charge of electric cooking and heating sales in the New York territory. Miss Winifred Potts, in the household department, is assisted by five lady demonstrators. Among those from out of town were Mr. C. C. Chesney, manager Pittsfield works; Mr. F. H. Gale, in charge of advertising, exhibits and electric heating appliances; Mr. H. B. Wilson of the heating department, Pittsfield; Mr. E. L. Callahan, electric heating department, Chicago, and Mr. C. E. Bibble, small-motor department; Mr. J. O. Case, exhibit engineer, and Messrs. H. J. Mauger and H. Fulwider, electric heating department, Schenectady.

Another exhibit of great interest is that of the Westinghouse Companies, which occupies a space of about 2,000 square feet, and is perhaps the most varied of any at the Electrical Show. Approximately twenty applications of electric motors are shown, including ironing machines for the home and for laundries; pipe-threading machinery, showing the most compact arrangement with this sort of work that has yet been made possible, the outfit being operated by means of a motor, rheostat, switches and wiring all on one bed; a blower for ventilating mines, subways, etc.; vacuum cleaner, made by the Sanitary Devices Manufacturing Company, for the renovation of houses, hotels, etc.; exhaust fan made by the American Blower Company, for ventilating purposes; the Watson-Stillman pump, for the raising of water to small house tanks for summer residences, hotels, etc.; a rotary air compressor, for the operation of compressed air, tools, inflation of automobile tires, etc.; Yale & Towne hoist, for factory uses; dish-washing machinery, for the cleaning of dishes in the home and in hotels and restaurants; Singer sewing machine for domestic purposes; textile loom, which will be operated to show the manner in which fabrics are woven; dough mixer, showing the manner of mixing dough in the home and in the



A GENERAL VIEW OF THE ELECTRICAL SHOW IN MADISON SQUARE GARDEN, NEW YORK CITY.

bakeries; and last, but perhaps most interesting to the commercial man, is the phonograph in conjunction with the shaver. All of the apparatus is driven by Westinghouse motors, and in attendance with each exhibit is an expert who explains the operation of the machinery.

In the same space the Westinghouse Lamp Company, very much to the edification of visitors, gives continuous demonstrations of incandescent-lamp manufacturing, showing the different processes through which an electric incandescent lamp passes before it is ready for use as an instrument for illumination. The Westinghouse Electric and Manufacturing Company shows a full line of its arc lamps for all currents and voltages, as well as a complete line of current-measuring instruments. Fan motors for all circuits are shown, and transformers of various types and sizes are exhibited. The space is attractively lighted with Nernst lamps mounted on columns. This, as is well known, is the lamp that has come into such general use for storehouse, church and other lighting. It has many admirers, on account of its beautiful light and the tungsten light attracts especial attention. Tungsten being the most modern as well as the most efficient electric incandescent illuminant, is being closely observed by those interested in electric lighting. The National Electric Lamp Association has brought this lamp to the point where it can be operated horizontally as well as vertically and a number are on exhibition at the association's attractive booth to the right as one enters. This was the most noteworthy improvement to be seen along this line. The naturally brilliant quality of the light given by these lights attracted considerable attention.

Directly adjoining the booth of the National Lamp Association is that of the Driver-Harris Wire Company, which has on exhibition the various grades and kinds of wire produced by it. Across the center isle to the left the India Rubber and Gutta Percha Insulating Company has on display Habirshaw wires and cables of all kinds.

The electrical show has apparently come to stay in New York, and it will be looked forward to each year as a medium for the display of new developments, especially in the commercial world, and

A PROMINENT EXHIBIT AT THE NEW YORK ELECTRICAL SHOW.

economy in current consumption. Cooper Hewitt mercury-vapor lamps are also exhibited from the ceiling of the Madison Square Garden, demonstrating the value of this lamp for the lighting of large areas, such as shops, factories, train sheds, wharves, etc.

The Westinghouse Machine Company shows storage batteries for central-station work and also sparking batteries for automobiles. A 15-horsepower type "SA" motor of Westinghouse make is shown in the exhibit, operating under load on a 220-volt direct-current circuit, and attached to this machine is a speed-indicating device.

It may be interesting to note, in connection with this exhibit, that apparatus manufactured by five of the Westinghouse Companies is shown. The Westinghouse Companies embrace a circle of about 25 companies, altogether employing about 40,000 men. There are about 25 factories in different parts of the world, the largest, of course, being at East Pittsburg, Pa. These form the nucleus of all the works, and from these all the others have grown. At East Pittsburg are employed 20,000 to 25,000 men. The works cover an area of altogether about 100 acres. In New York city all these companies have offices at different places.

The Federal Sign Company and the Metropolitan Engineering Company both have on display many signs of very original pattern, which, being studded with incandescent lamps, gave great brilliancy to their respective spaces, while the Advertising Mirrorgraph Company's flashers blink at you on either side as you enter the arena.

The Marconi Wireless Telegraph Company has in operation at either end of the Garden a small station, and marconigrams can be sent from one to the other for the amusement of the public. The New York Telephone Company has a very imposing space to the left as one enters the arena, where are on exhibit all the various kinds of telephonic connection, which the company is prepared to furnish, from the simple subscribers' instruments to the complicated up-to-date switchboard.

The Beck flaming arc can be seen in the illumination of the exterior and interior of the Garden itself, as well as in the booths of the New York Edison Company, United Electric Light and Power Company and the Driver-Harris Wire Company.

Among the hundreds of cellulose, Gem, metalized, tantalum and tungsten lamps displayed by the National Electric Lamp Association, the new inventions and applications. Among the officers of the electrical show are Arthur Williams of the New York Edison Company, James R. Strong of the National Electrical Contractors' Association, Dudley Farrand of Newark, and W. W. Freeman of Brooklyn. George F. Parker is president, James C. Young secretary, and Walter Neumiller treasurer.

Among exhibitors not previously mentioned are the following-named:

Morlite Company—Tungsten lamps.

Mechanical Appliance Company—Watson multipolar motors and generators.

F. Wesel Manufacturing Company—Proof presses.

Chicago Pneumatic Tool Company—Electric and air tools and accessories.

Dayton Hydraulic Machine Company—Centrifugal pumps.

Crocker-Wheeler Company—Generators and motors.

Roth Bros. & Co.—Motors.

American Floor Surfacing Machine Company—Floor cleaners.

Robinson Machine Company—Victoria vegetable peeling machine.

Spencer Turbine Cleaner Company—Suction cleaners.

Hygienic Cleaning Company—Portable vacuum dust extractor.

Temple-Ingersoll Company—Electric air rock drill.

F. Alexander Electric Company—Arc lamps.

G. M. Gest—Electrical conduit wires.

Kenny Electric Manufacturing Company—Electric novelties.

Monoton Construction Company—Electric construction.

Safety Car Heating and Lighting Company—Electrical equipments.

Standard Roller Bearing Company—Ball bearings.

Telharmonic Music Company—Electric music.

Sunbeam Incandescent Lamp Company—Lamps.

Warren Electric and Specialty Company—Lamps.

American Wire Brush Company—Brush cleaners.

Robert Findlay Manufacturing Company—Electric fixtures.

Holophane Glass Company—Globes.

Brunswick Refrigerating Company—Refrigerating and ice-making.

Robbins & Meyer Company—Motors and applications.

Emerson Electric Manufacturing Company—Buffing motor.

Charles W. Leveridge—Showcase reflectors.

T. R. Almond Manufacturing Company—Flexo desk lamp.

The Street-railway Conventions.

Beginning on October 14th and concluding on October 18th, the American Street and Interurban Railway Association and its three subsidiary organizations of street-railway accountants, engineers and claim agents will meet in annual convention in Atlantic City. The parent or American Association will meet on the Steel Pier, the Accountants at the Chalfonte Hotel, the Engineering Association on the Steel Pier and the Claim Agents at the St. Charles Hotel. Headquarters of the American Association will be at the Marlborough-Blenheim.

Following are the full programmes of two of the associations:

American Street and Interurban Railway Association.

Wednesday, October 16th, 9:30 a. m. to 1 p. m.—Convention called to order. Address of welcome. President's address. Report of executive committee. Report of secretary and treasurer. Addresses by presidents of affiliated and allied associations. Announcements. New business. Reports of committees on (a) membership, (b) compensation for carrying mails, (c) subjects, (d) car wiring, (e) standardization of equipment. Papers—"The Technically Trained Man and the Electric-railway Profession," by Prof. H. H. Norris, Cornell University, Ithaca, N. Y.; "The National Fire Protection Association and Its Work in the Street and Interurban Railway Field," by Ralph Sweetland, Boston, Mass.; "The Influence of the Design of Railway Structures on Economy of Operation," by H. J. Campion and William McClelland, consulting engineers, New York, N. Y.

Thursday, 9:30 a. m. to 1 p. m.—Appointment of nominating committee. Reports of committees on (a) promotion of traffic, (b) rules, (c) heavy electric traction. Papers—"Light Freight Handling by Electric Lines," by P. P. Crafts, general manager, Iowa and Illinois Railway Company, Clinton, Iowa; "Freight Service on Electric Railroads," by H. H. Polk, president, Interurban Railway Company, Des Moines, Iowa; "A Department of Publicity," by J. Harvey White, advertising manager, Boston Elevated Railway Company, Boston, Mass.; "Advertising from the Street-railway Standpoint," by A. W. Warnock, general passenger agent, Twin City Rapid Transit Company, Minneapolis, Minn.; "The Problems of a Small Road," by H. S. Cooper, manager, Galveston Electric Company, Galveston, Tex.; "The Use of T Rail in Cities," by C. Gordon Reel, vice-president, Kingston Consolidated Railway Company, Kingston, N. Y.

Friday, 9:30 a. m. to 1 p. m.—Reports of committees on (a) insurance, (b) rules for the construction of modern car houses, (c) municipal ownership, (d) public relations. Papers—"Public Policies of the Past and Future," by C. Loomis Allen, vice-president, Utica and Mohawk Valley Railway Company, Utica, N. Y.; "Interurban Railway Fares," by Theodore Stebbins, J. G. White & Co., New York, N. Y.; "Municipal Ownership in Great Britain and the United States," by William J. Clark, New York city. Discussions—"Reduced-fare Agitation" and "Depreciation from the Financial and Managerial Standpoints." Report of nominating committee. Election of officers. Resolutions. Unfinished business. Adjournment.

American Street and Interurban Railway Engineering Association.

Monday, October 14th, 2 p. m. to 5 p. m.—Convention called to order. Address—John I. Beggs, president, American Street and Interurban Railway Association. Reading of the minutes of the last meeting. Address of the president. Annual report of the executive committee. Annual report of the secretary-treasurer. Appointment of convention committees. Reports of special committees. Report of committee on control apparatus. Report of committee on maintenance and inspection of electrical equipment.

Tuesday, 9:30 a. m. to 12:30 p. m.—Report of committee on way matters. Papers—"Care of Electric-railway Tracks," by George L. Wilson, engineer, Twin City Rapid Transit Company, Minneapolis, Minn.; "Rails and Joints as Affected by Traffic in New York City," by W. Boardman Reed, engineer, New York city. Report of way committee on "Rail-corrugation Investigation." Report of way committee on "Concrete Tie Investigation." Report of sub-committee on "Rail and Rail Matters."

Tuesday, 2 p. m. to 5 p. m.—Report of committee on standardization. Report of committee on Open vs. Closed Terminals for Car Storage. Report of committee on Operating and Storage Car-house Designs. Question Box.

Wednesday, 9:30 a. m. to 1 p. m.—Joint meeting of "American" Association and allied associations.

Wednesday, 2:30 p. m. to 5:30 p. m.—Paper—"Gas Engines," by Paul Winsor, chief engineer motive power and rolling stock, Boston Elevated Railway Company, Boston, Mass.; "Gas-engine Operation," by W. W. Cole, general manager, Elmira Water, Light and Railway Company, Elmira, N. Y.; "Steam Turbines," by St. John Chilton, engineer, Allis-Chalmers Company, Milwaukee, Wis.; "Operating Features of Curtis Turbines," by August H. Kreusi, engineer, General Electric Company, Schenectady, N. Y.; "Recent Developments in Steam-turbine Power-station Work," by J. R. Bibbins, engineer, Westinghouse Machine Company, East Pittsburg, Pa. General business. Election of officers.

The programmes of the Accountants' and Claim Agents' associations are equally well supplied with papers and discussions of interest to the membership. The accountants begin their convention on Tuesday morning and end on Thursday morning. The claim agents start in on Monday afternoon and conclude on Wednesday afternoon.

In the matter of railroad rates, the Trunk Line Association, New England Passenger Association, Eastern Canadian Passenger Association and the Southeastern Passenger Association have granted a rate of a fare and a third on the certificate plan for all points within their territories. The Central Passenger Association has granted a uniform rate of two cents a mile within its territory. The Western Passenger Association grants special one-way rates to its eastern terminals. The Southwestern Passenger Bureau grants reduced one-way rates to St. Louis. From Chicago the Pennsylvania Railroad announces that it will run a special train leaving the Union Station at noon on Sunday, October 13th, arriving in Atlantic City about noon the next day. C. L. Kimball of No. 2 Sherman

Street, Chicago, can give further information in relation to this train.

Atlantic City is abundantly supplied with hotels. Arrangements are made directly with the hotel management by visitors to the conventions.

All the delegates and guests of the American, Accountants', Engineering, and Claim Agents' associations will register and receive badges at the association booth, which will be located at the Board Walk entrance to the Steel Pier. This booth will be kept open from 9 o'clock a. m. to 6 o'clock p. m. during all days of the convention. It will be the general headquarters for all the associations, and will serve as an information bureau concerning association matters. The Manufacturers' Association will also have a booth at the same place, which will take care of similar matters relating to the exhibitors and the members of the Manufacturers' Association.

The American Street and Interurban Railway Manufacturers' Association is making great preparations for a fine exhibit, which will cover the entire Steel Pier. This exhibit will be larger and more comprehensive than ever before. More than 200 different companies have already been assigned exhibit space, and the total amount of floor space will be considerably greater than that used at the 1906 convention exhibit in Columbus.

Delegates to the American Association convention are requested to attend the Tuesday afternoon session of the Engineering convention, when the report of the Engineering Association's committee on standardization will be presented and discussed. The report of the American Association committee on standardization will be short and will be based upon the work of the Engineering Association committee.

It is expected that there will be a roll call at each session of the various conventions. Notices will be sent to the various companies immediately after the convention, informing them at what sessions their representatives were present.

President Beggs and the executive committee of the American association have decided that there will be no annual banquet this year. The entertainment committee of the Manufacturers' Association has practically completed its plans for the convention week. This committee will probably arrange for a theater party on Thursday evening to take the place of the annual banquet. Entertainment features will also be provided for the other evenings of the week.

Quebec Cantilever Bridge.

The collapse of the Quebec cantilever bridge over the St. Lawrence River between Sidney and St. Romauld, five miles above Quebec, resulting in the death of some 80 workmen on the afternoon of August 29th, draws attention to the really remarkable size of this structure and the imporant engineering undertaking involved. The original plans for the structure were prepared in 1851, but it was not until 1898 that the actual work of raising the funds for construction was begun. It took more than 40 years of agitation on the part of the business men of Quebec to get the bridge under way.

The point where the crossing over the river is made is 175 miles nearer the sea than the nearest present crossing, the Victoria bridge, Montreal, and the channel here is 2,000 feet wide and over 200 feet deep. These conditions made necessary the use of the cantilever type of bridge with the unusual span of 1,800 feet. The total length of the bridge is to be 2,220 feet.

There are so many novel features of construction and methods of conducting the work of building this bridge, that, even with the recent serious setback, much has been learned which would otherwise have remained untried. For the first time in the history of bridge erection, electricity has been used exclusively, and with gratifying results, for operating all the hoists and other machinery. There has been a very apparent absence of smoke, noise and the confusion usual to a large undertaking of this sort.

The electric current for operating all the motors is generated by the hydro-electric plant of the Canadian Electric Light Company at La Chaudiere Falls, three miles from the bridge, and among the units installed there is a 1,000-kilowatt Allis-Chalmers water-wheel type alternator. This current is transmitted at 2,400 volts to motor generator sets installed on the approach span to the bridge, where it is transformed to 550-volt direct current and distributed to all parts of the work.

Air for operating the pneumatic hammers, drills, reams, etc., is furnished by two motor-driven air compressors also placed on the approach span and connected to a three-inch main, running through the center of the bridge, from which branch lines were tapped.

The cost of the completed structure was estimated at $10,000,000, of which $5,000,000 had already been spent. The concrete work alone, which has been completed for nearly three years, and for which 40,000 barrels have been used, cost about $2,000,000.

ELEMENTS OF ELECTRICAL ENGINEERING.

By Geo. R. Metcalfe.

XXXVII. Electric Railways.

Car Accessories.

Resistances are always used in connection with controllers for regulating the speed of trolley cars, and, except on very small equipments, these resistances consist of cast iron grids assembled in a frame and connected so that all the grids are in series. The grids are thoroughly insulated from the frame in which they are supported, and are strung on rods with insulating washers between them, so there is a free circulation of air around each grid. The end frames, between which the grids are clamped, are made of either cast-iron or sheet-steel. The latter makes a very substantial frame, which is considerably lighter than cast-iron, and is not so liable to be broken by blows or by the jarring of the car.*

As more or less of the resistance is used on different steps of the controller, several terminals are used on the resistance, and these are generally arranged to be clamped between the grids at desired intervals. An important feature in connection with these resistances is to have all parts accessible for making the connections and to have them so assembled that a broken grid can be quickly and easily replaced.

For equipments of small capacity smaller resistances are sometimes used which are composed of several cells. These cells are built up of sheet-steel ribbon wound in coils with asbestos between each layer. These cells, like the grids, are connected in series and are provided with several terminals. The function of resistances on electric cars was fully explained in Chapter XXXV. under "Controllers."

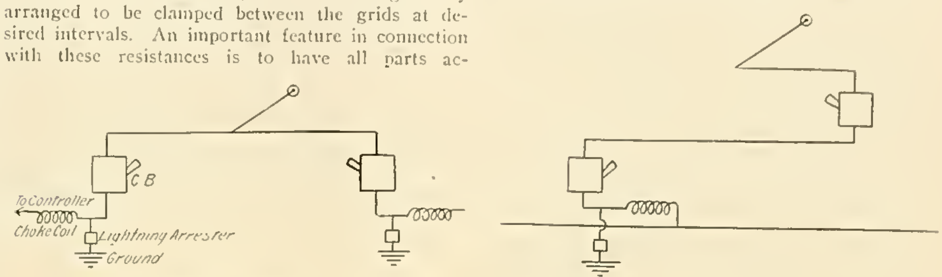
Canopy Switch.—A canopy switch is placed under the hood of the car directly over the motorman's head, and it consists of a single-pole switch, by means of which the current from the trolley may be entirely cut off from the apparatus on the car. When the car is equipped with controllers at each end, a canopy switch is placed under each hood, and the two switches are connected in series. These switches are generally used on equipments of small capacity, and it is necessary to use a fuse with them for the protection of the motors and controllers in case of an overload. On large equipments, automatic circuit-breakers generally replace the canopy switches.

Fuses.—The fuse is placed in the trolley circuit before it reaches the controller, and a number of types of both open and closed fuses are used for this purpose. Where a car is fitted with a motorman's cab the fuse box will be located in the cab; otherwise it is generally placed underneath one side of the car body at a point which is easily accessible for changing the fuses. The fuse consists of a short length of either copper wire or some composition metal which will melt and break the circuit when more than a safe amount of current for the motors passes through it. In one style of fuse-box it is only necessary to open the cover and drop in the fuse wire. Closing the cover clamps this wire in circuit.

Automatic Circuit-breakers.—An automatic circuit-breaker is generally used on equipments of large capacity, in which case the canopy switch and fuse are omitted. By means of an automatic circuit-breaker the current can be cut off from the car at any moment by tripping the breaker by hand, and a solenoid magnet which can be adjusted for a definite current is contained in the circuit-breaker, which automatically opens the circuit when the current exceeds the amount for which the magnet is adjusted. In one design of circuit-breaker the electromagnet is connected in series with a single-pole switch, and a single coil serves the double purpose of a winding for the operating magnet and a blowout coil.

In addition to the main switch contact, there are provided arcing tips. When the circuit-breaker is opened the main switch contact opens slightly in advance of the arcing tips, so that all of the arcing is concentrated on these tips, which are easily renewable, thus leaving the main contacts smooth and clean. When the circuit-breaker is closed, it is held in closed position by means of a latch, and it closes against a heavy spring, which forces it open instantly when the latch is released. The operating magnet releases this latch on overload, allowing the circuit-breaker to fly open. A tripping rod is also provided by means of which the latch may be tripped by hand.

The circuit-breaker not only protects the car wiring and apparatus in case of a short-circuit, but it also opens the circuit in case the motorman turns on the current so rapidly as to endanger the motors. Where circuit-breakers are used on each end of the car they may be connected either in series or in parallel, as shown in the accompanying diagrams. If they are connected in parallel, two lightning arresters and two choke coils are necessary. If they are connected in series, only one lightning arrester and one choke coil are required; but in this case the circuit-breaker on the rear of the car is liable to open, which would require a trip through the car in order to reset it.



Parallel Connection. Series Connection.

CAR CIRCUIT-BREAKERS.

Lightning Arresters.—One or two lightning arresters are always used on each car, as indicated in the accompanying sketches, and they are located in the trolley circuit before it reaches the controller. The function of the lightning arrester is to divert static discharges to the ground before they can pass through the apparatus on the car and puncture the insulations of the windings. The theory of lightning arresters, and the principles upon which a number of the types operate were fully described in Chapter XX. Ordinarily one lightning arrester for each car is sufficient, except when the automatic circuit-breakers are connected in parallel.

Trolleys.—The wheel trolley, which is familiar to everybody, is universally used for overhead direct-current systems of five to six hundred volts pressure. On third-rail systems the trolley is replaced by contact shoes, which are fastened to the sides of the truck and rest upon the surface of the third rail. In high-potential alternating-current roads the pantagraph form of trolley is generally employed.

The wheel trolley consists of four principal parts, namely, the base, trolley pole, trolley harp and trolley wheel. The bases are provided with a swivel, so that the trolley may be turned in either direction according to the direction of car travel, and the socket which holds the trolley pole is pivoted so as to swing in a vertical plane. Heavy adjustable tension springs tend to hold the trolley normally in a vertical position, and when the pole is pulled down to a sufficient angle to run under the trolley wire, the tension of these springs keeps the wheels in firm contact with the wire.

The trolley pole is formed of hollow steel tubing, slightly tapered, which gives the lightest construction for the required strength. The trolley harp is placed on the upper end of the trolley pole and contains journals in which the trolley wheel revolves, and usually has some form of contact springs for taking the current from the wheel. As the trolley wheel revolves at a very high speed, and frequent arcing between the wire and the wheel tends to destroy the wheel, provision is generally made for removing the old wheels and placing new ones in the trolley harp with but little trouble.

This high speed also requires specially careful lubrication, as oil or grease has not been found suitable for this service. Graphite bushings are

*Note.—This series of articles, intended to survey, briefly, the whole field of applied electricity for light, power and heat, was begun in the Western Electrician of February 2, 1907.

largely used, consisting of a brass shell with a spiral groove filled with graphite. Some of these wheels are made with roller bearings.

In some climates the use of sleet wheels is necessary for removing the coating of sleet and ice which occasionally forms on the trolley wire. This ice acts as a non-conductor and entirely cuts current off from the car when a smooth trolley wheel is used. To overcome this trouble special wheels are provided with sharp ribs in the groove, which bears against the wire, and these ribs cut the ice from the wire as the wheel passes under it.

Third-rail Shoes.—Third-rail shoes are used to collect current from the third rail, and they are of the sliding-contact type, unlike the trolley wheel, which has a rolling contact. Four shoes are generally provided on each car, and they are supported on the sides of the truck close to the journal boxes, for the reason that these points of the truck remain a fixed distance from the third rail when the car is passing around curves. The shoe consists of a cast-iron block which rests against the third rail and makes contact either by its own weight or in some cases by means of a spring. These shoes are thoroughly insulated from the truck, and provision is generally made for folding them back out of the way when not in use.

Wherever cars are liable to be turned end for end, third-rail shoes must be provided on both sides of the car. These shoes are generally supported by links, which permit the shoe to accommodate itself to any variation in the height of the third rail.

Car Heaters.—Most all car heating at the present time is done either by electric heaters, or by hot-water heaters. Electric heaters are generally used in city and suburban cars, while hot-water heaters are chiefly used in large interurban cars. The hot-water heater consists of a stove containing hot-water coils, and as this requires considerable space this method of heating is generally only employed on cars provided with a cab exclusively for motormen.

Hot-water heating is probably the cheapest as well as the most efficient kind of heating, but requires more attention than electric heaters, and is also dirtier than the latter, on account of the coal and ashes, which must be carried on the car. The dirt, however, when confined to the motorman's cab, is not objectionable to passengers. The pipes from the heater are led along the sides of the car and are extended out so as to form a coil under each of the cross-seats. The piping is so arranged that there is a gradual fall in the pipes from the place where they leave the heater to where they return to it.

An expansion tank is placed on top of the car in which there is a small opening to the atmosphere, in order to prevent the water reaching a dangerous pressure and to permit the escape of steam should any be formed. From the expansion tank the hot water flows down, circulating through the coils under the seats and returns again to the lowest part of the heater, thus maintaining a constant circulation.

Electric heaters consist of coils of iron wire which are heated by the passage through them of a current of electricity. The iron wire is wound on tubes of insulated material, and a number of these coils are assembled together and are mounted in a frame of non-combustible material. As there must be free circulation of air about the coils in order to warm the car, these heater units are surrounded with perforated metal to prevent mechanical injury of the coils and at the same time permit free circulation of air through them.

The connections of heater coils vary in different makes of heaters. In some cases they are arranged to be connected either in series or in parallel, so as to give different degrees of heat. In other cases coils of two different resistances are used, and each is connected in an independent circuit. This allows three different degrees of heat, as the high-resistance coils can be used alone, the low-resistance coils used alone, or both coils used together.

It is not advisable to run electric heaters at too high a temperature, as when the iron wires are heated very hot they oxidize rapidly and are very liable to become broken. It is better practice to use a large number of heaters which can be run at a moderate temperature, as the heaters are less liable to damage, and the same amount of heat is produced by the larger amount of radiating surface at a lower temperature as would be obtained from a smaller number of heaters run at a higher temperature.

[illegible] heaters offer an opportunity for a considerable waste of current unless managed with good judgment, the temperature of the car should be carefully watched, and the heaters turned off when not required. By turning them on and off at intervals considerable current can be saved, and there is no sudden drop in temperature when they are turned off, as the heaters maintain heat for a considerable time after the current is shut off. The amount of current consumed by the heaters depends, of course, upon the size of the car and the temperature of the outside air. Under average conditions the heaters for a moderate-sized car will consume from five to eight or nine amperes, and under severe conditions this amount may be considerably increased.

[*To be continued.*]

QUESTIONS AND ANSWERS.

Resonance Formula.

C. F. W., New York, still fails to understand the critical formula for resonance:

$$2\pi n L - \frac{1}{2\pi n C} = 0,$$

for he asks "why is it necessary to add to L, if C is reduced, to again strike a balance."

ANSWER.

This is a little problem in mathematics. To see through it, it is best to simplify it and substitute ordinary numbers for L and C. Let n have such a value that $2\pi n = 1$; then $L - \frac{1}{C} = 0$, or $L = \frac{1}{C}$. Now let $L = 2$ and $C = \frac{1}{2}$; evidently $2 = \frac{1}{\frac{1}{2}}$. Next let $L = 3$ and $C = \frac{1}{3}$, and surely $3 = \frac{1}{\frac{1}{3}}$. In other words, if L is increased, C must be correspondingly diminished in order to maintain the balance.

Alternating-current Problems.

G. H., St. Paul, Minn.: 1. I made a voltage test on a three-wire, 220-volt, 60-cycle alternating-current system recently when there was a large load between the neutral wire and one of the mains. The voltage on that side of the system was 90 and on the other side it was 100 volts, whereas between the outside mains there was a reading of 198 volts. Why was it not the sum of the two branch readings, or 190 volts?

2. How do you make a test to find the impedance voltage of a transformer?

3. What is a two-phase system?

ANSWERS.

1. The reading across the outside mains should have been equal or less than the sum of the two branch readings, if all readings were taken at the point where the three mains either enter or leave the switchboard. If there was a slight difference in phase between the two sides of the system the reading across outside mains would have been less than the sum of the branch readings. The discrepancy may have been caused entirely or partly by taking the high reading on the machine or transformer side of the switchboard and the low readings on the load side. Or, more likely, if separate voltmeters were used for the high and low readings, they may not check, due to errors in calibration or adjustment. These errors sometimes occur in the same instrument, it being not uncommon to find a voltmeter correct at one portion of the scale and incorrect at another, or that has different degrees of error in different parts of the scale.

2. The impedance voltage of a transformer is the voltage that must be applied to the primary coil to produce full-load current in both coils when the secondary is short-circuited. To determine it, cut out the transformer, short-circuit its secondary, then connect in series with the primary an ammeter and a variable rheostat of sufficient resistance to cut down the low-tension voltage to about two per cent. of the primary voltage and of sufficient carrying capacity to carry the full-load primary current. Adjust this resistance to a maximum and then connect this primary circuit across the low-tension mains. Gradually decrease the resistance till the full-load current is indicated on the ammeter, and then measure the potential difference over the primary with a voltmeter, this reading being the desired value.

3. A technical definition of a two-phase system is the following: A two-phase system is a network of conductors which has two distinct electrical circuits receiving current from the same alternating-current generators, or from several generators connected in parallel, the electromotive forces of the two circuits being practically 90 degrees out of phase. To understand the phase relation more clearly it must be remembered that an alternating current goes through four changes in every complete cycle or period: (a) An increase from zero to maximum in one direction; (b) a decrease back to zero; (c) an increase from zero to maximum in the reversed direction; (d) a decrease back again to zero. Each complete cycle being regarded as 360 degrees, each one of these quarter periods is 90 degrees. In the two circuits of a two-phase system, therefore, the electromotive force of one is always a quarter period, or 90 degrees, ahead of the other, and since the two do not rise and fall in unison or phase, they are said to be 90 degrees out of phase.

York Haven Plant to Double Its Capacity.

That sufficient electric current may be generated to more fully meet the demand for its product, the York Haven (Pa.) Water and Power Company, as originally proposed, is doubling the capacity of its plant. Within the next year 10 additional turbines will be erected in an addition to be built to the present power house, which will give the company a supply of 20,000 horsepower for the market. E. F. Baker, general manager of the company, says that all the electricity generated at the York Haven plant is being used and that during October and November the plant will have an output of more than 10,000 horsepower. At present the company is supplying current for lighting and power purposes in several counties in Southern Pennsylvania. Its product is being used for street lighting and 85 per cent. of the industrial operations in York, and the running of trolley cars in the county; street lighting of Harrisburg; street lighting and operation of manufactories in Middletown; street lighting of Carlisle and other Cumberland Valley towns and the operation of the lines of the Valley Traction company and street lighting in Steelton and 1,500 horsepower for the operation of the Pennsylvania steel plant in that borough.

A 12,000-Miles Wireless Message.

A news dispatch from Sydney, N. S., states that while the engineers were testing several new receiving cones on the tops of the towers of the Marconi station at Port Morien on the most easterly point of Cape Breton, on October 7th, the operator in the room below picked up a message that was sent from Manila in the Philippine Islands, nearly 12,000 miles away, or practically half way around the world. The message said to have been received was that the American cruiser Philadelphia had arrived there with all on board well.

At the time experiments were being made to perfect means for receiving messages from Ireland. Several were received, when suddenly the Philippine message was picked up. The Marconi experts say there is no doubt the message was sent by the Manila station and that their instruments must have been perfectly in tune with those at that remote point.

This forms a new and most wonderful record, if the reports are true. About a fortnight ago the station at Savannah, Ga., reported a communication it had received from a warship cruising in the Pacific Ocean about 4,000 miles distant.

Another Power Project on the Susquehanna.

The Conawingo Electric Company, with charter rights to dam the Susquehanna River at Conawingo, eight miles from Havre de Grace, Pa., is said to be getting ready to build a new power plant with 100,000 horsepower capacity to rival the McCall's Ferry power plant. The object is to transmit power to Baltimore, Philadelphia, Wilmington and perhaps to New York city. It is proposed to construct the power house on the Hartford County side of the river, the same as the York Haven Water and Power Company's plant. The dam, it is said, will be about the same height as the McCall's Ferry dam and will back the water as far as Peachbottom, a few miles below McCall's Ferry. If this is the case, the Susquehanna River from Chesapeake Bay to York Furnace will be navigable.

Fall Meeting of American Electrochemical Society.

The fall meeting of the American Electrochemical Society will be held at the Chemists' Club, 108 West Fifty-fifth Street, New York city, on October 17th, 18th and 19th. In addition to the programme of papers there will be a lecture by Dr. George F. Kunz on "The Diamond and Moissanite," a subscription dinner on Friday evening and excursions to Mr. Edison's laboratories and to the Long Island City power house of the Pennsylvania Railroad and other points of interest.

Factory Lighting.

By A. P. Biggs

From a standpoint of illumination, the lighting of factories may be divided into space and applied lighting. For general space and floor lighting there must be some large source of artificial light, and the sources now available are the electric and gas arcs, the Cooper Hewitt and Nernst lamps. The incandescent lamp in large sizes is still inefficient as compared with these others, and in ordinary sizes does not give the illumination necessary.

An arc requires minimum cost for installation; has the greatest efficiency per watt expenditure and lowest maintenance cost. The unsteadiness of an arc is not serious in space lighting, and while the shadows from a single arc are apt to be annoying, the arc on the whole is the best unit for such work as above noted.

The Nernst lamp is desirable in small space lighting, in low-ceiling machine shops and in foundries. In one instance a complete installation of Nernst lamps is giving excellent results. The lamps are spaced from 8 to 10 feet apart at a standard height of nine feet. The light is soft and pleasant, and current consumption low.

For particular application of artificial light, single incandescents are the sources used. Although the installation of a lamp at each machine in every kind of business is not sanctioned by all illuminating engineers, it has the sanction of custom, the recommendation of the wiring contractor, and enjoys the hearty endorsement of those responsible for getting the same amount of work out of the machine by artificial light as is expected by daylight.

In a shop having low ceilings and much window surface, illumination may be good from natural sources for the first six months or so, but after that, by continuous process, the windows, ceilings, walls, posts and everything blacken and cease to let in or to reflect any light. The lighting installation fares the same way, and the workman shades his eyes by covering the lamps with anything available, until there is almost no light available.

An example of shop practice with individual lights—uncommon because definite data accompanies it—was presented by Mr. George C. Keech, before Chicago section of Illuminating Engineering Society in May last. A bare lamp, 13 inches above face plate of drill press, and seven inches from center, gave 3.7 foot candles at center of face plates. The dirtiest lamp in the shop when substituted, gave 1.55 foot candles, while a new clean lamp in the socket gave 5.7 candles.

When the customer gives us the opportunity of making recommendations upon his equipment, we generally advise him to place at every machine a drop or bracket light with reflector, and that he use eight-candlepower lamps wherever possible. Often, to satisfy the customer that the efficiencies and economies pointed out are worth securing, we loan him a half a dozen styles of shades and reflectors, and he purchases when he has determined the kind most suitable. Further—and here the policy of the company may seem heretical—space lighting is often disposed of by advising and urging the use of gas arcs. All possible short-hour burning is turned over to the gas company, and the electric-light company is relieved from the "lighting-bill' complaint, which formerly afflicted us for several months each winter. As this policy results from our differential rates, its presentation may be comforting only to those who make high prices per kilowatt-hour for lights burned but few hours per year; unless the "Flat-rate" man wishes to mend his way.

The usual factory lighting can be considered by central-station men as none other than unprofitable business, which is to an extent a necessary evil. By reason of its character, the brute requires all of the attention and all of the equipment which more respectable branches of the industry necessitate, but refuses to make adequate return on the investment and work to supply its need.

The assumption is not to be made that the Detroit company is securing proper and adequate return for its service in this branch of lighting. The company has certain rates and is, as a public-service corporation, required to furnish and does furnish service for all customers. Further, it is needful that this unprofitable business have a fairly low rate in order that we get the profitable business that goes with it.

The rates at which this class of lighting is sold in Detroit are as follows:

First—Open Order—60 hours' use per month of the demand at 16 cents per unit, balance at 4 cents per unit. This agreement is not a contract, having no definite term.

Second—Demand Contract—30 hours' use per month at 16 cents per unit, balance at 4 cents per unit; minimum bill 30 hours' use per month of maximum demand at 16 cents; term, one year.

1. Paper read at the Toledo convention of the Ohio Electric Light Association on August 21st. The author is with the Edison Illuminating Company of Detroit, Mich.

The following discounts for prompt payment are allowed on both agreements:

On bills less than $50, 10 per cent

On bills $50 and less than $100, 15 per cent

On bills $100 or more, 20 per cent.

Under "Open Order" we furnish standard incandescent lamps and renewals and will trim and care for arcs and Nernsts owned by the customers. Under "Demand" we furnish all incandescents, arcs, Nernsts, renewal and maintenance.

The "Open Order" is the most common prescription for factory lighting. It cares for that class of customers whom we all term "Short Hour," who use our service as auxiliary to sunlight and daylight; who have a few places which, due to poor construction of building, blackened windows, or later construction by their neighbors, need light occasionally during the day, but whose principal service is from dusk to 5:30 p. m., and who either cannot or will not make, nor pay us for making, the investment necessary for good lighting.

The "Demand Contract" is suited to the lighting conditions of but a small portion of factories, inasmuch as it is designed for satisfaction of long-hour burners. The factory whose conditions are met by it is probably one in which there is a requirement for a large number of individual lights, and for small lights in isolated parts of the factory, for which there is necessity for service all through the day.

To illustrate that under our rates factory lighting is unprofitable to us, the following cases have been figured to show cost to consumer under "Open Order" and under "Demand Contract," and the amount the business should have brought in in order that it might just begin to be profitable, the later amount being arrived at as fixed charge per kilowatt-year plus operating costs per kilowatt-hour:

		Connected	Demand	Earnings	Income per Year	
					Demand	Minimum
	Kwh.	Kw.	Kw.	Open Order.	Contract.	Allowable.
1...	4330	29.0	12.0	$ 552.00	$ 632.00	$ 780.00
2...	8163	36.6	13.5	916.00	815.65	973.89
3...	1800	5.6	2.2	220.00	157.00	172.30
4...	6850	30.6	22.2	884.00	1,061.70	1,410.80
5...	10410	26.3	17.6	1,168.70	875.80	1,262.80
6...	3052	16.6	9.16	416.70	492.93	500.40
7...	1644	5.1	2.81	226.72	170.25	201.10

Nos. 1, 2, 3, 4, 5—On open order, 60 hours' use of the demand.
No............ 6—On demand contract.
No............ 7—On open order, 60 hours' use of connected load.

The first three calculations are for a customer, carriage manufacturer, in successive stages of his business. For two years he did all his lighting by clusters; at the end of that time, by reconstruction of building, the electric lighting was reduced from 13 kilowatt Demand to two kilowatts, and all general floor lighting was done by gas arcs. Only in this third year, after the changes had been made which took from us the pleasure of serving 650 lamps, did we make any profit on the business.

The fourth and fifth calculations are successive years in a cigar factory—a six-story building lighted throughout by incandescents. At the end of the first year given, the customer was persuaded to change 300 individual lights from 16 candlepower bare, to eight candlepower lamps with reflectors. Demand was reset and he was billed upon 60 hours' use by its readings—as he was an Open Order customer. He saved considerable, and we only lost 10 per cent. on the lighting business, against 60 per cent. the year before. His power business in the last year amounted to 30,800 kilowatt-hours, with a demand of 11.6 kilowatts.

The sixth is a manufacturer of shirtwaists, skirts, etc.; has all electric equipment, using electric arcs for general floor lighting. His lighting business, which was on demand contract, lost us but eight dollars. During this year we had the profit from sale of 20,000 kilowatt-hours for power, with demand of 8.5 kilowatts.

The seventh, which is a bathtub factory, has space of 20,000 square feet—has woodworking, sheet-metal and brass-foundry departments. For space lighting gas arcs are used, and the business gave us some respectable return.

As a public-service corporation having established rates we must sell at these rates whether the customer causes us to lose on service, or brings us revenue from it. We tell customers that by our experience his lighting will be cheapest for him, say, on demand, but inform him that there are so many conditions of surroundings, location of lights, faults of building design, amount of natural lighting, etc., that he must fix his conditions and try it out for himself. Usually we install such services on Open Order. If we find later that the Demand Contract rate will be to the customer's advantage, we offer it to him.

Our rates are based on customer's demand even when the Open Order is taken. If demand is same as connected load, and the customer signs the Open Order, we will bill him at 60 hours' use of the connected load at 16 cents.

If his installation is greater than his demand, we install demand indicators and bill on showing of indicators.

If he has many empty sockets in his installation, we install demand indicators, and probably bill on connected load until demand shows that customer has fitted empty sockets with foreign lamps and would have us continue to bill him without increasing his rate.

By the same method of figuring as used above, a business begins to be profitable to us when the customer has paid for 480 hours' use of demand per year at 16 cents, say 40 hours per month. As an approximation to get at classification of business as profitable or unprofitable, the consumption of current per year of factories as found in several customers' ledger accounts has been divided by 12 times demand, giving hours' use of demand per month. All of these factories are operating on a regular 10 hour day.

Number of Cases.		Average Hours' Use of Demand per mo.	
5	Bakeries, wholesale	107	
8	Brass Works	57	
2	Breweries	85	
2	Brush	12	
4	Candy	51	
3	Chemical	10	
7	Cigar	29	
9	Clothing	37	(5 cases average 11.9)
3	Engravers	70	
3	Harness	35	(2 cases average 11.9)
1	Knitting	9	
14	Machine Shops	31	(7 cases average 13.4)
3	Paper Box	13	
4	Printing	20	
8	Sheet and Metal	18	
3	Shoes	33	(2 cases average 13.7)
2	Toys	31	
1	Upholstering	4	
1	Wire Works	12	
6	Woodworking	24	(4 cases average 11.10)

From their nature, several kinds of business are invariably profitable. The wholesale bakers use some lighting for 24 hours per day. Breweries have a good bit of small power about their establishments which is shut down about 4 p. m. and the lighting load up to that time continues quite uniform throughout, making their lighting demand negligible.

Machine shops and brass works need electric light for individual machines only, and give a good lighting load summer and winter. The clothing manufacturer, whose record makes the best showing of his class—to our way of thinking—in the above list, has on each machine a movable arm carrying lamp of low candlepower with parabolic reflector, permitting operator to bring source of light close to work without unpleasant effect on eyes; all his space lighting is by gas arcs.

We persuaded one customer operating a brass foundry to put in gas arcs for all lighting, and further satisfied him that, with little hardship, his air compressor could be shut down in the afternoon at such times as would prevent any increase of total load due to shop lighting. As a matter of general policy, in addition to giving other advice, we recommend to the manufacturer that a fraction of the amount spent this last year for lighting, be turned over to a window cleaner and a man with a hand pump and a tank of whitewash; expecting that both of us will then be better satisfied with his factory lighting.

Our conclusions then are: That an electric-light company cannot afford to take on all factory lighting offered to it; that it is obliged to take a certain amount which is inherently unprofitable: that it should minimize this amount by (first) advising the customer how to reduce his demand by utilizing light to best advantage—that is to say, by good illuminating engineering; (second) advocating the transfer to daylight hours of any power load that can be dispensed with during the evening hours, and (third) by passing over to the gas company such factory space lighting as can be profitably furnished by gas arcs, retaining for electricity the long-hour localized lighting.

It is worth while to note that the new metal filament incandescents may modify these conclusions. They will not change the rates of demand to sales, but they may make gas so comparatively expensive as to put it out of competition either partially or altogether.

Vermont Electrical Association.

The sixth annual convention of the Vermont Electrical Association was held on September 18th and 19th at Paige's Hall, St. Albans, Vt. The meetings were well attended and the papers read evoked much interest. Among these were the following: "Heating," by James I. Ayer of Boston, Mass.; "Notes of a Layman on Electricity and Its Allied Forces," by E. L. Bates of Bennington, Vt.; "Rates and Systems of Charging," by J. S. Codman of Boston, Mass.; "Modern Illumination," by V. R. Lansingh of New York city.

The following-named gentlemen were elected as the officers for the coming year: President, E. E. Larrabee, Bennington, Vt.; first vice-president, Frank H. Parker, Burlington; second vice-president, J. E. Davidson, Montpelier; secretary and treasurer, C. C. Wells, Middlebury.

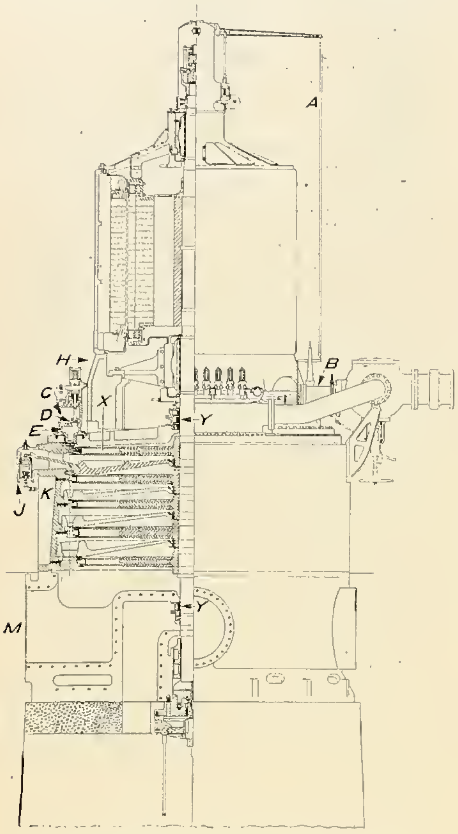
An enthusiastic meeting and banquet of the Vermont section of the Sons of Jove was held in connection with the convention, at which 22 new members were initiated. An inspection trip was made to the power plant of the Vermont Power and Manufacturing Company at Fairfax Falls.

Curtis Steam Turbine-generator.

Although now widely used and well known in this country, a brief general description of a large Curtis steam turbine-generator, taken from a handsome bulletin issued by the General Electric Company, will be of interest. The half cross section of a 9,000-kilowatt unit shown herewith illustrates the simplicity, rigidity and beautiful mechanical proportions of this type of unit.

The turbine-generator set may be considered conveniently in four parts: First, the governor; second, the generator; third, the turbine proper; and fourth, the exhaust base.

The governor is of the centrifugal type and transmits its motion through the connecting rod (A) to the hydraulic cylinder (B), which controls the



HALF CROSS SECTION OF A 9,000-KILOWATT CURTIS TURBINE-GENERATOR.

valves. The steam chest (C) is connected to the main steam pipe, and steam is admitted by the raising of the main valves (D), through the passage (E) into the first stage nozzles.

Steam passes through the first row of revolving buckets, then through a set of intermediate buckets (X), then through the second row of moving buckets on the first stage wheel and in the same manner through the nozzles and buckets of five stages in succession. It will be noticed that the buckets and nozzles increase rapidly in size in succeeding stages as the pressure falls and the volume of steam increases. The parts are so proportioned that the steam gives up approximately one-fifth of its energy in each of the five stages.

The stator, or generator frame, completely encloses the generator, thus insuring noiseless action and at the same time providing for a vigorous and positive ventilation. The generator is mounted on the base (H), which is bolted to the turbine casing.

The turbine shown is of the five-stage type and exhausts into the base and through the opening (M) into the condenser. The method of mounting the revolving wheels on the shaft and their relative position in each stage are indicated; also the method of supporting the diaphragm or cast-iron separating pieces which form the divisions between the different stages. The step-bearing is outside the base, but belted it, as shown.

The intermediate bearing is supported by a spider at the bottom of the generator, the upper bearing by the shield which covers the generator.

The automatic stage valve (J) connects the first stage directly to a set of auxiliary second-stage nozzles. Thus the overload capacity is increased, not by admitting high-pressure steam into an intermediate stage with corresponding reduction in efficiency, but by widening the steam belt. The space (K) is filled up with lagging and covered with sheet-steel casing, thus giving the turbine a finished and compact appearance.

Since the pressure on each side of the rotating wheels is the same, it will be seen that no special provision is required to neutralize steam thrust. The fact that there is no necessity for a complicated arrangement of balance rings, which occasion heavy and variable leakage losses, constitutes one of the most important advantages of this type.

Air and steam leakage are prevented by the carbon packing rings shown at (Y), and these rings are practically frictionless, since there is no pressure of carbon on the shaft and since the action of carbon on steel produces a highly polished surface without tendency to cutting or friction.

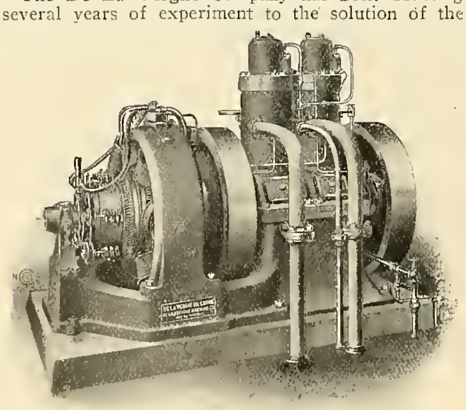
The chief advantage asserted for the Curtis steam turbine is high efficiency at all loads. Other important advantages are simplicity, moderate initial cost, economy of space, low cost of maintenance, economy in foundations, absence of oil in condensed water, minimum labor and skill required in attendance, etc.

Generators used with these turbines are of the revolving-field type, and the rotor is so designed that it acts as a powerful impeller, which forces a large volume of air definitely into the parts of the generator structure requiring ventilation. A copious supply of clean, dry air at as low a temperature as possible is required. This air is taken into the generator generally through a single opening, and is discharged after it has circulated through the magnetic cores and windings. The outside casing of the stator is a closed casting which serves to deaden sounds which may be occasioned by movements of air in the machine, and at the same time does not prevent proper flow of air to all parts which it should reach. The air-impelling force of the rotor is so definite that the air supply can be drawn through a pipe from some outside source, which is generally desirable in order to secure cool air. The method of ventilation employed with these generators has a practical advantage in that it is practically noiseless.

A New Vertical Kerosene Oil Engine.

Kerosene oil engines are not known as well as gas and gasoline engines, although they have been on the market for over 15 years. A type which has been frequently referred to is the "Hornsby-Akroyd," a heavy slow-speed machine, operating on the four-stroke cycle, single-acting, horizontal, built by the De La Vergne Machine Company, New York, in sizes up to 250 horsepower. While this engine is with great success applied to all kinds of stationary and even portable work, there is a demand for a lighter, faster and vertical engine for use for marine purposes and for driving direct-connected high-speed electric generators, fans, centrifugal pumps, etc.

The De La Vergne Company has been devoting several years of experiment to the solution of the



15-HORSEPOWER KEROSENE OIL ENGINE DIRECTLY CONNECTED TO A 10-KILOWATT GENERATOR.

problem, and now, that a number of engines have been operating satisfactorily for many months, at various kinds of work, it has been decided to manufacture the engine as now perfected. This engine is especially designed for the use of ordinary kerosene or fuel oil, obtainable anywhere, and not for gas or gasoline, thus eliminating danger of accidents.

Granted that the oil engine consumes the same weight of fuel per brake horsepower per hour as the gasoline engine, namely, about nine-tenths of a pound, the company says that one gallon of oil will develop $6.7 \div 0.9 = 7.44$ B. H. P. for one hour, while one gallon of gasoline will develop $5.8 \div 0.9 = 6.44$ B. H. P. for one hour. The relative market prices are at present 10 cents and 17.5 cents, respectively; consequently one horsepower-hour costs, with oil, $10 \div 7.44 = 1.34$ cents, and with gasoline, $17.5 \div 6.44 = 2.72$ cents—or fully twice as much. With fuel oil, the cost is lower still.

The accompanying illustration shows a twin-cylinder De La Vergne engine which operates on the two-stroke cycle, and is single-acting; hence the crank-shaft receives in each revolution two impulses, causing the engine to run much steadier than a four-cycle engine. The chief characteristic is the absence of an electric igniter. This, together with the usual batteries or other sparking devices, and the mixing valve, eliminates much trouble, because it requires skill to keep these things in proper working order. Similar to the "Hornsby-Akroyd," the cylinder head is shaped as a bulb and kept hot enough by the successive explosions to ignite the combustible mixture. This bulb or vaporizer is made of gun iron, heated up at the start by a kerosene blow lamp.

Preignitions, which cause a great deal of annoyance and loss of power, cannot occur in this engine, for on the up-stroke there is nothing but air in the cylinder which has entered under slight pressure from the enclosed crank case through the port. Just as the piston is reversing its motion, and not before, oil is sprayed into the vaporizer by the nozzle. The heat of the walls of the vaporizer and the hot air resulting from the high compression, at once vaporize the oil and burn it rapidly, thus giving the descending piston an impulse. Just before the end of the down-stroke, the exhaust port is uncovered by the piston to let the burnt gases escape to the atmosphere. No exhaust valve is required.

It is, of course, necessary that the oil be forced into the vaporizer suddenly, at the right time and in quantity to suit the load on the engine. This is accomplished by a small plunger pump which is under the control of an ingenious and simple throttling governor fastened to and revolving with the flywheel. A centrifugal crank-pin oil ring is turned out from the solid of each crank, and with a straight oil hole so disposed that it is always kept clear by the action of centrifugal force. All oil cups have been eliminated, oil being supplied to the cylinders and all bearings, except, of course, the wrist pin, from one forced feed central oiler actuated from the crank-shaft. After the oil reservoir is filled for the day, oiling requires no more attention.

The lower half of the crank case of a twin-cylinder engine is water-cooled. A small rotary pump driven by spur gear on the shaft circulates the water first through this crank case and around to the three bearings; then through the two cylinders and heads around the spray nozzle. This cooling prevents heating of the air aspirated into the crank case and keeps down the temperature of the lubricating oil and that of the bearings. The two outer shaft bearings and the lower half of the center bearing are carefully lined with special bearing metal. The upper half of the center bearing is of phosphor bronze; it unites the two cylinders and makes the joint air-tight.

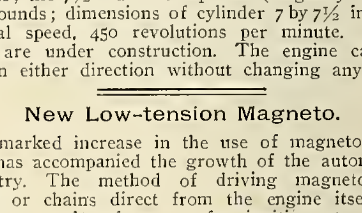
The 15-horsepower engine weighs complete 1,180 pounds; the 7½-brake-horsepower (single cylinder), 750 pounds; dimensions of cylinder 7 by 7½ inches; normal speed, 450 revolutions per minute. Other sizes are under construction. The engine can be run in either direction without changing any part.

New Low-tension Magneto.

A marked increase in the use of magneto ignition has accompanied the growth of the automobile industry. The method of driving magnetos by gears or chains direct from the engine itself insures a supply of energy for ignition at correct and regular intervals. The magneto is simple and eliminates complicated wiring with the attendant dangers of short-circuits, and avoids the use of vibrating spark coils and batteries.

The General Electric Company has recently developed a magneto which is said to embody the most desirable features of construction as determined from its past experiences in other lines of work. This magneto is of the low-tension type and differs mechanically in many respects from other machines on the market at the present time. The general construction is most substantial and without superfluous trimmings. The general appearance of this magneto is shown in the accompanying illustration.

A number of especially desirable features are noticeable in the construction of the armature. One end of the armature winding is brought out through the hollow shafting by means of a steel conductor. The insulation bushing between the shaft and this conductor is of bone, and is there-



NEW LOW-TENSION MAGNETO.

fore little affected by moisture or light. The current is carried from the steel conductor by means of a phosphor-bronze spiral spring to the lever nut which forms the outside terminal, thus avoiding any loose contacts. A hard-rubber cover screwed to the bearing carries the contact with all its parts. This cover is provided with a knurled exterior. The grounded side of the armature winding is firmly fastened to the core, and a carbon brush insures good contact between armature winding and frame or ground.

The magnets are of the double type, sprung on the frame and secured by one screw on each side, thus minimizing the detrimental effect of drilling the magnets.

The design of the armature allows generous insulation and also permits two other important advantages. With this magneto an open-circuit voltage of over 100 volts is easily obtained, while a short-circuit current of approximately 0.4 ampere is available. In order to secure this high short-circuit current the resistance of the armature winding is as low as possible, while the number of turns is sufficiently high to give an adequate open-circuit voltage.

The Ward Leonard Motor-starting Rheostats.

In the April, 1907, "List of Electrical Fittings that have been Examined and Approved by the Underwriters' National Electric Association," page 30, certain types of motor-starting rheostats made by the Ward Leonard Electric Company of Bronxville, N. Y., are specifically enumerated as in compliance with the National Electrical Code after testing. As the subject of motor-controlling rheostats is just now exciting much attention among electrical men, it will be worth while to consider

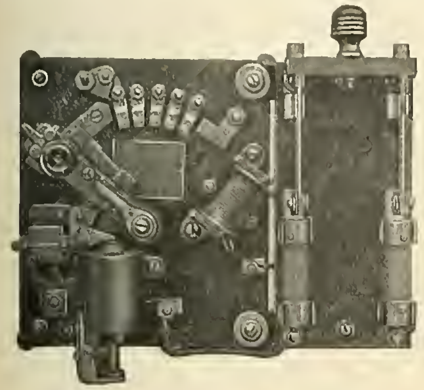


FIG. 1. MOTOR-STARTING RHEOSTAT.

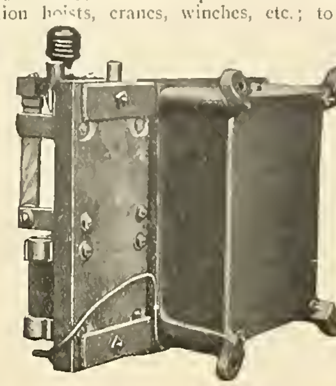


FIG. 2. BACK VIEW OF MOTOR-STARTING RHEOSTAT.

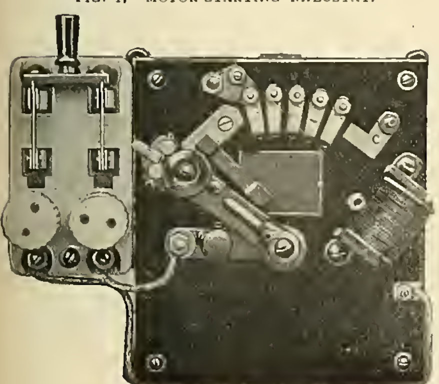


FIG. 3. NO-VOLTAGE RELEASE STARTER.—THREE-HORSEPOWER, 220 VOLTS.

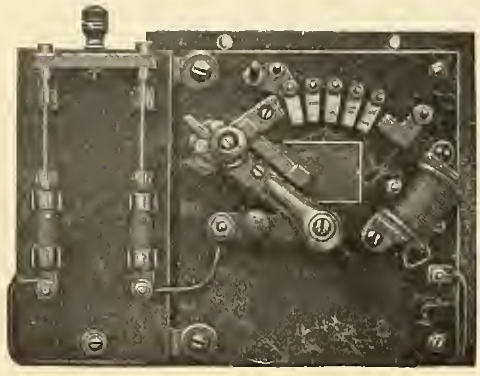


FIG. 4. NO-VOLTAGE RELEASE STARTER WITH BACK MOUNTING OF SLATE.

the advantages the manufacturer asserts as characteristic of these devices.

For one thing, it is declared that no other motor starter on the market gives the same protection afforded by this one. For protection against overload due to starting too rapidly these starters have a circuit-breaker as a part of the starter, and this circuit-breaker can be set at any predetermined amperes from one-half load to 50, 100 or 200 per cent. overloads, or higher. For protection against closing the circuit-breaker upon short-circuit or overload, and holding the breaker closed till damage occurs, the circuit-breaker is functionally related with the no-voltage arm in such a manner that it is impossible to close the overload switch except when the no-voltage arm is in a protective position. Overload protection during the period of starting the motor as well as at all other times is positively assured.

The rheostat is "universal," first, because it can be used to start any known type of direct-current motor, whether shunt-wound, series-wound, separately excited, or any other known type, allowing speed control by field regulation. Second, because it is equipped with switch and fuses, making it a complete outfit ready for mounting. Third, because it has a capacity for one-minute starting duty. It is the intention of the manufacturer to place this apparatus upon the market at such a low price that it will be found more profitable to install than a separate switch, fuses and rheostat wiring, etc. In sizes below those requiring 25-ampere fuses a porcelain base combined switch and fuses (approved) is used. In larger sizes approved plain finished switches and approved fuses are used.

Fig. 1 shows this motor starter. Fig. 2 shows the back of the rheostat, showing the method of attaching the switch and fuses. Fig. 3 shows a plain no-voltage release starter of three-horsepower, 220-volt size. Fig. 4 shows a no-voltage release starter equipped with back mounting of slate.

Electrical Equipment of New Battleships.

The General Electric Company has received orders for the electrical equipment of the two new battleships, No. 28 and No. 29. The former is to be built by the Newport News Ship Building Company, and the latter is in course of construction in the Fore River Ship Building Yards at Boston, Mass. These are the two largest war vessels ever built in this country, and a notable feature of No. 29 is that it is the first battleship to be propelled by turbine engines. These are of the Curtis type and have a capacity of approximately 25,000 horsepower. The one set of turbines can be used for both high speed and cruising. In addition to this advantage and the attendant economy in space and weight, the absence of reciprocating parts and consequent vibration and strains is expected to make this battleship the speediest in the navy.

Four 300-kilowatt Curtis turbo-generating sets will be installed on each ship to supply the lighting circuits and furnish power for about 100 motors, varying in size from two to 75 horsepower. These motors will be used to operate the turrets, ammunition hoists, cranes, winches, etc.; to run the forced draft and the hull ventilation fans, and to supply power to the laundry and workshops. The vessels will be equipped with four 36-inch and four 60-inch searchlights.

Steam-turbine Demonstration by United States Navy.

Turbine ships have been in use by the British naval authorities for some time, beginning with the diminutive turbine launch "Turbinia," which appeared first at Queen Victoria's Diamond Jubilee naval review at Spithead in 1897, uninvited, and proceeded to attract the attention of the British Admiralty to the novel type of propelling machinery installed in it by deliberately trespassing in and out between the lines of warships, thereby challenging the patrols, which were unable to come near, much less overtake the swift little craft. So convincing was the argument of the Parsons turbines that at the end of March, 1907, there were 14 turbine-driven warships completed for the British navy, aggregating 107,000 horsepower, and 49 building aggregating nearly four times that amount.

Now it is reported that the United States Naval Department will enter upon an interesting demonstration of the comparative merits of the steam turbine by the placing in commission of three similar scout ships, the Salem and Birmingham, being built by the Fore River Ship Building Company of Quincy, Mass., and the Chester by the Bath (Me.) Iron Works.

These boats are the same model, having similar boiler outfits and alike in every respect except that the Salem and the Chester will be equipped with two types of turbines, those of the Chester being Parsons type, similar to that built by Allis-Chalmers Company, Milwaukee, and the Birmingham with reciprocating engines.

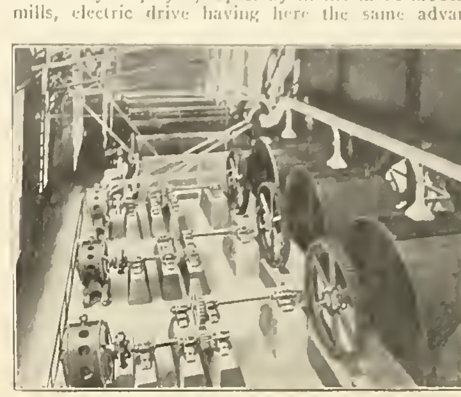
The horsepower of each vessel being 16,000, the Chester will have four shafts with a high and low pressure Parsons turbine upon each of two of these and a cruising turbine upon each of the other two.

The comparative performance of these trial vessels will naturally be watched with interest.

Electric Motors for Cement Mills.

By R. B. Williamson.

For driving the various machines used throughout a cement mill, electric motors are now almost universally employed, especially in the more modern mills, electric drive having here the same advan-



INDUCTION MOTORS DRIVING BALL MILLS.

tages of flexibility and economy that have been demonstrated in so many other lines of work. The elimination of belting and countershafting is specially desirable in a cement mill, where the gritty dust makes the maintenance of both belts and bearings expensive.

In some mills, particularly those located in the West, power is purchased from transmission companies, but usually each mill is provided with a steam plant of its own. In either case the alternating-current system is almost invariably used in modern installations, and it may be either 60 or 25 cycles, two or three-phase. Although direct current has been used in a few cases, the present practice is to use alternating-current motors almost exclusively for this class of work. The polyphase induction motor has many advantages, not the least of which is the absence of commutator and brushes. The cost of maintenance is less than for direct-current machines, and in the dusty atmosphere of a cement mill, the simple "squirrel-cage" rotor of an induction motor is much less liable to give trouble than the wound armature of a direct-current machine.

In these mills the motors are used for operating rock crushers, ball mills, tube mills, rotary kilns, hoists, conveyors, pumps, etc.; in fact, for all the machines used throughout a modern cement plant. In most instances the motors are run at or near full load continuously, and the service as a whole is especially severe. In nearly all cases they are of the squirrel-cage type, with short-circuited secondary—a type that necessarily operates at constant speed. For variable-speed work the induction motors are provided with a wound rotor connected through collector rings and brushes to an external resistance. By this means the speed can be varied at the expense of lower efficiency. However, collector rings and brushes are undesirable features when exposed to cement dust, and these motors are used as little as possible; they are installed occasionally for operating rotary kilns, where a variation in speed is sometimes desirable, and also for electric hoists; but for practically all other classes of work constant-speed squirrel-cage motors are preferred.

Probably the most severe service is that demanded of motors for running ball and tube mills. These mills are used for grinding the raw material before calcining, and also the clinker from the rotary kilns. For driving the ordinary sized ball mill a 50-horsepower motor is required, while for a 5 by 22-foot tube mill a 75-horsepower motor is usually installed; a 5½ by 22-foot tube mill requires about 95 horsepower, and a 6 by 22-foot, 115 horsepower; the 5 by 22-foot mill is the size generally used.

Ball and tube mills, especially the latter, are difficult to start. The material clings to the sides of the mill, particularly in the tube mill, where pebbles are used to effect the grinding, and at starting the whole mass has to be swung up until the first half revolution has been made. This demands heavy starting torque, usually amounting to 1½ to 2 times full-load torque. It is desirable, therefore, to use for these mills a motor having starting torque higher than for ordinary service. If this is not done, the motor will take an excessive current at starting, or, if the voltage drops to any great extent, the motor may even fail to start the mill at all. Motors for this service must be of liberal size to give the requisite starting torque, and also operate continuously at full load in a dusty atmosphere without undue rise in temperature. It must be remembered that in cement mills the fine dust gets into the ventilating passages in the motor, and they may in time become clogged up, thus materially increasing the temperature rise.

The starting apparatus used with these motors must also be of liberal design in order to carry heavy starting currents. Sometimes the mills are started by throwing the current off and on, giving them two or three swings until they finally turn over. This is especially hard on the stator, and should not be necessary if the motor has ample starting torque. All starters have oil-immersed switches for changing the connections from "starting" to "running," and transformers are provided so that a reduced voltage can be applied to the motor at starting, thus reducing the current taken from the line. For this severe starting service, where the motors are frequently operated by an unskilled class of help, the starters can be fitted with a device that prevents the handle from being left on a starting position; if left on a starting position it at once returns to the off position, thereby preventing a burnout of the starter.

Motors for operating these mills are usually belted and run at moderate or slow speed. On 60 cycles, 50-horsepower motors running at approximately 850 revolutions per minute full load have been used for ball mills, but a slower speed motor is more desirable, and 670-revolutions-per-minute machines are now recommended. On 25 cycles, four-pole motors running at approximately 700 revolutions per minute full load are used.

For 5 by 22-foot tube mills a 75-horsepower motor running at 670 full load on 60 cycles is suitable, while on 25 cycles speeds of 700 revolutions per minute or 470 revolutions per minute are available, the latter being preferred. Motors are belted directly to the main driving shaft on the mill, from which the latter is driven through spur gearings.

As regards voltage and frequency, the majority of cement mills are operated on 440 or 550 volts and frequencies of 60 or 25 cycles. Although there are instances where 2,200-volt motors have been used, the lower voltages are preferable on account of the greater security of the insulation on the motors and greater safety in working around them. There does not appear to be any settled practice as regards frequency, either 60 or 25 cycles giving satisfactory results; in many cases the frequency is fixed by that of the transmission system from which power is obtained, and most plants supplied from such systems are operated at 50 or 60 cycles.

As regards mechanical features, it is important that the bearing sleeves be arranged so that they can readily be removed and relined. All bearings are made as dustproof as possible by means of felt dust guards, and journals are of liberal dimensions.

The accompanying picture of induction motors driving ball mills is from a photograph taken in one of the numerous cement mills in which the complete equipment was built and installed by the Allis-Chalmers Company of Milwaukee.

Electrical Equipment of New County Building, Chicago.

Now nearly completed, the large new County Building at Randolph, Clark and Washington streets, Chicago, is one of the imposing structures of the city. It contains 40 court rooms and is 374 feet long, 157 feet wide and 205 feet high. The machinery room, as noted in an article in the Wire Market News, is centrally located in the basement, and from this point conduits and wires radiate into every remote corner for the operation of 15,000 lights and 1,000 horsepower in motors. The power plant includes 16 ventilating and miscellaneous motors in attic; five ventilating fans, 15 elevators, two high-duty fire pumps, two house pumps, one drinking-water pump and one pneumatic-tube motor in basement; one stoker, three ash-handling machinery, two ejector sets and two emergency pump motors in sub-basement. All necessary arrangements have been made for a generating plant, but for the present, current for this load will be taken from the Edison three-wire direct-current mains, which are now connected to a three-panel service board under the Clark Street sidewalk. Four separate sets of mains connect to this board from different generating stations of the power company, so that the supply can be shifted from one to another as emergency requires.

The main operating switchboard, erected and connected by the Arthur Frantzen Company, is a handsome 10-panel affair, built on white Italian marble slabs two inches thick and mounted on a substantial iron frame 25 feet long and seven feet high. There are four light-feeder, four power-feeder, one light-service and one power-service totalizing panels, which represents a remarkably flexible control of power from a single point in the engine room. The mains for lighting are carried in conduit through two vertical raceways, one on the north and the other on the south side of the elevator lobby. From the two centers on each floor submains are run to cabinets in their respective wings for control of wing lights. Fifty-two cabinets totaling 1,500 circuits are distributed throughout the building. The panels are built of white Italian marble with polished bus-bars, plug fuses and receptacles and represent a high class of workmanship.

Wiring Conditions in Kansas City.

The National Board of Fire Underwriters has made a full and interesting report on electrical conditions at Kansas City, Mo. By city ordinance, a city electrician, under the supervision of the superintendent of buildings, is given control over inside and outside electrical wiring. The city electrician is appointed by the mayor, subject to confirmation by the upper house of the Common Council, for the term of two years. He is required to be expert in the theory and practice of installing electrical wires and apparatus and to have had at least five years' practical experience. Mr. C. M. Caldwell, the city electrician, was appointed to his present position in February, 1900. He was inspector in the department for two years previous and is well qualified for his position. He is assisted by two inspectors and a clerk. He or his assistants examine all new inside work, making inspections during installation and on completion. Old work is inspected when in connection with new work and on special request; a systematic reinspection of a part of the business district is made each year during the slack time in the winter months. Outside work receives only a general supervision.

Notices, stating that the equipment is approved, are placed in prominent positions on each installation inspected and found to comply with the ordinances. These serve to notify lathers and others that the wiring may be concealed. Wiring concealed before inspection is condemned, and a red notice posted, but recourse to this is seldom necessary. A notice warning carpenters, plumbers, etc., from interfering with wires or placing anything within two inches of them, is also in use. Good records are kept of inspections and approvals. A small fee is charged for inspections.

A city ordinance, passed in January, 1903, requires that before any electrical wiring or apparatus is installed, altered or added to, an application must be made to and a permit obtained from the city electrician. It is the duty of the city electrician to inspect and examine thoroughly all electrical apparatus and devices, either upon the public streets and highways of the city, or within buildings, and to condemn all that, in his opinion, may be dangerous or improperly installed. Appeal may be made to a board, composed of the chief of the fire department, the superintendent of buildings and the city engineer; the decision of this board is final. It is unlawful to use electric current for light, heat or power before a certificate of electrical inspection has been granted by the city electrician, and service connections may not be made until a service permit has been obtained. The National Electrical Code, with some additions and slight changes, has been adopted as the standard.

Every person, firm or corporation owning or controlling electrical wires for the transmission of light, heat or power is required, at time of fire, to disconnect such wires as may be designated by the mayor, any officer of the fire department, or the city electrician or his deputies.

The city electrician is required to keep a full record of all permits, condemnations and inspections. Electrical contractors must secure a license, have an established place of business and satisfy the city electrician that they are competent to do electrical wiring; contractors are under a $5,000 bond to observe the city ordinances.

An ordinance passed in July, 1903, requires all overhead wires in the district bounded by the north line of Second, west line of Jefferson, south line of Eighteenth and east line of Forest to be placed underground within one year from the date of its passage. This ordinance also requires all overhead wires extending along or across the boulevards of the city to be placed underground.

In June, 1907, 25 new and 50 old representative inside installations were inspected by a National Board engineer to ascertain the quality of the new work being installed and the general condition of the old wiring. In the new work inspected a total of 95 defects was found, an average of 3.8 per equipment, showing a good installation. There were 20 different violations of the National Code, due to poor workmanship and the inspection department not insisting on a strict adherence to the Code in several particulars. Among the more prominent defects were: Fuses too large for the circuit; flexible cord too long; unapproved flexible cord for portables; wires not protected from mechanical injury; unapproved work at meter; rheostat or starting box not properly mounted, and no drip loop at service entrance.

In the old work inspected 395 defects of 92 different kinds were found, an average of 7.9 per equipment, indicating, according to the insurance interests, the need of a systematic reinspection of all old wiring. Besides those enumerated under new work, the following violations of the Code were noted in ten or more risks: Circuits overloaded; link-fuse cut-outs not standard; unapproved link fuses; unapproved flexible cord for pendants; joints not soldered and taped; wires in contact with or not properly separated from gas pipes or other metallic or conducting bodies; wires not properly supported; switches broken or in poor condition. Many other defects occur, but each only a few times. There are no series arc lights or other high-tension circuits in buildings.

As regards outside work, light and power wires are underground in a small section of the business district; telephone wires are largely underground, with pole distribution, and the wires of one telegraph company are partly underground; otherwise, all wires are overhead. There is no district which is entirely free from overhead wires, the underground ordinance not having been enforced. Overhead telephone and telegraph wires are on different poles from light and power wires. Overhead trolley wires are on practically all of the principal streets, and, with few exceptions, all of the car lines in the city pass through the congested-value district. Overhead light and power wires are double and triple-braided weatherproof, in fair to good condition, on poles 100 to 120 feet apart. Transformers are on poles or brick building walls. All overhead light and power circuits are protected by lightning arresters at the power house and at frequent intervals on the line. Overhead low-tension circuits are well protected with fuses and lightning arresters.

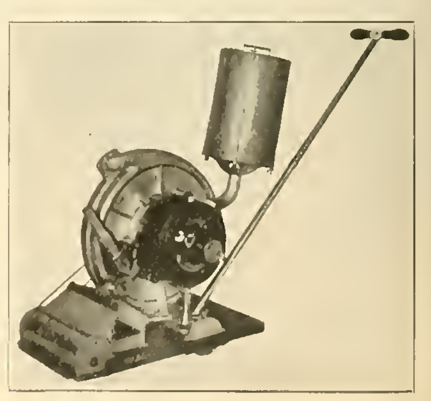
The Metropolitan Street Railway Company and the Kansas City Electric Light Company, which are practically one company, operate the street-railway service and furnish most of the electric light and power. The Edison three-wire direct-current system, 110-220 volts, is used exclusively in the congested-value district and adjacent territory. Three-phase, 2,300-volt alternating current, transformed to 104 volts at pole transformers, is used in outlying districts. A 500-volt direct-current power circuit is in use to a small extent, and a few motors are on the grounded street-railway circuit, it is said. Street-railway current is 575 volts direct current, with overhead trolley and ground return. Series street arc-light circuits are mainly under 5,000 volts alternating current; one circuit is 6,500 volts. Three-phase 6,600-volt alternating current is generated at two power houses and transmitted, mainly underground, to four substations, from which one or more of the above described currents are distributed. Several small plants supply current to individual buildings, generally 110 volts direct current. The following-named companies maintain low-tension or signalling systems: Kansas City Home Telephone Company, Missouri and Kansas Telephone Company, Western Union Telegraph Company, Postal Telegraph and Cable Company, Missouri District Telegraph Company and the municipal police signalling system.

The city electrical laws are good; the electrical electrolytic action and reports no trouble from this source other than an occasional breaking of a lead house service in the vicinity of the street-railway power stations. The telephone companies make periodical tests of their cables and report little trouble. Rails are well bonded with stranded copper compression bonds.

The city electrical laws are good, the electrical department is well organized, has good control over new inside wiring, and this class of work is being installed practically in accordance with the National Electrical Code. The notice-posting system adopted by the city electrician is productive of many good results.

The Electric Renovator.

One of the most interesting exhibits to be seen at the New York Electrical Show was that of the electric-driven renovator, illustrated by the accompanying picture. The construction of this machine is of the simplest, and, being absolutely enclosed, except the end of the motor bearing, there is small opportunity for injury. The renovator is equipped with three attachments, one to clean floors, carpets, cushions, mattresses and the like; the second for all small crevices, corners and confined places from floor to ceiling, and the third for walls, pictures, ornaments, decorations, fixtures, etc. The manufacturers of this simple device (which consists of



THE ELECTRIC RENOVATOR.

an electrically driven suction fan and rotating brush, with a convenient receptacle for receiving the dust and dirt removed, all mounted upon a wheeled base, as shown) assert that the expense of removing and replacing delicate decorations will more than offset the cost of the "renovator," which can be operated by the most inexperienced help. The device is made by the Electric Renovating and Manufacturing Company of Pittsburg, Pa.

Production of Tungsten and Titanium in the United States.

The bulletin of the United States Geological Survey shows that there was mined in this country in 1906 tungsten ore valued at about $349,000 and aggregating 928 tons, which was a gain of 29 per cent. in value and of 15½ per cent. in quantity over the previous year. The rise in value of this metal stimulated the production considerably and will probably continue to do so. The principal constituent in the ores is tungsten trioxide and the chief ores are wolframite and scheelite. The greatest producing locality during 1906 was Boulder County, Colo., but tungsten mining was also carried on in California, Arizona, Montana, New Mexico and Washington. New deposits of scheelite are just being developed at Osceola, Nev., and at Murray, Idaho. No production of tungsten has yet been reported from the deposits in Alaska, Connecticut and Oregon. The large demand for tungsten for the new incandescent-lamp filaments will doubtless develop many of those deposits. Tungsten salts also find considerable employment in the textile industries.

According to Dr. F. W. Clarke, chemist of the United States Geological Survey, titanium should not be classed with the rare metals, since it is much more plentiful than lead, zinc, copper and other metals classed as "common." A great many schists and gneisses carry titanium and it is found in appreciable quantities in clays—not only surface clays but also those that have been dredged from the sea bottom. Many iron ores contain this metal. Added to cast-iron it greatly increases the strength of that metal. It is believed that titanium is used by various manufacturers to increase the tensile strength and elastic limit of steel, although these processes are kept secret. A number of firms are now trying to use titanium in incandescent-lamp filaments, but the difficulties in reducing it to a pure metallic state have hindered this utilization. Titanium compounds are extensively used in arc-lamp electrodes.

Waterpowers Neglected in Saxony.

Waterpower is not used to any great extent in Saxony, being entirely limited to small saw and corn mills in outlying mountainous districts. The laws relating to the development and use of waterpower give the right of concession to the ministry of public works. Before any concession is granted the applicant must file plans of the system proposed, buildings, etc., and power required. These plans are laid before the local technical commission, which reports to the ministry. No large projects have been accepted during the last decade.

The government has no waterpower station in operation at present. Formerly a few turbines were in use for milling purposes on the Upper Elbe, but have been discontinued. All waterpower plants at present in operation are in private hands, controlled by the government. As far as can be ascertained there are only a few plants established, all of which develop but sufficient power for the needs of the mills which own them; no power is rented or sold.

In the absence of any figures as to waterpower it is impossible to make any comparison with steam power, but the former is absolutely negligible.

Telegraph Companies Deny Joint Action.

Attorney-general Jackson of New York appeared on October 2d before Supreme Court Justice Ford and asked for an order to show cause why he should not be permitted to begin an action against the Western Union and Postal telegraph companies. In his petition he declares that the companies have violated the laws of the state which prohibit monopolies and the restraint of trade. He seeks to annul the charters of the two corporations. He declares that the two companies entered into an agreement by which a uniform rate should be charged for messages, and that under this agreement the tariff for messages was materially increased by both companies, the said increase being in many instances 20 per cent. over and above the rate of charge in force prior to the establishment of the new tariff of charges.

Representatives for both companies assert that there is absolutely no foundation for the charges of the attorney-general and contend that the two companies are absolute rivals.

Traffic on the Chicago and Oak Park Elevated Railroad for September showed a daily average of 43,059 passengers, being an increase of 146 a day compared with the corresponding month last year.

Electrical Conventions in New York.

On the evening of October 1st a joint meeting of the Street Railway Association of the State of New York and of the Empire State Gas and Electric Association was held in Madison Square Garden in connection with the New York Electrical Show. This meeting considered questions of public policy.

The first speaker was the Hon. Frank W. Stevens, chairman of the Public Service Commission of the second district of the state of New York, whose subject was "The Work of the Public Service Commission, Second District, and Its Policies with Relation to the Corporations Under Its Supervision." Mr. Stevens outlined in general the work of this newly appointed commission and declared it probably would devote most of its time to three lines of activity: First, investigation of accidents; second, study of the finances of public utility corporations, and third, consideration of public complaints about traffic arrangements for both passengers and freight.

Mr. Henry J. Pierce, president of the International Railway Company, Buffalo, N. Y., next spoke on "The Electric Railway Situation of Today." He said that public-service corporations that were properly conducted would welcome investigation by the new commission, of which Mr. Stevens was head, as they had confidence in the fair-mindedness of the commissioners. He urged the latter to relieve these corporations from the burden of excessive taxation.

The next address was by Dr. Alex. C. Humphreys, president of Stevens Institute of Technology, on the "Control of Gas Companies by State Commissions." After showing that both good and evil had resulted from the present agitation for control of public-utility corporations, he pointed out the importance of uniform systems of accounts and records in enabling state commissions to reach correct and just decisions.

The last speaker was Mr. Everett W. Burdett, chairman of the committee on public policy of the National Electric Light Association. He spoke on "Public Control from the Corporate Standpoint." Referring to the attitude of public-service corporations in the United States toward public regulation and control, he said that it had undergone a great change in recent years, and he had no doubt that before long most corporate interests would realize that an unfriendly attitude is a short-sighted policy, and that good service is the best assurance against hostile legislation and burdensome regulations.

The Empire State Gas and Electric Association held an independent meeting on October 2d in the auditorium of the New York Edison Company, 44 West Twenty-seventh Street. Reports of officers and committees were read. Papers were read as follows:

"The Meter-testing Situation and Report of Meter Committee," by R. M. Searle; "Buying Light," by E. L. Elliott; "Gas Standards," by A. E. Forstall; "Franchise Taxation," by L. C. Palmer; "Municipal Ownership in New York State," by G. Marston; "The Agitation for Underground Distribution in Place of Overhead," by W. W. Cole.

The following-named officers were elected: President, S. R. Bradley; vice-president, P. T. Glidden; treasurer, T. O. Horton; executive committee, Arthur Williams, W. T. Morris and R. M. Searle.

Western Electric Company to Sell Telephones to All Comers.

After thirty years of continuous manufacture of telephones and telephonic apparatus, manufacturing exclusively for the Bell telephone companies, the Western Electric Company of Chicago has made an important change in its sales methods and will hereafter sell telephones and supplies to all who may care to buy. This plan has been under consideration for some time, but it was only with the completion of a large addition to the Chicago plant that the company found its facilities sufficient to branch out into a general business. The company is now prepared to make quotations on telephones, apparatus and equipment of every nature and description

President Theodore N. Vail of the American Telephone and Telegraph Company, speaking of the new plan, said that a great improvement was looked for in the relations between the public and the associated Bell companies. He declared that at the present time many inefficient telephone instruments are in use, and it is desired to see these replaced by standard instruments.

Amish People Have Changed Their Minds.

The Indiana correspondent of the Western Electrician notes that the Nappanee Telephone Company is making plans for extensive improvements and extensions into the country, where a large community of Amish Church people live who have heretofore refused to have telephones in their houses, it being deemed irreligious to do so. These people are frugal and have recently changed their minds and are now demanding a large number of telephone connections. The Nappanee company, it is reported, will soon go into the market for the necessary material for the construction of these new lines.

Method of Increasing the Inductance of Telephone Cables.

A patent was recently granted to Mr. Walter C. Yeatman of Chicago, and assigned by him to the American Telephone and Telegraph Company, which relates to the deadening effect of capacity in telephone cables on the alternating currents transmitting speech. The inventor professes to have a very much simpler method of supplying the requisite inductance necessary for overcoming the capacity of the cable than the insertion at definite intervals of loading coils, as advocated by Dr. Pupin.

The object of the inventor was to obviate the expensive features of the Pupin plan and to secure as effective or better results by distributing the inductance uniformly along the conductors in a simple and inexpensive manner. The preferred method advanced by Mr. Yeatman is to use copper wires that have a thin, even coating of pure iron electrolytically deposited thereon. The result is said to be that the reactance of the circuit is so increased by the magnetic sheath that the effects of capacity are neutralized, or practically neutralized, and the efficiency of the transmission is greatly increased. The conductor can thus be made a simple one in the form of a continuous copper core surrounded by a continuous sheath of electrolytic iron, and this can be insulated in the usual manner, so that the wire can be handled and used just as any other simple conductor now in use.

As a matter of still further improvement the inventor arranges to send a direct current through the cable or conductor at the same time that the voice current is passed through it, and this direct current increases the magnetic flux in the material composing the sheath, and thereby increases the permeability of the same and still further increases the effective reactance. The direct current may be transmitted over the circuit at the same time as the voice currents without interfering with their transmission, it is said, by a number of well-known means. The simplest of these is a repeating coil or transformer at either end of the circuit, in the center of which is the source of constant electromotive force sending the direct current over the line, and the other windings of which are connected to the source and receiver of the voice currents. This source of direct current may be a storage battery and can be used also for signaling or supervising connection. A battery at each end or at only one end may be used. Where two batteries are employed it is not thought advisable in telephonic transmission to connect one side of both of these batteries to earth, as a difference of earth potential between the stations would then cause an unequal amount of current to flow through the two conductors, thereby causing their self-induction to be unequal and the line unbalanced. In practice, the inventor says, it would be found that these batteries should be of from 20 to 200 volts electromotive force, the latter value being taken as the highest value which would be found expedient to use as a working pressure in a paper-insulated cable.

The inventor prefers to use for the magnetic sheath a metal of high permeability and low electrical conductivity, such as electrolytic iron. The conductor—which, to enable the best results to be obtained from the magnetic sheath, should not be of too great diameter—may be constructed in this form in any suitable manner which will give the large magnetic permeability and small electrical conductivity required. However, the best way to secure the iron coating or sheathing is by electrodeposition, thus obtaining a metal of the best magnetic qualities. With electrolytic iron the permeability is extremely high and the hysteresis losses low, both of which tend to increase the efficiency of transmission. The high permeability of the iron increases the amount of self-induction for a given amount of iron and so lowers the current attenuation. Or, for any required amount of self-induction in the conductor a thinner coating of electrolytic iron suffices, with a corresponding decrease in the longitudinal electrical conductivity of the sheath, and a like decrease, therefore, in the "skin effect" and eddy current losses, which are among the factors that determine the attenuation of the current waves.

A cable made up with composite conductors as described, insulated with paper and twisted in pairs and surrounded with a lead sheath, while possessing the characteristics of neutralizing capacity, and thereby permitting the transmission of electrical wave energy is a simple continuous cable, easy to manufacture, to lay and to maintain, and avoids the inconvenience and expense of the complicated structures heretofore provided for this purpose.

The inventor says that careful calculations show that for a periodicity of 1,000 per second, which corresponds approximately to that of the transmission of speech, a cable composed of iron-plated copper conductors, such as here proposed, through which a magnetizing current is passed, will transmit a given amount of electrical energy 3½ times as far for the same efficiency, as the corresponding plain copper wire cable, and without the distortion of wave lengths of the higher frequencies, which occurs in telephonic transmission over ordinary cables. This absence of distortion in the conductor of Mr. Yeatman's invention is due to the fact that the value of the attenuation constant is practically the same for the various telephonic frequencies, so that all frequencies are attenuated alike, and the current waves have substantially the same relation to each other at both ends of the conductor. It results from this that the voice currents are transmitted clearly and distinctly without the muffling effect that accompanies speech transmission over ordinary conductors, and in consequence speech is intelligible even when the conductor is very long and attenuation very great.

Indiana Telephone Items.

John H. Wilkinson, who purchased the North Judson telephone exchange, proposes to put it in first-class condition and extend several lines.

The Farmers' Telephone Company of Lamb will erect and equip a new telephone system.

The Brazil Farmers' Telephone Company of Brazil will install a new switchboard and construct several new lines.

The New Home Telephone Company of Linton, which also controls the telephone companies at Jasonville, Bloomfield, Worthington, Lyons and Switz City, will spend nearly $40,000 in improvements and extensions.

The matter of the telephone and telegraph as applied to the operation of steam and electric railways is to be inquired into by the Indiana railroad commission.

The Rushville Co-operative Telephone Company of Rushville, although co-operative in name, has none of the mutual features peculiar to a co-operative system. The company has moved into its own new and elegant building and has almost completed the installation of a modern automatic telephone system, with all the wires radiating from the new building underground. The entire cost of everything complete will be about $50,000.

The Home Telephone Company of Wabash, one of the pioneer Independent companies of the state, is preparing to move into its new building, now almost completed. The building is said to be one of the most modern for a telephone exchange in the country. A new common-battery system of 1,280 lines and 3,000 ultimate capacity is being installed. S.

GENERAL TELEPHONE NEWS

The Northwestern Telephone Exchange Company announces the cancelation of the half rates for toll service during the night hours. The reduced rates made the night service congested, and the change is on that account.

The officials of the New England Telephone and Telegraph Company were notified a few days ago in Boston that the corporation had been indicted by the grand jury. The indictment is the result of the investigation made by District Attorney John B. Moran relative to the charge that politicians had obtained from the company employment for their constituents in violation of the law.

At its regular meeting this week the Chicago City Council adopted a resolution directing the committee on state legislation to draft a bill to confer upon the city the power to fix rates for street railway, subway, telephone and telegraph service with a view to its passage by the Legislature. This action was taken to make sure the city would have the power to enforce the rate-regulating clause of the present pending Chicago Telephone Company franchise, should it be passed by the council.

Information concerning the present condition and plans of the Illinois Telephone and Telegraph Company (Illinois Tunnel Company) is to be secured by a committee of the Chicago City Council according to a resolution adopted this week. The resolution states that the company has without authority transferred its franchise to another company; has failed to install a telephone system according to the terms of the franchise, and is devoting the tunnels to freight transportation service exclusively. An ordinance which was referred to the proper committee asked for the repeal of the franchise of the company.

CORRESPONDENCE.

Continental Europe.

Paris, September 25.—A new line of electric railroad in the Alpine region which presents considerable interest is the Locarno-Bignasco road, and it runs throughout the whole length of the Maggia Valley. It is soon to be started and will open up a picturesque region which has been but little frequented heretofore on account of lack of means of communication. In fact, the Maggia Valley, which is one of the finest of the southern region of Switzerland, was almost cut off from the rest of the country, as it is difficult of access and can only be reached by gorges or long passages over the mountains. For this reason it has been neglected by tourists, but the new electric road will bring it within easy reach of the railroad lines of Switzerland or Italy. The present line has been promoted chiefly by Mr. Soldati, prominent in Swiss politics, and not long since Parliament voted in favor of building three narrow-gauge roads, one in the Blenio Valley, a second from Lugano to Tesserete, and the present line of the Maggia Valley. Part of the funds were supplied by the government, but the greater portion, $540,000, is supplied by a stock company formed for the purpose. Work was commenced on these lines in 1905, and it met with some difficulties on the first section from Locarno to Ponte-Brolla, as this had to be built along the side of the mountain. The line crosses the Maggia River upon a high bridge. At the latter locality is built the hydro-electric station. From here the road mounts in an easy grade by Maggia, Someo and Cevio, and reaches the terminal point, which is about 18 miles from the start.

The Pyrenees Electric Company, which is now in formation in the southern region of France, will undertake to develop a number of waterfalls in the central region of the Pyrenees. Current will be taken by a network of lines through the southwestern region and will supply many towns and villages. The new company is to be formed in several stages, and the capital of $1,300,000 will be employed in carrying out the first portion of the work. When this is entirely completed, there will be as much as 90,000 horsepower furnished by the different hydraulic plants. It is stated that the new company is assured of a large consumption of current, as it lies at a point midway between two extensive regions, to wit, the region of Toulouse in France, and the Spanish district of Barcelona, and these two districts have not as yet been supplied with current to any extent. The future of the new company seems promising.

At Moschi, in East German Africa, has been opened a new telegraph station, and it will be used for international service. The locality of Moschi is situated about 160 miles to the northwest of Mombo, which lies at the foot of the Kilimandjaro Mountains.

In France a new company has been formed for the purpose of carrying on operations in the northern region at Valognes and Montebourg, relating to the supply of current and the erection of the necessary electric plants. The headquarters of the company are located at Paris.

The Japanese government recently decided to hold an international exposition in that country, which is fixed for the year 1912, and preparations have already been begun to this effect. It will be held at Tokio, and will be preceded by a series of expositions in different cities of the empire. This year the municipality of Tokio is organizing an exposition which is to be held in the Veno Gardens.

A. de C.

Great Britain.

London, September 28.—The Municipal Tramways Association, which numbers among its membership practically all the municipal tramway authorities of the country, is now holding its annual conference at Manchester, Mr. McElroy, the general manager of the Manchester System, being president. In the presidential address, Mr. McElroy contrasted America and Great Britain. He stated that in tramway matters America has taught Great Britain many lessons, for which we had certainly reaped the benefit of her pioneer work in electrical traction. During his recent visit to the United States he had come to the conclusion that we now had little or nothing further to learn from America on matters connected with construction, equipment and co-operation generally, but we still had a very important lesson to learn from there in the way the population was spread by the energetic manner in which tramways were extended in districts absolutely unbuilt upon. In America they did not wait until a district grew before they provided transit facilities. In America, for the most part, these facilities were provided by private companies working for their own selfish ends, but it was a lesson which the municipalities of this country should bear in mind. Of the technical papers read at the meeting, one of the most interesting was by the manager of the Chesterfield tramways, in which he expressed the opinion that a considerable extension of wheelbase for tram cars would come into general use later, and he instanced 10 feet.

In connection with tramway matters, mention may be made of a new type of tramcar which has been devised by a Liverpool man. So far only a model has been constructed, but the principle adopted has something to recommend it. By an arrangement of folding and hinged doors, passengers are enabled to enter the car at the conductor's end and always leave it at the driver's end. The model is being inspected by many tramway managers but so far no detailed particulars of it have been given away.

About a month ago I reported that the Home Office had published a new set of regulations (in draft) dealing with the use of electricity in factories and workshops. Being published in the summer comparatively little notice was taken of them for a week or so. Now that people are back from their holidays, however, there appear to be considerable discussion and criticism, and, apart from individual companies, the various chambers of commerce throughout the country have entered into the matter with vigor. At Bradford there has been a public discussion, and I believe the London Chamber of Commerce has also taken the matter up. The very excellent example set by the Board of Trade in connection with other similar rules, viz., to call a conference of interested persons was not followed by the Home Office, and this is one of the points of attack.

The annual meeting of Messrs. Dick, Kerr & Co. was held last week. Although the net profit for the year amounted to over $400,000, this was about $30,000 less than last year. This was attributed to the high price of copper and the continuation of the very keen competition which has existed for such a long time. The point of the chairman's speech was that although the Board of Trade returns, as a general thing, indicated that the country was exceedingly prosperous, yet a careful study of the true position, so far as the electrical industry was concerned, would prove that the margin of profit now was less than when the Board of Trade returns, some years ago, showed a less prosperous condition of things for the country as a whole. To that extent the Board of Trade returns did not indicate the true position

We have not had to wait long for evidence that the continued rise in the price of coal has had a detrimental influence upon the accounts of electricity works. Thus at West Ham, hitherto regarded as one of our most successful electrical undertakings, at any rate in the extra metropolitan district, there has been a somewhat serious loss owing in the main to this cause, the coal bill being $12,500 more than it would have been on the old price of coal. Similarly at Kingston-on-Thames the extra coal bill has been sufficient to prevent a small profit being made. It is becoming the common practice now, however, for central-station managers to stipulate, in the case of long contracts, that there shall be a specified increase in the price corresponding with the increase in the price of coal. Of course, this cannot be put into effect in the case of ordinary lighting consumers, but more than one manager has been thankful for the existence of this clause in his large power contracts.

Little has been heard of the Victoria Falls power scheme for some little time now, but within the past few days a notice has been sent around to the press stating that the capacity of the Germiston station together with that at Brakpan (purchased respectively from the General Electric Power Company and the Rand Central Electric Works) are now loaded to their full capacity, and that the former is being extended pending the erection of the 24,000-horsepower station, the machinery for which is said to be in an advanced state. Sir Charles Metcalfe, Mr. R. D. Mershon of New York and Mr. Arthur Wright, the consulting engineers to the scheme, are all in South Africa at the present time, with some of the directors. G.

Dominion of Canada.

Ottawa, October 5.—The City Council of Kingston, Ont., will ask the Ontario Hydro-electric Power Commission to quote prices for 2,000 horsepower of electric energy, to be supplied at the city power station, ready for distribution.

It is now understood that the Electrical Power Company of Niagara Falls is anxous to come in and supply the Hydro-electric Power Commission of the Ontario government with electrical energy at Niagara Falls. Representatives of the company have seen the local prime minister and members of the commission in regard to the matter. The company, which before would not quote rates satisfactory to the government, now desires to come in on the same terms as the Ontario Power Company, which made an agreement with the government of Ontario to supply power at the Falls at $10.40 for an amount of electrical energy up to 25,000 horsepower, and at $10 above that amount.

The Marconi Wireless Telegraph Company of Canada has issued a notice to the effect that rates on messages exchanged between vessels and shore stations, in the Gulf and River St. Lawrence, will be reduced from $2 for ten words to $1, and in some cases to 50 cents for ten words. This step has become desirable on account of the increasing amount of business being done with ships. For each additional word over, ten words the charge will be six cents a word.

An immense work is being prosecuted by the Montreal Light, Heat and Power Company and the Provincial Light, Heat and Power Company at the Coteau du Lac Rapids, where a million and a half dollars is being expended on a hydro-electric plant. The two companies intend that the plant shall be complete in every detail. The object is to secure power for Montreal. The work is situated about 30 miles from Montreal, and it is expected that it will be completed so that power can be brought to Montreal this autumn. The dam has a 50-foot head and the plant will develop about 15,000 horsepower. W.

Winnipeg, October 3.—At a meeting of the City Council, Calgary, Alberta, it was decided to at once call for tenders for the construction of the electric street railway to be built by the city. Mayor Cameron or City Engineer Thorold may be addressed.

A special meeting of the shareholders of the Canadian General Electric Company has been called for October 28th to amend the by-law recently passed to issue $2,000,000 preference stock having priority of claim over the common stock in the matter of dividends. English interests, which were to take the bulk of the new stock, demanded that it be made plain that this stock has priority over all assets of the company as well as priority in the matter of dividends. The meeting, which will be held in Montreal, is called to amend the by-law to that effect.

Mr. Stinsel, representing the Minneapolis Street and Town Lighting Company, Minneapolis, Minn., has applied to the Town Council, Carnduff, Saskatchewan, for a franchise to light the town and supply power.

The Board of Trade, Olds, Alberta, is considering the securing of an expert on the matter of developing waterpower on the Little Red Deer River, 13 miles west of town. Address S. Craig, Olds, Alberta.

Tenders for the construction of Winnipeg's power plant at Point du Bois were opened on October 2d. In all there are over 100 different bids for the 27 different parts of the work. The number of tenders received is an indication that there is a brisk competition for the various parts of the work, and, in the opinion of the power committee, the work will only cost about $2,750,000, against the estimate of $3,250,000. Alderman Pulford or Cecil B. Smith, civic power expert, Winnipeg, Man., may be addressed in relation to this work.

The Ratepayers of Kelowna, B. C., voted favorably on a by-law to provide $40,000 for waterworks and electric light. J. F. Burn, Kelowna, B. C., may be addressed.

The directors of the Central Electric Light Company, Portage la Prairie, Man., are considering the spending of $35,000 on extensions to their plant for the purpose of making provision for the supply of power during the day. They also propose to double the number of arc lights on the streets, but will require an extended contract from the council before undertaking this. R.

New York.

New York City, October 5.—On Sunday, October 6th, four New Haven trains are scheduled to arrive at Grand Central Station from Stamford, Conn., and this will mark the beginning of the last stage of this great enterprise in electric railroading. Within two or three months it is expected that every one of the New York, New Haven and Hartford passenger trains will drop its steam locomotive at Stamford and will be propelled by electric power alone for the remainder of the journey. Since July 24th five electric trains have made the round trip from New Rochelle to the Grand Central Station daily, and since August 5th ten have completed the trip from Port Chester to New York and return daily. Stamford is 34 miles from New York. The Westinghouse Company has supplied the railroad with all of its locomotives and equipment. The New Haven road uses both the third rail and overhead catenary suspension systems. From near Woodlawn to the Grand Central the New Haven uses the New York Central's third rail, supplied with direct current of about 650 volts. The overhead wires, however, carry a potential of 11,000 volts and all the necessary transforming and converting apparatus is self-contained in each locomotive.

The Brooklyn Rapid Transit is preparing to put into operation 150 "pay-as-you-enter" cars. On these cars the passenger must hand the conductor his or her fare before entering the body of the car. Under the present system the company says that the fares missed by the conductors amount annually to fully a five per cent. dividend on the company's stock. It is further argued that by this plan the conductor will not have to leave the rear platform and in consequence many accidents will be avoided.

The annual report of the Brooklyn Rapid Transit Company for the year ended June 30, 1907, has been made public and presents some very interesting figures. During the year 511,839,437 passengers were carried, an increase of 13.1 per cent. over the previous year. The average gross earnings per passenger decreased from 3.89 cents for the previous year to 3.60 cents, and the averare net earnings per passenger from 1.70 to 1.48. The average number of cars operated daily for the 12 months is 2,093, as against 1,922 for the year 1906, an increase of only nine per cent. The cost per car mile is given as 17 cents, which is one cent more than that given for horsecars 30 years ago. As to increase in equipment—143 convertible surface passenger cars and 100 enclosed surface passenger cars, also two 7,500-kilowatt turbo-generators have been put in operation, and orders have been placed for an early delivery on 100 elevated motor passenger cars and five 10,000-kilowatt turbo-units with all necessary equipment, two of which will be put in service the ensuing year. The extension of the power houses to receive this equipment will be completed early in 1908.

Prof. B. B. Beltwood of Yale University announces that he has discovered a new element of the radium family. He says: "Strong evidence has been obtained of the existence in the uranium minerals of a new radio-active element which emits both alpha and beta radiations, but which produces no emanations and therefore resembles in its chemical properties thorium. It is without doubt a disintegration product of uranium and is in all probability the immediate parent of radium. The name "ionium" is proposed for this new substance, a name derived from the word "ion," and is especially appropriate because of the ionization action which it possesses in common with the other elements which emit alpha rays."

The fifty-second college year of the Polytechnic Institute of Brooklyn opened on Monday, September 30th, with an entrance class of 85 day students and over 200 evening and extension students. The Polytechnic is again offering instruction to engineers engaged in the practical field, the studies to be pursued evenings and on Saturday afternoons. It has greatly enlarged its corps of instructors, and the courses to be given by C. O. Mailloux and Charles P. Steinmetz and others will be of the greatest interest. The Institute has also enlarged its steam and gas-engine laboratory and has added new machinery, and has also equipped a new laboratory for the testing of materials. Prof. William D. Ennis, who has been in the practical field for about 10 years, being a graduate of Stevens, class 1897, will take charge of the department of mechanical engineering. E. H. S.

Northwestern States.

Minneapolis, October 5.—The Northwestern Interurban Electric Railway Company has been organized at Moorhead, Minn., with T. T. Bubb as president and T. R. Brown, secretary. The company proposes to build a trolley line from Fargo, N. Dak., to Detroit, Minn.

The Winnebago Traction Company of Oshkosh, Wis., which recently went into the hands of a receiver, will be reorganized, and $100,000 will be expended on the Oshkosh plant and $300,000 on an interurban line to Berlin, Wis.

A contract for financing the Omaha and Nebraska Railway Company has been negotiated by the H. J. Folts Company of Minneapolis. The line will be an electric road and will extend from Omaha to Hastings, Neb.

The Dakota Electric Company has been organized at Grand Forks, N. Dak., by C. F. McLean and associates.

The Wagner (S. Dak.) and Lake Shore Traction Company is purchasing material for its proposed electric line.

The Fremont Gas and Electric Light Company of Fremont, Neb., is negotiating with the city council for the sale of the system there to the city. R.

Michigan.

Grand Rapids, October 5.—The Shiawassee Light and Power Company of Corunna has purchased another 250-kilowatt Warren generator which will be able to generate 300 horsepower. The company's capacity will soon be doubled by the raising of the company's dam to a 15-foot head. The company will now light three more towns, Durand, Vernon and Byron. It is already lighting Perry, Bancroft and Morrice.

An appraisement of the Kingsley power plant at Manchester is being made with a view to purchase by the city and the establishment of a municipal electrical-lighting system Mr. Kingsley wants $22,000 for the property, which was established fifteen years ago.

The village of Northport is installing a $5,000 municipal lighting plant.

The Eagle Tanning Company at Grand Haven is preparing to install electrical equipment. William H. Mead of Holland has the contract. The plant will have a 300-horsepower engine and a 200-kilowatt generator. Induction motors of 15 to 50-horsepower will be installed.

Work of construction by the Electric Land and Development Company of Traverse City on the Tyler dam site near Walton has begun. There are four available dam sites on the river, two with a 40 foot head, one with a 37 foot head and one with a 35 foot head.

The Canal Street Business Men's Association of this city has on foot a project for making the street a "great red way." Flaming arc lights are to be erected every 50 feet on the street for a distance of four blocks.

The directors of the Traverse City Board of Trade are pushing the project for an electric road from that city to the north and for city street railway lines, a franchise for which has been let to the Carter Company.

Rigid restrictions have been placed on the Michigan United Railways by the city of Kalamazoo. Cars must be heated so as to maintain a temperature of 75 degrees and not less than 60 degrees. Two thermometers must be placed in each car. Cars for the use of transporting material must be operated between 12 o'clock midnight and 5 o'clock in the morning. All cars, including interurbans, must be stopped at any corner that passengers desire to get on or off. There are many other minor restrictions. L. W. B.

Indiana.

Indianapolis, October 5.—The Evansville, Petersburg and Vincennes Railroad Company, incorporated last week, has already secured 11 miles of the right-of-way of the proposed trolley line from Evansville to Petersburg. It is the purpose to build the road sufficiently strong to do a good freight business. This road will give Evansville five traction lines.

Regular service was begun during the past week on the Richland branch of the Evansville and Eastern, nine miles, and the Seymour extension of the Indianapolis and Southern, 20 miles.

A. A. Anderson, superintendent of the Indianapolis, Columbus and Southern and the Indianapolis and Louisville electric railways, announces that the fare from Indianapolis to Louisville will be $1.90, and the round-trip fare $3.45. All fares for intermediate points have also been arranged, and a schedule of the mileage and tariff rates has been filed with the State Railroad Commission.

The Indiana Harbor and East Chicago Electric Company has filed articles of incorporation, proposing to construct a plant to supply East Chicago and a number of other cities and towns in Lake County, with light, heat and power. The promoters are Harry H. Phillips, Rollie M. Cole, H. S. Oakley, C. B. Woods and C. W. Sherman. The same persons have also incorporated the East Chicago and Indiana Harbor Water Company to establish a plant to supply East Chicago and nearby towns and cities with water.

Taking advantage of a recent court decision, officials of the Winona Interurban Railway Company will start action to force the Lake Shore Railroad Company to accept the mileage used on the electric line between Warsaw and Goshen and on all the Murdock lines in Indiana and Ohio. For several months past there has been an understanding between the officials of the Bg Four Railroad and the officials of the Winona interurban company whereby conductors on the two roads have orders to accept either form of mileage. Should the point raised by the electric road officials carry in their favor, patrons can purchase 1,000-mile books from the electric road for $15, and in the event this mileage can be used on the railroads the patrons will get a rate of 1½ cents a mile. The contract on the cover of the mileage books just issued by the Winona Interurban Railway Company and the Murdock lines contains a clause which makes it possible for one, two or more persons to ride on mileage from the book. If the Winona company wins its point, purchasers of these mileage books can go to Chicago over the Grand Trunk, Lake Shore, Wabash, Baltimore and Ohio, Pennsylvania, Nickel Plate or Erie railroads on these mileage slips. S. S.

Pacific Slope.

San Francisco, October 2.—Samuel L. Naphtaly, manager of the City Electric Company, which was expecting to start up its new electric-light and power system in San Francisco about October 15th, has failed to come to an agreement with the International Brotherhood of Electrical Workers and a strike is imminent. The union is in conflict only with those companies owned by the Fleishhacker and Mack interests. These are the American River Electric Company, the Truckee River General Electric Company, the Reno Traction Company, the Nevada Light, Water and Power Company and the City Electric Company. The proposed strike would cut off the electric power which operates the pumps and hoists in the Comstock mines at Virginia City, Nev.

Officials of the Metropolitan Light and Power Company state that they are about to close a deal with the Stanislaus Electric Power Company by which the former will be able to sell electricity in this city for light and power purposes. Leopold Wallach of New York, representing the eastern people in the Metropolitan company, is expected here this week to confer with President Michaels and assist him in closing the deal with the Stanislaus Electric.

James Mullen of the California-Nevada Electric Power Company is out with a corps of surveyors running a pole line from Bridgeport, Cal., toward Bodie and Aurora.

The American River Electric Company has just made a highly satisfactory test of its new steam turbine generator at Stockton, Cal., an auxiliary to the waterpower plant at Placerville. A duplicate steam plant will be erected beside the present one.

The contemplated improvements to be made in the municipal electric plant at Pasadena, Cal., will cost, according to one estimate, $195,000, while another estimate places the cost at $245,000. Because of the difference Prof. C. L. Cory of Berkeley, Cal., has been appointed to make a closer examination of the project.

Bids are requested for the construction of 42 miles of telephone line from Red Bluff, Cal., to the property of the California and Massachusetts Copper Mines Company.

The Northern Light and Power Company is now getting material for its Cow Creek power house, near Redding, Cal., and the building will soon be under way.

The contract for a $1,700 power house to be built on the grounds of the insane asylum at Las Vegas, N. M., has been awarded to M. M. Sundt.

The Ocean Shore Railroad Company, which will operate electric trains between San Francisco and Santa Cruz, Cal., is conducting an active campaign in the latter city for the sale of its bonds, as upon this sale depend the completion and operation of the road in the near future. The company may yet run through trains early next year.

The Central Electric Company has been incorporated in San Francisco by L. R., H. W. and J. L. Boynton, with a capital stock of $25,000.

The Napa Valley Electric Company has been incorporated at Napa, Cal., to conduct a general electric and gas-lighting, heat and power business. The capital stock is $200,000. Work will be begun at once. The organization of this company is regarded as the first step for a branch of the Snow Mountain Line in Napa County. A.

PERSONAL.

Elmer H. Littlefield, superintendent of the ninth division of the Boston Elevated Railway, died on September 30th at his home in Allston, Mass.

Percy H. Thomas and N. J. Neall announce the formation of the firm of Thomas & Neall, electrical engineers, with offices in New York and Boston.

J. G. White, the contracting engineer of New York, is the subject of an interesting article in the October Review of Reviews by David F. St. Clair entitled "A Yankee Engineer on Five Continents."

George W. McClure has resigned his position as superintendent of the Norwich and Westerly (Conn.) electric railway to become superintendent of construction and equipment of the Illinois Traction system. His headquarters will be at Danville.

Mr. Frank Stout, for the last nine years a salesman for I. P. Frink, now occupies a similar position with the Bryant Electric Company of Bridgeport, Conn., and will represent it in the territory controlled by the branch of the sales organization which in general can be described as the territory east of Buffalo and Pittsburg.

Mr. Harry De Steese of New York has been appointed Eastern representative of the International Timber Preserving Company of Chicago, which manufactures the timber preserver, "Neosote." Mr. De Steese has been connected with electrical and allied interests for nearly a score of years and has made himself an enviable reputation as an aggressive business man.

G. D. Hettrick, chief engineer of the Iowa and Illinois Railway Company of Clinton, Iowa, has gone to Texas to accept a position with the El Paso Electric Railway Company as chief engineer. He has been with the Iowa and Illinois road for the last three years, and will be succeeded by J. B. Skiff, who has also been connected with the company for some time.

H. H. Vreeland has resigned from the position of manager for the receivers of the Metropolitan Street Railway Company and the New York City Railway Company. Mr. Vreeland is admittedly the best posted man on street-railway matters in New York. His resignation follows the inquiry before the New York public-service commission into the affairs of the Metropolitan company. Mr. Vreeland will be succeeded by Oren Root, vice-president and general manager of the New York City Railway Company.

ELECTRIC LIGHTING.

W. A. Mason and others are organizing a company in Texhoma, Okla., to build an electric-light plant.

Representatives of the Chicago and Milwaukee Electric Railroad Company assert that if permission is granted the company to enter Racine, Wis., it will be in a position to make a bid for the street lighting at a figure considerably below that now paid by the city.

C. C. Smith has been granted a franchise for an electric-lighting system in Exeter, Neb.

E. E. Bigham of Minneapolis, Minn., has been granted an electric-light franchise in Northome, Minn.

Oscar Kihlberg and others have been granted a franchise for an electric-light and power plant in Sulphur Springs, Ark.

An electric light and power plant has just been installed on the Robbins Ranch, 30 miles from Aberdeen, S. D., by Minneapolis representatives of the Fairbanks-Morse Company. The plant is operated by water from an artesian well. It furnishes 30 lights for the house, barn and other buildings, and there is plenty of power for feed cutting, etc. F. H. Barnard, manager of the ranch, is delighted with the plant. The Aberdeen Engineering Company installed the machinery.

ELECTRIC RAILWAYS.

Yegen Bros. have been granted a franchise for an electric railway in Billings, Mont.

The Oklahoma Electric Terminal Company has been incorporated to furnish terminal facilities in Oklahoma City. The capital is $2,500,000.

Electric cars were operated for the first time in Eugene, Ore., on September 26th. The trial run was made from the depot to the University of Oregon, and was in charge of Mr. A. Welch, general manager of the Eugene and Eastern Railway Company, which built the system.

The complete traffic returns of the elevated roads of Chicago for September show an increase of 1,881,733 passengers. These figures for September compare as follows for 1907 and 1906, respectively: Metropolitan, 4,229,372, 3,809,244; South Side, 3,547,677, 2,692,472; Northwestern, 2,923,413, 2,825,254; Chicago and Oak Park, 1,350,520, 1,342,279; totals, 12,050,982, 10,169,249.

The report prepared for the Illinois Railroad and Warehouse Commission by the Metropolitan Elevated ailway Company of Chicago to cover its operations in the 12 months ended June 30th shows gross earnings of $2,800,000, net earnings of $1,438,400 and a balance of $430,700 for the stock. This is at the rate of 4.9 per cent. on the preferred stock outstanding.

The Oklahoma Central Interurban Railway, Telegraph, Telephone, Light and Power Company was incorporated at Guthrie, Okla., with a capital of $5,000,000 for the main purpose of building a system of electric lines between McAlester and Cheyenne amounting to about 500 miles. Among the incorporators are: C. D. Freeman, Denver, Col.; Leon Brown, St. Louis, Mo., and F. M. Stone, Weatherford, Okla.

The Philadelphia Rapid Transit Company reported for the last fiscal year the largest gross earnings in its history. The net earnings, however, have vanished and a deficit of $364,048 was shown. The president of the company attributes this poor showing to the unusually heavy claims for damages that amounted to $1,217,986. In the last 10 years the percentage of gross earnings required for settlement of damage claims rose from 2.5 to 7 per cent.

POWER TRANSMISSION.

The Pennsylvania State Water Supply Commission has put into effect a law giving it authority over all obstructions in streams, and hereafter permits must be received before erection of any power dams, wing walls, embankments, bridge piers and wharves. The commission has a force of engineers to inspect plans and sites for proposed work and every locality on which it is intended to build this fall must first be approved. Several proposed enterprises have been held up pending grant of authority by this board and in three instances hearings will be held on protests.

Kennebec River and its important tributaries furnish some of the best waterpowers of the country, besides affording many excellent sites for further development, and the welfare of the whole state of Maine is involved in the wise extension of the use of this river and its branches for waterpower, for log driving and lumbering, and for municipal and other purposes. To meet the constant demand for information in regard to the hydraulics of this great drainage basin, the United States Geological Survey has just issued, as Water Supply Paper No. 198, a report embodying all available data in regard to the flow of the streams and the possibilities of regulating that flow by means of storage, opportunities for which are exceptionally good.

PUBLICATIONS.

The Weston Electrical Instrument Company of Newark, N. J., issues a leaflet illustrating many of its portable and switchboard instruments, both for direct current and for alternating current. F. B. Badt & Co., 1503-1505 Monadnock Building, Chicago, are western sales agents for the Weston company.

The Western Electric Company's arc-lamp department at Hawthorne, Ill., has published and is ready to distribute a pamphlet describing the various types of direct and alternating-current arc lamps made by the company.

The Wire Market News is the name of the house organ of the Western Wire Sales Company of 324 Dearborn Street, Chicago. The latest number contains interesting articles on copper and other subjects.

The General Electric Review for September contains a number of interesting and well illustrated articles, including "Fundamental Principles of Centrifugal Fans," by Maxwell W. Day; "Gyroscopic Forces," by W. E. Miller; "Potential Control of Alternating-current Systems," by Ernst J. Berg, and "Recent Advances in Illuminating Engineering," by W. D'A. Ryan.

Under the direction of the Swiss railway authorities there has been compiled a comprehensive directory of Swiss steam, electric, funicular and street railways. This work, besides giving the salient features of each line now in operation, with headquarters address, includes all projects now under construction and also the 111 projects for which concessions have been granted, with addresses in each case. It is in the French language.

The new Standardization Rules of the American Institute of Electrical Engineers have been separately published, bound in paper or cloth, and are to be had by addressing the Institute at 33 West Thirty-ninth Street, New York city. These rules were adopted in June, 1907, and it is to be noted that they supersede the rules of the Institute adopted in 1902. Copious extracts from the new rules were made in the Western Electrician of July 13, 20 and 27, 1907.

Mr. Sidney Aylmer-Small has written a book entitled "Electric Railroading as Applied to Steam Railways." The book is intended for the motorman, engineer and electrician, and should be found convenient as a handbook for reference. In it the author leads the reader through the elementary stages of electricity, bringing him to a comprehension of its application to railway operation. The book has 450 pages and 500 illustrations, with a full leather binding. It will be ready November 1st, Frederick J. Drake & Co., 350-52 Wabash Avenue, Chicago, being the publishers.

The Blake Signal and Manufacturing Company of 246 Summer Street, Boston, Mass., has just published an instructive booklet entitled "Requirements for Efficient Telephone Train Dispatching." To get the best and most reliable results in telephonic dispatching it is pointed out as being necessary to install an efficient signaling system, such as the Blake signals, as this enables the dispatcher to call a train crew at any desired point to communicate his orders to them and also gives him a means for visually reminding them of these orders. The booklet also gives valuable rules for making the dispatching safe and yet rapid, so as to permit a maximum volume of traffic to be expeditiously handled.

The October number of For California, a monthly publication published by the California Promotion Committee of San Francisco, is devoted entirely to the electrical resources and developments of the state. A page editorial calls attention to California's two resources, fundamental to manufacturing—raw material and power—both of which are within the borders of the state in abundance. The longest transmission of electrical energy in the state (and probably in the world) is given in the editorial as 350 miles. Several good articles are devoted to the development of power from mountain streams, electric traction and the use of electricity on the farm. A list of 106 hydroelectric power stations is given ranging in capacity from 75 horsepower to 26,000 horsepower.

SOCIETIES AND SCHOOLS.

The tenth annual meeting of the Kansas Gas, Water, Electric Light and Street Railway Association was scheduled to be held on October 9th and 10th at the Commercial Club rooms, Topeka, Kan.

Arthur A. Noyes, acting president of the Massachusetts Institute of Technology, made his first appearance as president before the students of that institution on October 3d. Professor Noyes has given up his office as head of the physico-chemistry research laboratory and is devoting all his time to his duties at the Institute.

MISCELLANEOUS.

The City Council at Akron, Ohio, has adopted a resolution requiring the wires on Main and Howard streets, between Jackson and Federal streets, to be placed underground. The electric-railway company will be allowed to keep its trolley, feed and span wires where they are, but all others, including telephone and telegraph wires, must be buried. This is the main retail district of the town.

Guests of the Monongahela House, Pittsburg, Pa., were badly frightened a few days ago by a series of explosions near the hotel which sounded to them like the rattle of musketry. Investigation revealed that a street car in Smithfield Street had hit a wagon loaded with boxes of electric incandescent bulbs. The exploding lamps made the noise.

At a meeting held recently in Marion, Ohio, the Marion Electric Association, composed of the Marion Electric Supply Company and the Marion Railway, Light and Power Company, was organized. The association, which is to promote the electrical business in Marion, is planning for an exhibit to be held some time in November. The officers are: President, D. J. Sheldon; secretary, Frank Glosser; treasurer, W. G. Lucas.

A large tract of coal land in the province of Alberta has been purchased by the Great West Coal Company of Port Arthur, Ont., as a result of recent investigations, and claims have been filed for 12,000 acres of what is said to be the best coal land in the Northwest. In connection with the development of the coal lands, the company has acquired the charter of the Great Western Railway, which extends from Calgary through the coal fields to the international boundary.

Responding to an American inquiry relative to the demand for pumps in the Dunfermline (Scotland) district, Consul J. N. McCunn says that steam pumps are now becoming obsolete, and in most of the collieries electrically driven pumps are being adopted. This class of pumps found in most favor is what is termed the "three-throw," and centrifugal or turbine pumps. The electric three-throw pump is a type which has an extensive application and is operated by the intervention of gearing.

Writing from Cartagena, Consul I. A. Manning states that the platinum industry in Colombia (South America) seems to be attracting considerable attention from abroad. Recently a French company, headed by Albert L. de Lantreppe of London has made some heavy purchases of mining properties in the platina district. It is soon to send competent engineers to make a complete study of the region from which platina is taken at present, and especially of their properties. Other capitalists and companies have also recently secured large holdings, which they expect to develop more scientifically than has been usual in working the mines.

"Worthwine a Good Lineman" is the heading of a recent news item in a daily paper. But further perusal shows that this statement has nothing to do with electrical construction work; it merely indicates that the college football season is at hand.

TRADE NEWS.

Frank W. Morse of Boston has removed from 116 Bedford Street to 514-516 Atlantic Avenue.

The address of the Birmingham office of the Crocker-Wheeler Company has been changed from 2119 Third Avenue to Woodward Building, Birmingham, Ala.

The Massachusetts Chemical Company of Walpole, Mass., will exhibit at the American street and interurban railway convention at Atlantic City, N. J., October 14th to 18th. Messrs. A. T. Baldwin, L. O. Duclos and A. E. Duclos will represent the company with a full line of samples, descriptive literature and souvenirs.

An American consul in South America reports that a city of about 200,000 inhabitants is about to issue a call for bids, open for four months, for contracts to supply drainage and electric power. He says that contracts will probably be tied together and that interested houses should send an expert representative at once. Address the Bureau of Manufactures, Washington, D. C., referring to No. 1463.

The many old friends throughout the West and Northwest of Mr. J. E. Ham will be interested to know that through the home office of the Waterbury Company of New York he has recently received the appointment as representative of that company in the West for the introduction of the company's high-grade insulated wires and cables. It will be recollected that Mr. Ham for a long time represented the Hazard Manufacturing Company in the West. The headquarters of the Waterbury Company's new western manager will be at that institution's branch office, 108 La Salle Street (Stock Exchange Building), Chicago.

BUSINESS.

The American consulate, Amoy, China, would like to receive catalogues, commercial publications, etc., from all American business houses desiring to enter that field.

Secretary J. D. Kenyon of the Sheldon School, 209 State Street, Chicago, sends out a letter in which he calls attention to the facilities of that institution for teaching the science of business and of successful salesmanship.

F. B. Badt & Co., Monadnock Building, Chicago, call attention to the merits of the Excello flaming arc lamp. This lamp, taking 6 and 10 amperes and at 55 volts across the arc, gives 1,300 and 2,500 mean hemispherical candlepower and will burn from 10 to 17 hours. It is used for both direct-current and alternating-current circuits and for either indoor or outdoor lighting.

The Central Electric Company of Chicago reports very large sales on Stanley G-I arc lamps, for which it is agent. Referring to the new type "K" lamp, the company says that it is the simplest arc lamp on the market and asserts that no matter what the conditions, current or circuit, it can furnish a type "K" lamp which will give good light and do it economically. The company is sending out to the trade special bulletins on this lamp and requests inquiries for descriptions and prices.

The New York Central and Hudson River Railroad Company has made extensive and varied use of the Dossert solderless connector in the electrification of the road. It has used up to date over one thousand straight two-way connectors of all sizes up to 1,000,000 circular mils and of cable taps it has used an even larger number, of sizes from 350,000 circular mils up to 1,350,000 circular mils. These cable taps were used principally in tapping off from the third rail in series of three to connect by way of the structure to the overhead cables. Dossert & Co. also made for the New York Central an emergency jumper clamp connector. In case of a break in the third-rail current the connector is attached to the third rail on either side of the break, thus preventing a tie up of the service until the regular flow of current is re-established. Dossert & Co. are addressed at 242 and 244 West Forty-first Street, New York city. They will have an exhibit at the street-railway convention at Atlantic City next week.

ILLUSTRATED ELECTRICAL PATENT RECORD.

Issued (United States Patent Office) October 1, 1907.

867,256. Subaqueous Light System. Léon Dion, Wilkesbarre, Pa., assignor to the Dion Submarine Light Company, Wilkesbarre, Pa. Application filed November 6, 1906. Renewed July 10, 1907.

As a means for illuminating a marine course, electric cables are laid along the course at the bottom of the body of water and a series of permanently submerged electric lamps buoyantly supported above the cables. The lights under the incoming course are of a different color from those under the outgoing course.

867,257. Fuse-box Support. James S. Doyle, New York, N. Y. Application filed January 24, 1907.

A truck frame beam has brackets supporting a spring strip at its ends. A bar supported upon this spring carries a fuse box so as to permit it to have fairly free movements.

867,312. Electric Wire Connector. John A. Shutz, Richmond, Ind., assignor of one-third to Madison L. Kirkman and one-third to William H. Woolley, Richmond, Ind. Application filed December 3, 1906.

This device connects the cables together in tandem. Each cable is soldered into a terminal lug provided with an interlocking wedge and a longitudinally coiled spring extending out from the wedge portion. These springs are adapted to contact with a shoulder on the opposing lug so as to separate the cables. A band slides over the united lugs and holds the interlocking wedge together against the action of the springs.

867,319. Electrode. John W. Stubbs, Middlewich, England, assignor to the General Electrolytic Parent Company, Limited, of Great Britain. Application filed April 9, 1907.

This electrode consists of a mass at end of a conductor composed of a mixture of powdered carbon, resin and tetrachloride of carbon.

867,320. Electrolytic Process and Product. Clinton P. Townsend, Washington, D. C., assignor to Elmer A. Sperry, Brooklyn, N. Y. Application filed April 24, 1905.

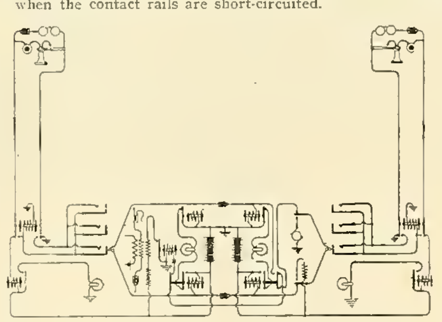
This is a method for producing lead oxide and consists in passing a current from an anode of lead through an acetate solution, producing lead acetate and a plumbite, which are subsequently combined to form lead oxide.

867,329. Block-signal Apparatus. Frank C. Williams, Philadelphia, Pa. Application filed July 17, 1905.

Each signal point is provided with an electromagnet whose circuit is closed by a passing train, thus setting the signal to danger in the block ahead and releasing the one at the entrance of the block just traversed. Another electromagnet has its circuit closed only when a train passes a danger signal, and this magnet immediately operates a motor on the locomotive or car which brings the train to a full stop.

867,331. Automatic Safety Controlling Means for Trains. David S. Affleck, Chicago, Ill. Application filed August 16, 1906.

The track is subdivided into electrically insulated blocks, which are also provided with signal and safety contact rails. When a block is occupied the contact rails of the adjacent blocks are short-circuited. The locomotives are equipped with signaling devices, actuated by contact with the signal rails, and with a local circuit normally energized which shuts off the power and puts on the brakes when the contact rails are short-circuited.



NO. 867,349.—TESTING SYSTEM FOR TELEPHONE LINES.

867,335. Cementitious Pole for Supporting Overhead Wires and the Like. William M. Bailey, Richmond, Ind., assignor to the American Concrete Pole Company, Richmond, Ind. Application filed December 17, 1906.

A reinforced cement pole consists of an elongated cement body enclosing a number of longitudinal rods remote from each other and disposed about the longitudinal axis of the body, and a wire disposed in a continuous spiral about and closely encircling the rods substantially from end to end of the body.

867,349. Testing System for Telephone Lines. William W. Dean, Chicago, Ill., assignor to the Kellogg Switchboard and Supply Company, Chicago, Ill. Application filed July 27, 1903.

A high-resistance test relay is adapted to be connected with any one of a set of cord circuits by inserting the answering plug in the jack of the calling line, and to be disconnected by inserting the calling plug in the jack of the called line. (See cut.)

867,354. Automatic Weighing Machine. Clinton A. Douglass and Fred L. Jones, Denver, Colo. Application filed April 15, 1907.

A scale has situated above it a hopper with a discharge outlet provided with a cut-off. A chute below the outlet has a gate at its lower end, which is operated simultaneously with the cut-off. An electrically operated latch arm holds these open until the circuit is closed by the tipping of the scale beam and then the latch is released and a spring closes the gate and cut-off.

867,355. Safety Device for Heaters. Ira Filson, Springfield, Ohio. Application filed May 28, 1906.

An electromagnet has its circuit closed by a thermostat when the temperature of the heater reaches a desired maximum. The stop clock in the gas supply has an extended arm adapted to be struck by a weighted lever pivoted near by. The armature of the magnet prevents the fall of this lever until the circuit is closed, whereupon the gas is shut off.

867,358. Ice and Sleet-cutting Contact Shoes. Rutherford Fullerton, Columbus, Ohio. Application filed March 13, 1907.

This device has ice-cutting members which lie across the rail at an angle thereto and which engage with the rail at its edges. Springs draw these members into engagement with the edges of the rail.

867,364. Automatic Railroad Signal. William H. Harris, Stark, Mont. Application filed January 9, 1907.

The signal is operated by the passage of trains through the medium of two circuits containing electromagnets. These magnets actuate pawls that engage ratchet wheels which move the signal disks.

867,391. Storage-battery Plate or Grid. Joseph Marx, Buffalo, N. Y. Application filed January 30, 1907.

The grid is made with a series of shelves and vertical ribs. Upon the shelves are placed units of active material in such a way as to leave space between the units and vertical ribs to allow for expansion.

867,406. Rail Bond. Lewis T. Pates, Upper Alton, Ill. Application filed December 26, 1906.

Rail ends have pairs of oppositely inclined apertures and a rail bond has pairs of prongs forced into the apertures and bent in opposite directions thereby.

867,415. Rail Bond. Frank W. Richey, Chicago, Ill., assignor to the General Electric Company, Schenectady, N. Y. Application filed December 5, 1902.

The conductor has loops at its ends fitting over terminal heads that are flanged to receive them. A plate is welded over the loop and to the projecting end and flange of each terminal.

867,416. Electrical Conductor. Frank W. Richey, Schenectady, N. Y., assignor to the General Electric Company, Schenectady, N. Y. Application filed February 10, 1904.

A terminal of an electrical conductor has an expanding device comprising a pin having end portions connected by an intermediate reduced portion and a split bushing surrounding the reduced portion.

867,436. Lead Pigment and Similar Compounds. Elmer A. Sperry, Brooklyn, N. Y. Application filed August 30, 1906.

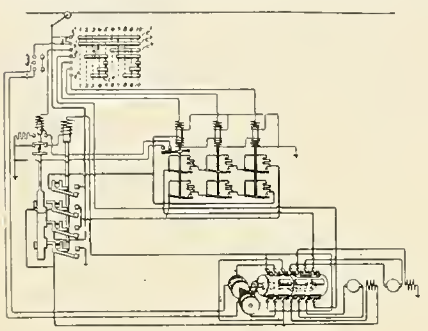
This is a process for preparing lead pigments and consists in using lead as anode in an electrolysis that produces metallic lead at the cathode, which is then used as anode in another electrolyte depositing a lead compound. This compound is finally subjected to a reagent at a high temperature so as to form the product desired.

867,440. Three-wire Molding Receptacle. James S. Stewart, New York, N. Y., assignor to Annie Stewart, New York, N. Y. Application filed June 29, 1906.

An insulating base has a sleeve and central stud terminal suitable for receiving a lamp or attachment plug. Two terminal clips pass through the base on one side so as to connect to two of the three circuit wires in the molding and still allow the receptacle to be symmetrically placed over the molding.

867,448. Signaling System for Railways. Louis H. Thullen, Edgewood, Pa., assignor to the Union Switch and Signal Company, Swissvale, Pa. Application filed June 23, 1906.

This system is adapted for electric railways which use the rails as one side of an alternating current for propelling the cars. The track is divided into block signaling sections, each of which contains a relay and a source of alternating current of different frequency from that of the power current. The relay has two coils, one having inductance in series with it and the other capacity so as to produce a movement of the relay armature in one direction by current of one frequency and in the reverse direction by current of a different frequency.



NO. 867,476.—MOTOR CONTROL.

867,452. Electrolytic Bleaching of Cotton. August A. Vogelsang, Dresden, Germany, assignor to the British Hosiery and Electrolytic Bleaching Company, Limited, London, England. Original application filed September 21, 1901. Divided and this application filed July 28, 1902.

This process consists in placing the whole of the material in a vat at one time, treating it with caustic solution, collecting from an electrolyzer bleaching liquor in a separate vessel in sufficient quantity to cover the whole bulk of the material and in sufficient strength to bleach it without further electrolytic treatment, admitting the collected liquor into the vat after the withdrawal of the caustic liquor and allowing the bleaching liquor to act *in situ* on the material continuously until this liquor is exhausted.

867,456. Electrode for Arc Lamps and Method of Making the Same. William S. Weedon, Schenectady, N. Y., assignor to the General Electric Company, Schenectady, N. Y. Application filed December 10, 1903.

This method consists in forming a mixture containing substantially seven parts of titanium oxide and one part of carbon, forming electrodes out of the mixture, and, prior to the completion of the electrodes, converting the mixture into titanium sub-oxide.

867,475. Motor-starting Rheostat. Eugene R. Carichoff, East Orange, N. J., assignor to the General Electric Company, Schenectady, N. Y. Application filed May 25, 1905.

The rheostat is made up of superposed spiral grids connected in series. Each unit is provided with a short-circuiting switch, which is normally open but can be closed by means of an electromagnet whose armature actuates the switches successively.

867,476. System of Control. Eugene R. Carichoff, East Orange, N. J., assignor to the General Electric Company, Schenectady, N. Y. Application filed January 19, 1906.

A speed controller for a motor or motors has a series of individual switches arranged to cut resistance out of the motor circuit step by step. Actuating coils for the switches are operated successively as the counter electromotive force of the motor rises. (See cut.)

867,481. Prepayment Meter. Frank P. Cox, Lynn, Mass., assignor to the General Electric Company, Schenectady, N. Y. Application filed July 14, 1897.

A motor meter is provided with a switch connecting in the load. This is closed by the insertion of a coin and held closed by a latch which is electromagnetically released when a predetermined amount of electrical energy has been consumed.

867,482. Locking Mechanism for Controller Handles. Archibald S. Cubitt, Schenectady, N. Y., assignor to the General Electric Company, Schenectady, N. Y. Application filed January 2, 1906.

The controller handle carries a dog engaging stops on the top of the controller box that are so shaped as to permit free movement of the handle in one direction and only intermittent movement in the other. A button release in the handle can release the dog only when the handle has fully reached certain definite positions.

867,483. Self-adjusting Brake for Hoists. Philip J. Darlington, Glenridge, N. J., assignor to the Sprague Electric Company. Application filed May 11, 1904.

A motor-driven hoist has two adjustably pivoted braking arms, one having a link pivoted to it, the other having a bell crank lever pivoted to it and to the link. A connection from the lever is arranged to draw the pivots of the braking arms closer together when these have an increased [illegible] range of pivotal movement due to wear.

867,484. Spur-geared Hoist. Philip J. Darlington, Glenridge, N. J., assignor to the Sprague Electric Company. Application filed May 11, 1904.

A motor-operated hoist has a spring-applied brake arranged to normally prevent a lowering movement of the hoist and to exert a reduced restraint upon the hoisting movement. Means are provided on the controller for causing the brake to be released when the controller is moved to lowering position.

867,486. Electric Locomotive. Samuel T. Dodd, Schenectady, N. Y., assignor to the General Electric Company, Schenectady, N. Y. Application filed February 18, 1907.

An electric locomotive with driving wheels and idlers has an equalizing link suspended between a driving wheel and idler and supporting a portion of the weight of the locomotive frame. Pneumatically actuated means are provided for shifting the effective load-point on this link, these means being operated by the motor-controlling switches.

867,494. Fire-alarm Telegraph System. Manious Garl, Akron, Ohio. Application filed October 20, 1905.

This system has an alternating-current generator as source of current, a normally closed line circuit, a normally open ground circuit and local alarm circuit. A relay in the line circuit normally keeps open the local circuit which is closed by breaking the line circuit. The ground and line circuits are opened and closed alternately.

867,496. Fuse. Henry Geisenhöner, Schenectady, N. Y., assignor to the General Electric Company, Schenectady, N. Y. Application filed June 29, 1903.

This fuse is a combination of a body containing two chambers, of a fuse in one of them, a spring in the other connected with the fuse, and a lock for preventing the operation of the spring when only a temporary over-load occurs.

867,509. Electric Switch. Edwin Johnson, Schenectady, N. Y., assignor to the General Electric Company, Schenectady, N. Y. Application filed August 24, 1905.

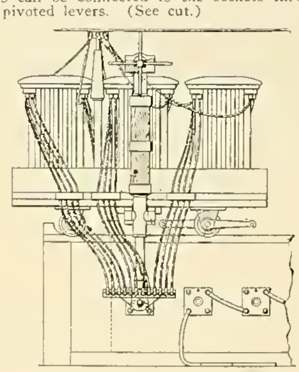
This switch has two sets of contacts, a contact disk, a spring-actuated stem connected therewith, a toggle pivoted to the stem, a plunger and a rocker actuated by the plunger and operating to set and trip the toggle.

867,517. Method of Preliminary Treatment for Accumulator Plates. Henry Leitner, Maybury, Woking, England. Application filed August 25, 1904.

The process consists in immersing the plate in a weak electrolyte comprising not more than 3½ per cent. of sulphuric acid, to which is added not more than 3½ parts per 1,000 of hydrochloric acid, subjecting the plate as an anode to an electric current of high density and maintaining the electrolyte at a temperature of not more than 85 deg. F., artificial cooling thereof being resorted to.

867,519. Electric Furnace. John T. Marshall, Metuchen, N. J., assignor to the General Electric Company, Schenectady, N. Y. Application filed January 26, 1907.

This furnace has a box-like structure with carbon tubes extending across the box that are held in metallic sockets in the walls thereof. A carriage, movable over the top surface of the furnace, carries transformers whose secondaries can be connected to the sockets through a system of pivoted levers. (See cut.)



NO. 867,519.—ELECTRIC FURNACE.

867,522. Means for Automatically Controlling the Speed of Railway Trains. Daniel J. McCarthy, Wilkinsburg, Pa., assignor to the Union Switch and Signal Company, Swissvale, Pa. Application filed April 25, 1907.

The brake-controlling valve on the train has placed near it a magnet responsive to currents of a certain high frequency. Along the track are placed means for exciting the coils of the magnet with frequencies proportional to the speed. When this reaches a predetermined value the brakes are applied.

867,528. Point Shifter for Tramways and the Like. George D. A. Parr, Leeds, England. Application filed August 18, 1905.

The point in a track switch is operated by an electric motor through the medium of weights alternately raised and lowered by the motor. A latch normally restraining movement of the weights is electrically operated from the car.

867,542. Attachment for Electrical Furnaces. Samuel M. Weaver and William Ambler, Cleveland, Ohio. Application filed September 29, 1905.

The casing carries thermo-couples and a pan mounted for supporting the work in a fixed relationship to the couples.

867,543. Filling for Thermal Cut-outs. Frederick H. Weston, Schenectady, N. Y., assignor to the General Electric Company, Schenectady, N. Y. Application filed April 22, 1905.

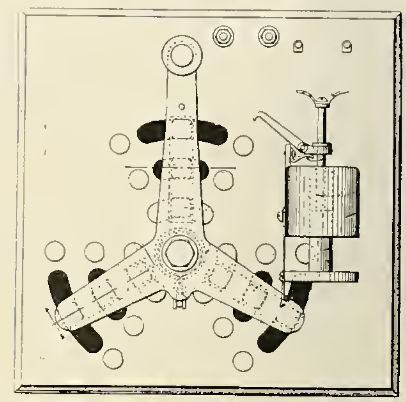
An absorptive filling for enclosed fuses consists of dry granules of slaked lime and calcium sulphate.

867,544. Electric Arc Lamp. Edward F. Winfield, Los Angeles, Cal. Application filed March 14, 1905.

An electric arc lamp has two vertical supports, insulated brackets secured thereto, a solenoid between the front edges of the upper brackets, and a carbon holder in the forward edge of the lower bracket. Means are connected with the solenoid for holding and feeding a carbon. A cross bracket is mounted on the supports intermediate their ends, and a reflector on the bracket with its forward end extending beyond the front edges of the brackets.

867,547. Starting Device for Alternating-current Motors. William C. Yates, Schenectady, N. Y., assignor to the General Electric Company, Schenectady, N. Y. Application filed October 18, 1905.

This is a starter for single-phase induction motors employing a phase-splitting device for starting. It has a no-voltage release for holding it in running position and spring for returning it to "off" positon. A stop prevents moving the handle direct from "off" to running positions without first pausing at starting point. (See cut.)



NO. 867,547.—INDUCTION-MOTOR STARTER.

867,555. Chandelier. Frederick A. Burton, Wahpeton, N. D., assignor of one-third to Christina E. Kouba and one-third to Peter H. Stenerson, Wahpeton, N. D. Application filed June 21, 1906.

This chandelier is made in two parts, the lower one being capable of vertical adjustment and being held by frictional rollers to the upper part. A coiled spring carries the electric wires.

867,561. Measuring Instrument. Albert G. Davis and Caryl D. Haskins, Schenectady, N. Y., assignors to the General Electric Company, Schenectady, N. Y. Application filed March 15, 1904.

A motor-meter has a flexible connection betwen its rotor and its shaft for supporting the weight of the shaft and parts carried by it. A ring-bearing prevents lateral displacement of the shaft.

867,563. Automatic Block-signaling System. Daniel J. McCarthy, Wilkinsburg, Pa., assignor to the Union Switch and Signal Company, Swissvale, Pa. Application filed August 16, 1907.

An alternating-current block-signaling system has home and distant-signal blades, a reversing relay through which the blades are controlled by the track circuits, a line circuit, an alternating-current slot magnet, and a slow-motion circuit-controlling device for controlling the circuit of this magnet.

REISSUE.

12,700. Electric-traction Apparatus. Alfred Zehden, Frankfort-on-the-Main, Germany, assignor to J. M. Woodward, Cleveland, Ohio. Application filed August 21, 1907. Original No. 782,312, dated February 14, 1905.

A rail-like armature and an electromagnet are mounted on a carriage, the armature being located relatively to the magnet, so that by the co-operation of these parts the carriage is not only moved forward but its weight is counterbalanced in whole or in part.

PATENTS THAT HAVE EXPIRED.

Following is a list of electrical patents (issued by the United States Patent Office) that expired October 7, 1907:

437,682. Electric Safe Lock. G. L. Damon, Boston, Mass.
437,704. Regulator for Electric Generators and Motors. R. Lundell, New York, N. Y.
437,720. Conduit Electric Railway. E. M. Reed, Wichita, Kan.
437,754. Electric Meter. J. Einstein and S. Kornprobst, Munich, Germany.
437,763. Electric Meter. A. Reckenzahn, Clapham, England.
437,767. Arc Lamp. R. H. Brach, St. Paul, Minn.
437,771. Electric Steam Generator and Water Heater. H. R. Butterfield, Waterville, Me.
437,789. Electric Ceiling Block. A. E. Nichols, Leeds, England.
437,832. Electric Motor. J. Emmner, Jr., Washington, D. C.
437,835. Electric Motor. G. Little and G. J. Little, Passaic, N. J.
437,848. Secondary Battery. H. Lampert, Jr., Chicago, Ill.
437,859. Electrical Transmitter and Indicator. D. Kelley and M. C. Parkhurst, Somerville, Mass.
437,868. Galvanometer. A. M. Ritchie, Brookline, Mass.
437,901. Electric Arc Lamp. C. W. Hazeltine, St. Louis, Mo.
437,926. Galvanometer. T. Harris, Detroit, Mich.
437,930. Receiving Instrument for Telegraphy. W. M. Miner, Plainfield, N. J.
437,946. Brush Holder for Electric Motors. E. A. Sweet, Milford, Mass.
437,953. Conduit and Electric Conducting Rail Therefor. J. H. Wehrle, Newark, N. J.
437,986. Telephone System. A. Graham, London, England.
438,036. Pole for Electric Wires, etc. E. Verstraete, St. Louis, Mo.
438,037. Rheostat. J. C. Vetter, New York, N. Y.

WESTERN ELECTRICIAN

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Moderate-sized Searchlights for the Mercantile Marine.

By Dr. Alfred Gradenwitz.

Searchlights, as well known, are projectors giving intensive illumination, to allow any objects to be searched and watched from a distance. To this effect the light of an electric arc lamp is concentrated by a parabolic mirror, which reflects it in the shape of a beam of very small angle. Both the mirror and lamp are located in a casing, which is free to move in all directions.

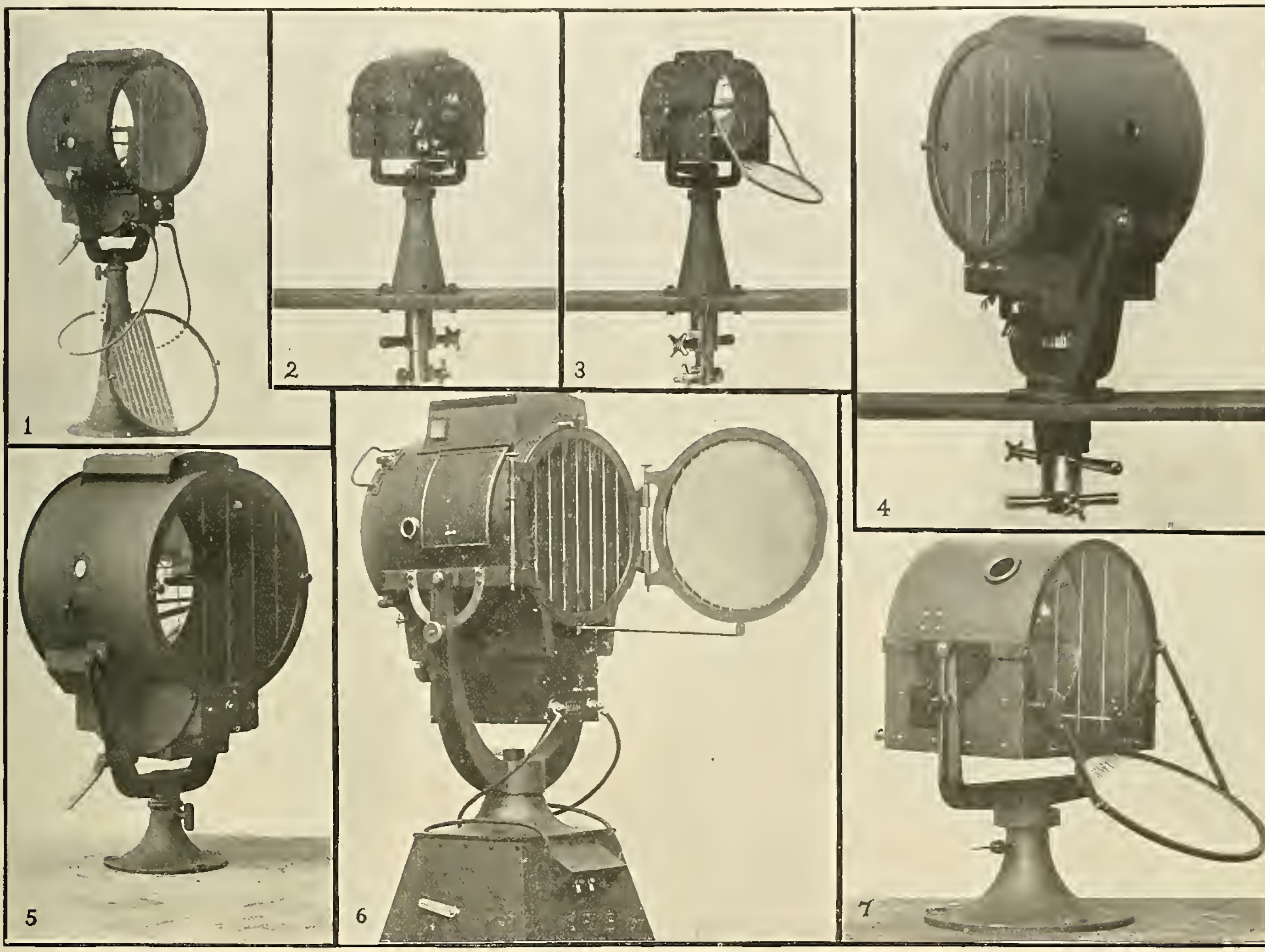


Fig. 1. Projector on Column with Metal Parabolic Mirror 350 Millimeters in Diameter.
Fig. 2. Projector Adapted to be Secured to Pilot-house Railing. Glass Mirror 210 Millimeters in Diameter.
Fig. 3. Pilot-house Projector with Ripple-glass Screen.
Fig. 4. Pilot-house Projector with Metal Parabolic Mirror of 450 Millimeters.
Fig. 5. Projector of 450 Millimeters Diameter on Low Stand.
Fig. 6. Suez Canal Type of Projector with Parabolic Glass Mirror of 450 Millimeters and Dispersing Screen.
Fig. 7. Low-stand Projector with Non-polished Parabolic Glass Mirror.

MODERN SEARCHLIGHTS OF MODERATE SIZE FOR MERCHANTMEN AND YACHTS.

Only continuous current can be used for the operation of searchlights. In alternating-current lamps there are formed at the ends of the two carbons opposite each other two equivalent sources of light, each of which radiates about half of the total energy converted into light to opposed directions. Now, as reflectors can be used only for one side, utilizing the light of one carbon, only half of the available energy can be resorted to for producing the desired effect. Moreover, the light from the other carbon would interfere with observation by dazzling the eye through the brightly illuminated objects surrounding the projector and by interposing between the observer and object a veil consisting of numberless small particles suspended in the atmosphere.

In continuous-current lamps, on the other hand, practically the whole of the light is generated in the crater of the positive carbon, from which the light rays are mainly projected to one side in a conical beam. Owing to this one-sided radiation the lamp is especially adapted for use in connection with a concave mirror, concentrating and projecting any light supplied to it in the shape of a projector beam.

The searchlights described herewith are mainly intended for use on board merchant ships and dredges, or on motor boats and steam yachts. A special searchlight on board merchant ships serves to light the edge and banks of canals on traversing the latter, while projecting no light immediately in front of the ship, so as not to dazzle any approaching vessels. These searchlights, the prototype of which is used on the Suez Canal, have been termed Suez Canal projectors.

The luminous intensity of a searchlight depends in the first place on the size of the mirror and next on the current intensity feeding the arc lamp. Projectors for merchantmen and dredges are usually designed for currents of from 6 to 50 amperes, while the smaller type of motor-boat searchlight is designed only for six amperes. The potential difference between the carbons of the arc obviously depends on the current intensity, and in the case of six amperes is about 43 volts, while increasing with increasing current intensities, though at a far slower rate than the latter, till a figure of about 47 volts is reached at 50 amperes.

The mirrors in the case of merchant-ship searchlights (Figs. 1, 4 and 5) are parabolic metal mirrors, of a diameter varying between 250 and 450 millimeters. The smallest searchlights for motor boats are provided with non-polished parabolic glass mirrors 210 millimeters in diameter. Figs. 2, 3 and 7 show searchlights designed for motor boats and steam yachts. The Suez Canal searchlight (Fig. 6) has a polished parabolic glass mirror 400 to 450 millimeters in diameter. Such mirrors combine the best obtainable optical qualities with a satisfactory and practically constant efficiency.

Each searchlight can be fitted with a device for allowing the beam to spread and to increase the lighted field. This is termed a disperser, and is a system of vertical plane-convex cylinder lenses fitted whenever desired before the front aperture of the searchlight.

The searchlights represented in Figs. 1, 2, 3, 4, 5 and 7 can be provided with rippled glass dispersers for an angle of about 12 degreees, while the Suez Canal projector (Fig. 6) is fitted with polished glass dispersers for angles of 6, 12, 15, 20, 30 or 45 degreees. It may also be fitted with polished dispersers for an angle of 15 degrees with a dark central field of five degrees, which design is especially adapted to the original purpose of this searchlight, namely, to light the banks of canals on the passage of the vessel. Merchant-ship projectors (Figs. 1, 4 and 5) may equally well be equipped with this special type of disperser for the passage of canals.

Each searchlight comprises a ventilated sheet-iron housing with a round locking glass, divided into strips, dark inspection glass for inspecting the arc and a shunt arc lamp with horizontal carbons, which is controlled either automatically or by hand. A device for adjusting the crater of the positive carbon to the optical axis is usually provided.

The housing rests in a trunnion, and can be rotated through 360 degrees round the vertical axis and about 45 degrees (in the case of the searchlights of Figs. 2, 3 and 7 through 25 degrees) by hand in a vertical direction, being readily fixed in any position. The projectors are provided with three different types of support, viz., flat cast-iron bases (Figs. 5 and 7), high cast-iron columns (Fig. 1) and cast-iron column or base for fitting on the pilot-house railing (Figs. 2, 3 and 4). In the last-named case the drive for the vertical and horizontal rotation is controlled from the interior of the pilot house.

The searchlight of the Suez Canal type (Fig. 6) is usually installed on sheet-metal pedestals, the size of which is adapted to the conditions of the case, and in this design can be also fitted on the pilot house.

A Novel Self-contained Electric Hoist.

A new and rather interesting electric hoist has been invented recently by James L. Pilling of Chicago, who has secured a United States patent on the device. The inventor aimed to design a power hoist of the block and tackle order that

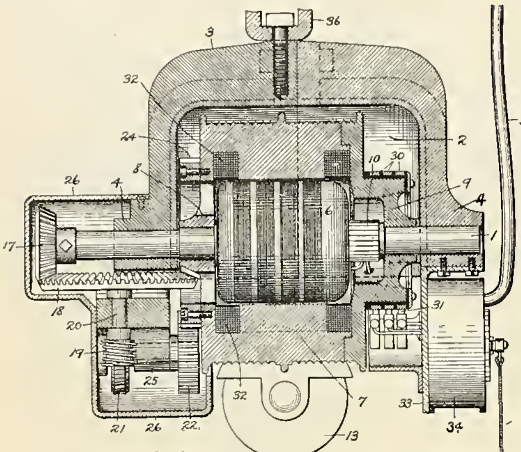


Fig. 1. Vertical Longitudinal Section.

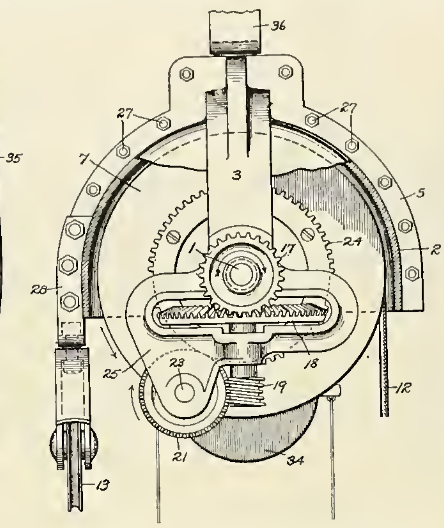


Fig. 2. Rear Elevation with Gear Casing Removed.

A NOVEL SELF-CONTAINED ELECTRIC HOIST.

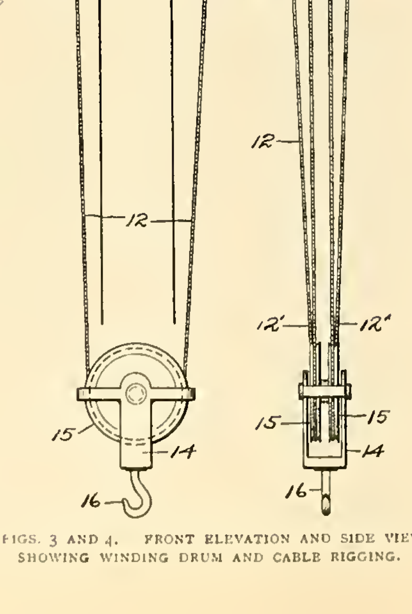
would be compact, simple and inexpensive in construction and yet capable of raising heavier loads in proportion to its own weight than power hoists heretofore constructed. The invention embodies a number of novel features.

The preferred form of this hoist is shown by the accompanying illustrations, of which Fig. 1 is a vertical longitudinal section and Fig. 2 is a rear elevation wherein the gear case is entirely, and the main casing partly, removed. Fig. 3 is an elevation of the front end of the hoist, while Fig. 4 is a side view, omitting the casing so as to show the winding drum. Figs. 3 and 4 show the full cable rigging for the hoist.

The framing of the hoist consists of an inverted U-shaped yoke (3) and a bell-shaped main casing or frame (2), which are preferably made integral with each other, but are divided transversely into two parts bolted together at the flanges (5) to permit of ready access to the interior mechanism. The yoke (3) terminates in the two bearings (4) for the main shaft (1).

The armature (6) of the motor is keyed on this shaft, which also supports the field (7) in such a way that it can revolve about the shaft, the two hubs (8) and (9) being provided for this purpose. Both armature and field revolve when the motor current is applied, since they are geared together by a system of gearing giving them opposite directions of rotation. The periphery or yoke of the field (7) is made cylindrical to form the drum upon which the lifting cables are wound and its outer surface is spirally grooved for this purpose. In order to preserve the balance of the hoist when loaded, both ends of the cable (12) are attached to the drum (at opposite ends thereof), thus forming one or more loops or bights for carrying a sheave-block. As shown, two loops or bights (12') are formed by carrying the cable up and around a sheave (13), suspended from the frame (2) of the hoist. A sheave block (14) suspended from the loops (12') carries two sheaves (15) and a lifting hook (16). The top sheave-block (13) is swiveled on a wrought metal clip (28), which is bolted to the flanges (5) at one side of the bell-frame. This arrangement of the hoisting cable is adapted to balance the frame of the hoist when loads are being lifted. The tendency of the load is to cant the hoist upwardly at the side to which the sheave (13) is attached. The downward pull of the cable upon this sheave counterbalances the tendency referred to, and the hoist frame will hang substantially the same when loaded as when unloaded.

The armature and the field are geared together in order to provide for holding suspended loads, and also in order to utilize the rapid rotation of the inner part or armature of the motor. This gearing is preferably a locking gear that will permit the rotation of the motor in either direction, but will not permit rotation of the cable drum by the suspended load even though the motor be switched off. The gearing as shown comprises a bevel pinion (17) on the shaft (1), a bevel gear wheel (18) and a worm (19) on a shaft (20), a worm wheel (21) and a spur pinion (22) on a shaft (23), and a gear (24), driven by the pinion (22) and secured to the field (7). The bearings for shafts (20) and (23) are provided with a casting (25) which may be either integral with, or secured to, the frame (2). The worm gear (19—21) forms a noiseless and absolutely reliable lock against backward rotation of the drum by a suspended load, and holds the load at any height while the motor is stopped. This gearing is so arranged as to cause the armature and field of the motor to turn in opposite directions, whereby the full power of the motor is obtained. When lifting a load the parts rotate in the direction of the arrows shown in Fig. 2. The object of driving from pinion (17) to a larger wheel (18) is to avoid excessive heating of the worm gearing by reducing the speed thereof. The gearing is enclosed by a casing (26), the lower portion of which forms a chamber for oil to lubricate the gears 19, 21, 22 and 24.



FIGS. 3 AND 4. FRONT ELEVATION AND SIDE VIEW, SHOWING WINDING DRUM AND CABLE RIGGING.

As the field is rotative, it is provided with collector rings (30) and brushes (31), through which the current is taken into the field windings (32). One field hub (9) carries the armature brush holders (not shown), and two of the rings (30) are in connection with them. The brushes (31) are held by a bracket (33) supporting also the motor controller (34). The leads from these brushes (31) pass into the controller, and a cable (35) leads from the controller to the supply conductors.

The operation is as follows: The hoist is suspended by its hook (36) and the object to be lifted is attached to the sheave-block hook (16). When the motor is started its two parts turn in opposite directions, the armature at a comparatively high speed; the speed of the outer part being controlled by that of the inner part through the medium of the gearing. The outer part, that is, the drum, draws up the two ends of the cable (12), which draws up the sheave-block (14). The cable winds from the ends toward the center of the drum. Suppose now that the motor should be intentionally or accidentally stopped. The weight of the load tends to turn the worm wheel (21), but that member cannot turn while the worm is at rest; thus the load is held suspended without the use of brakes, ratchets or other troublesome devices. The load is lowered by running the motor in reverse direction. The worm gearing prevents racing of the motor at such times and enables the operator to lower away as slowly as desired.

The winding drum need not be of the same diameter from end to end. A portion thereof may be of smaller diameter to receive a cable for hoisting very heavy loads.

Grounded Neutral in High-tension Systems.

At the meeting of the American Institute of Electrical Engineers in New York on October 11th the recently elected president, Mr. H. G. Stott, presided, and gave a brief inaugural address, reported elsewhere in this issue. The subject of the evening was "The Grounded Neutral in High-tension Systems," and papers were presented by Paul M. Lincoln, engineer of power division of the Westinghouse Electric and Manufacturing Company, Pittsburg; F. G. Clark, superintendent of power station of the Pennsylvania Tunnel and Terminal Railroad Company, Long Island City, and George I. Rhodes, assistant engineer of the Interborough Rapid Transit Company of New York city. The papers and discussions covered advantages and disadvantages of the grounded connection under various conditions, more particularly the possibility of cutting out faulty feeders without interrupting the service. The function of series resistance in the ground connection also received attention.

Before opening the meeting for the discussion President Stott announced the presence of two distinguished German visitors, Messrs. Wallen and Schrottke of the Siemens-Schuckert Company in Berlin and also of the Verband Deutscher Elektrotechniker.

Written contributions to the discussion were received from F. G. Baum of San Francisco and O. S. Lyford, Jr., of New York, and were read.

The oral discussion was opened by P. Junkersfeld of the Commonwealth Edison Company, Chicago, and continued by Philip Torchio, New York Edison Company; N. J. Neall, Boston; J. B. Taylor, General Electric Company, Schenectady; C. Schwartz, New York Central Railroad Company, New York; C. W. Stone, General Electric Company, Schenectady, and Charles F. Scott, Westinghouse Electric and Manufacturing Company, Pittsburg. Messrs. Lincoln and Rhodes, authors of two of the papers, then spoke, and the discussion was closed by Dr. C. P. Steinmetz of Schenectady. Although no conclusion was reached, a great deal of valuable material was brought out, some of which is presented in this issue of the Western Electrician and some of which will appear in a future issue or future issues, if space permits.

Narcosis by Blue Rays of Light.

A dentist at Geneva, Dr. Radard, after having for several years made experiments with the narcotic effect of blue light, has submitted his results to the Swiss Society of Odontology. According to Consul William Bardel at Bamberg, Dr. Radard asserts that a complete narcosis can be obtained if the rays of a blue electric light are brought to bear on the human eye while all other rays of light, particularly of daylight, are kept off of it. The narcosis thus obtained is so complete that, during the same, little dental operations, such as pulling or filling teeth, etc., can be executed without causing the patient the least amount of pain. While the effect of the blue rays is a very strong one, that of violet-blue and green rays is less intensive, and yellow or red rays show no effect at all.

Inland Empire Electric-railway System.

As readers of the Western Electrician are aware, from previous articles, one of the most important systems of electric railways in this country is that of the Spokane and Inland Empire Railroad Company, with headquarters in Spokane, Wash. Planned, built and operated by men prominent in the successful upbuilding of that portion of Washington, Oregon, Idaho and Montana, known as the "Inland Empire," the affairs of this large electric-railway system are directed by Mr. Jay P. Graves, president; F. Lewis Clark, first vice-president; A. L. White, second vice-president; W. G. Davidson, secretary, and H. B. Ferris, treasurer.

The "Inland Empire" reaches from the Rockies on the east to the Cascades on the west, and from the Selkirks of British Columbia to the Blue Mountains of Oregon. This territory of 150,000 square miles, with the growing city of Spokane, now nearing 100,000 in population, as the metropolis, has great wealth in its mines, forests and agricultural districts. To aid in the development of these resources there are excellent natural waterpowers in the rivers of the Northwest to furnish power for manufacturing and for operating electric railways.

MARKETING WHEAT VIA THE SPOKANE AND INLAND ELECTRIC RAILWAY.

Foremost in the ranks of this development is the Spokane and Inland Empire Railroad, known as the Inland Empire System, whose lines assist as well as share in the general prosperity of the Spokane country. This company has acquired the Spokane and Inland Railway, a railroad of "steam practice" (that is, equivalent to the best steam railroads), but electrically operated, extending south from Spokane 76 miles to Colfax, Wash., and 92 miles southeast to Moscow, Idaho; the Cœur d'Alene and Spokane Railway, an electric road reaching eastward from Spokane to Liberty Lake, Wash., and Cœur d'Alene and Hayden Lake, Idaho, a distance of 40 miles; the Spokane Traction Company, an electric street railway, having 31.5 miles of lines in the city of Spokane; the Spokane Terminal Company, having passenger and freight terminals and rights-of-way in Spokane, and the Spokane Power Development Company, including two power sites on the Spokane River, one developed to generate 20,000 electrical horsepower, and a valuable franchise for the distribution of light and power in Spokane.

With the Spokane and Inland division now operating to Colfax and Palous, the several lines of the Inland Empire System aggregate over 200 miles. With extensions now contemplated and under way the total miles in the system will aggregate 225 by June 1, 1908. Material additions to the equipment of the Cœur d'Alene and Spokane and the Spokane local divisions have been found necessary this last year. Traffic agreements have been entered into with two of the principal transcontinental steam railroads, thus giving the system access to markets east and west.

For the 113 miles of railroad in the Spokane and Inland division, power is furnished from a frequency-changing station in Spokane. Current is transmitted from this station to the sub-stations along the lines to Colfax and Palous, a distance of 76 miles. A 275-cell storage-battery equipment for this division shows a saving in operation of approximately 50 per cent. in power bills.

The passenger equipment on the Spokane and Inland division consists of Brill 58-foot coaches finished in mahogany and with seating capacity of 64 each. The road is built of 70-pound steel, fir ties, and well ballasted for carrying the heavy freight and passenger trains of this division.

Twenty-five miles south of Spokane is the Mt. Hope passenger and sub-station. This, like the other passenger and freight depots of the division, is of modern construction, brick with concrete foundation, economical in maintenance and fire risk. In the sub-stations, which are located every 10 or 15 miles, the high-tension current is received and reduced from 45,000 to 6,600 volts and applied to the wire for operating trains.

An example of the rapid growth of Spokane's rural communities, since the inception of the Spokane and Inland division, is afforded by the village of Valleyford, located 10 miles south. Here a prosperous and beautiful suburb has sprung up in one year. At Spring Valley Junction, 40 miles from Spokane, the Colfax and Palous branches of the Spokane and Inland division meet. Headquarters of the division superintendent, chief dispatcher, etc., are located at this point.

The Spokane and Inland is being extended from Palous 16 miles to Moscow, Idaho. In Palous the road passes through the center of town on an elevation, avoiding all grade crossings. Joint freight yards are used at this point with the W., I. and M. Railway, which runs 65 miles east to Potlatch, Idaho, tapping the Potlatch lumber district.

Oakdale is 53 miles from Spokane on the Spokane and Inland division. It has a population of 1,500. Passenger and freight service was opened to the town on April 15, 1907. Garfield is 65 miles south of Spokane and is one of the foremost shipping points in the Palous country. Passenger and freight traffic was inaugurated to Garfield on June 1st.

The first train out of Colfax was operated on July 31st. The Spokane and Inland freight and passenger terminals and yards are located in the heart of Colfax. The site for the new depot occupies the block directly opposite the county courthouse. Car barns and machine shops of the division are located at Olive and Cincinnati streets. Four miles north of Colfax it was found cheaper to drive a tunnel 622 feet through a 200-foot hill rather than to follow a one-mile detour of the Palous River. A view of this tunnel is given in one of the accompanying pictures.

It is said that 10,000,000 bushels of wheat and 40,000 tons of oats and barley were produced this year in the territory directly tributary to the Spokane and Inland division. A chain of 30 grain warehouses is being operated along this division. Warehouses are 50 by 150 feet and have a capacity of 40,000 sacks of grain, or 50 carloads. One of the accompanying pictures shows a string of farm teams waiting in line to unload their grain in one of the warehouses of the electric road. A traffic agreement has been entered into between the Inland Empire System and the Great Northern Railway, giving markets in eastern states and on the Pacific Coast.

COLFAX TUNNEL ON THE INLAND EMPIRE SYSTEM.

Farmers along the lines of the Spokane and Inland division have shown their anxiety to utilize the new electric railway by delivering their grain before the warehouses were completed. This division has been double-tracked between Greenacres and Spokane Bridge. It is said to have one of the most substantially built roadbeds in the United States.

The Cœur d'Alene division, as stated, extends eastward to Liberty Lake, Cœur d'Alene and Hayden Lake, a distance of 40 miles. It serves the Spokane Valley, Spokane's beautiful lake region, and affords the most direct route to the famous Cœur d'Alene mining country. Passenger traffic on this division has made an average increase annually of 30 per cent. This season's increase over that of 1906 was 40 per cent., and the increase in freight traffic 75 to 80 per cent. United States railway mail service was inaugurated on the division August 12, 1907.

"SHOSHONE FLYER" LEAVING SPOKANE.

In the city of Cœur d'Alene the company has well-equipped electric docks, shown in one of the pictures, where the trains connect with the Red Collar Line for Harrison, Wardner and points on the St. Joe and St. Maries rivers. It is 68 miles from Cœur d'Alene to Head of Navigation on St. Joe River. The company has a handsome terminal building in Cœur d'Alene. This is the chief city in Northern Idaho, and it has increased in population from 1,000 to 8,000 since the opening of the electric line in December, 1903.

Parlor-car service on the Cœur d'Alene division was inaugurated on June 29, 1907, and has proven a remarkable success. The eight-mile branch from Cœur d'Alene to Hayden Lake was opened August 15, 1906, and has made greater earnings per car-mile than any other division of the system. Hayden Lake is one of Spokane's popular summer resorts, lying 40 miles east of the city. Passenger and freight service was opened to Liberty Lake, Spokane's most popular bathing resort, on June 15th. This lake lies among the hills 16 miles east of Spokane. It is on a two-mile branch running south from the main line at Liberty Junction.

"ELECTRIC DOCK" IN COEUR D'ALENE, IDAHO.

In the city of Spokane is the Electric Terminal Building, which is one of the best equipped in the United States. It is centrally located in the block next the new postoffice. Forty-two passenger trains leave and arrive at the terminal building daily. One of the pictures shows the Shoshone Flyer leaving Spokane. St. Louis type of cars are used on 31.5 miles of city lines now in operation.

The company has a very complete system for connecting the Inland Empire System with all the steam lines entering Spokane. The terminal yards are 300 by 2,000 feet, centrally located, with three of the large steam-road yards to the north and the Northern Pacific yards to the south, terminal tracks connecting all. The freight terminal building used by all the divisions is located at Ferry and Market streets and is 40 by 300 feet in size.

The Inland Empire System owns two valuable power sites on Spokane River. The power plant at Nine Mile Bridge will generate 20,000 horsepower and will be completed in December. It is expected that 5,000 horsepower will be required for use on the railway system, leaving the balance for market purposes. A franchise is owned by the company for distribution of current for light and power in Spokane.

The Aurora, Elgin and Chicago electric railway and the Metropolitan Elevated Railway of Chicago have put in service two new funeral cars, which will be run to the Oak Ridge, Mount Carmel, Waldheim, Concordia, Forest Home and Elm Lawn cemeteries.

Electrical Engineers of the Iron and Steel Industry Organize.

The first annual meeting of the Association of Iron and Steel Electrical Engineers was held in the rooms of the Engineers' Society of Western Pennsylvania in Pittsburg on October 11th and 12th. The association, which is the outgrowth of a meeting of electrical engineers in Pittsburg last spring, has for its object the application of electrical machinery and appliances to the iron and steel industry. Thirty-three men prominently connected with electrical generating plants and equipment departments of a number of large companies throughout the country constitute the charter membership.

The first session of the annual meeting was devoted largely to the election of officers with the following result: President, James Farrington, superintendent of electrical department of La Belle Iron Works, Steubenville, Ohio; first vice-president, J. C. Reed, electrical engineer of the Pennsylvania Steel Company, Steelton, Pa.; second vice-president, G. W. Sturgess, electrical superintendent of the Lackawanna Steel Company, Buffalo, N. Y.; secretary, G. H. Winslow, electrical engineer of the National Tube Company, Pittsburg; treasurer, E. W. Yearsley, electrical engineer of the Midvale Steel Company, Philadelphia.

Following the adoption of a constitution and by-laws at the morning session papers were read by E. W. Yearsley, George W. Richardson and D. B. Rushmore. In the afternoon the following-named gentlemen spoke: A. C. Eastwood, D. S. Kendall, Gano S. Dunn, R. P. Wright, C. T. Henderson, B. A Behrend, R P. Jackson and Paul M. Lincoln. Those present were taken to the works of the Westinghouse Company at East Pittsburg, where luncheon was served at noon.

An elaborate dinner was served at the Duquesne Club in the evening. At the remaining sessions addresses were given and papers read by M. Van Blarcom, C. E. Skinner and L. E. Bogen. The initial meeting was very successful, and it is planned to hold a number of meetings each year to take up electrical questions.

The following companies are represented among the charter members: Colorado Fuel and Iron Company, American Steel and Wire Company, Carnegie Steel Company, La Belle Iron Works, Phoenix Iron Works, Republic Iron and Steel Company, Youngstown Sheet and Tube Company, Illinois Steel Company, National Tube Company, Alan Wood Iron and Steel Company, Lorain Steel Company, Jones & Laughlin Steel Company, Seneca Iron and Steel Company, Pennsylvania Steel Company, American Bridge Company, Inland Steel Company, Lackawanna Steel Company, Bethlehem Steel Company, Lukens Iron and Steel Company, Maryland Steel Company and the Midvale Steel Company.

The Possibility of Regular Transatlantic Wireless Service.

Regular wireless transatlantic telegraph service is at hand, according to officials of the Marconi company, as reported in the daily newspapers on both sides of the water. At the present writing, however, the service does not appear to be available for public use, and the skeptics, like the gentleman from Missouri, still insist that they must be shown. The subject naturally attracts much attention in England, where stocks of submarine-telegraph companies are largely owned. Under date of October 4th the London correspondent of the Western Electrician has this to say about it:

"For the second time within a few years the Marconi Wireless Telegraph Company, by persistent newspaper notices that a transatlantic wireless-telegraph service is about to be inaugurated, has been responsible for a very considerable drop in the value of the shares of the cable companies. Curiously enough, this fall is accompanied by very emphatic denials that Mr. Marconi can accomplish all he claims to be able to do. As a matter of fact the new service was to have been started in the middle of September; we are now told that it will be in a few weeks' time.

"Apart from those quarters which are very distinctly pro-Marconi there is, in the first place, considerable skepticism as to the commercial achievement of transatlantic wireless telegraphy, and secondly, even assuming it is accomplished, the effect upon the traffic is likely to be infinitesimal. In all the notices and articles which the Marconi company manage to get into the papers, one never hears a word of the speed at which it claims to be able to work.

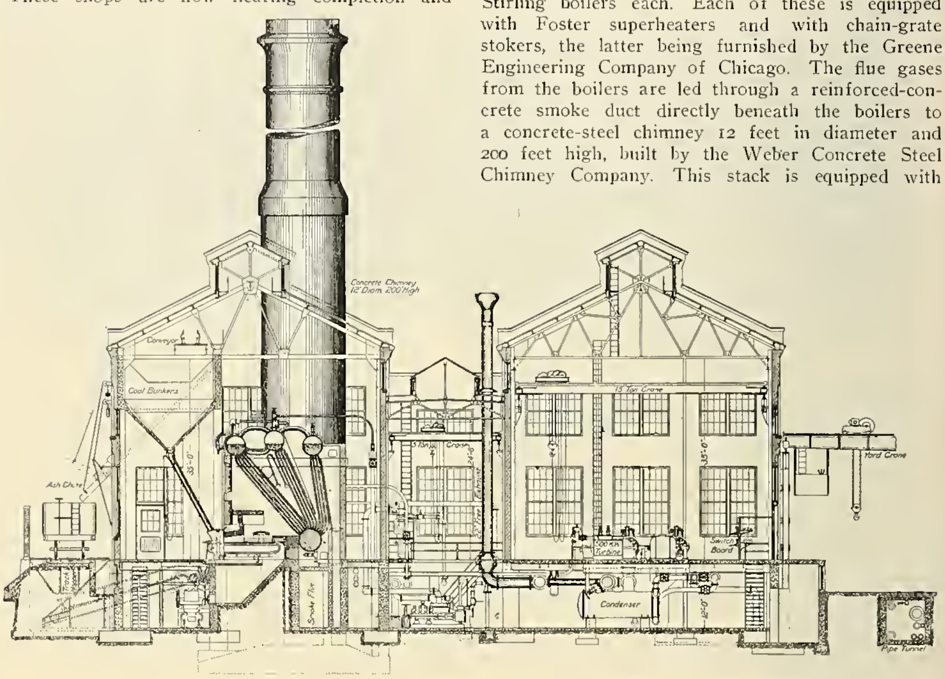
"Attention has been called to the very serious drop from 29 to 16 in the value of Anglo-American deferred shares. But a special interest attaches to this company, for in its last report a large sum was taken from revenue to meet depreciation in the company's invested cable renewal fund, and in the City this fact is recognized as being responsible for a great part of the decline.

"Already business men are being reminded of the possibility of delay through the wireless messages having to be retransmitted from Ireland by Postoffice wires, and the advantage of the present direct cable communication between our Stock Exchange and Wall Street is being pointed out and made much of. Comparatively few people seriously believe that any damage will be done to the existing cable traffic."

Power House for the "Big Four" Railroad Shops.

It has come to be practically standard practice in large industrial plants to generate all the power in one place and to transmit it electrically to the various shops and buildings. There is no uniformity, however, in the systems of electrical distribution used, as their selection is chiefly governed by the requirements of, and conditions about, the plant. An interesting example of a plant where special conditions were met is in the design of the power house for the new repair shops of the Cleveland, Cincinnati, Chicago and St. Louis Railway, located at Beech Grove, near Indianapolis, Ind. This railway is commonly referred to as the "Big Four" system.

These shops are now nearing completion and will be the largest of their kind in the country. There are 20 buildings, the power house being near the center of the group. Adjoining the shops a large freight yard and two roundhouses are being built. Each of the latter will have stalls for 25 locomotives.



CROSS-SECTION OF POWER HOUSE FOR "BIG FOUR" RAILROAD SHOPS NEAR INDIANAPOLIS.

The power house will furnish for the entire plant not only electric light and power, but also compressed air, service water, exhaust steam for heating, live steam for the steam hammers in the forge shop, and high-pressure water for hydraulic riveters and other tools.

The layout of the power house is clearly shown in the accompanying plan and sectional elevation, and the construction illustrated by the view taken about six weeks ago. The building, which is 114 feet by 128 feet, is of brick and steel construction to harmonize with the architecture of the other shop buildings. The foundations are of concrete, the column piers being reinforced. Sub-structure masonry is of shale brick of a dark color lined with sand lime brick. The turbine room is finished with a red pressed-brick wainscoting about six feet high. The roof is of slate laid on wood sheathing. By the liberal use of large windows in the side walls, and of monitors and skylights in the roof, an extremely well-lighted building is obtained. At present the building is closed on its east end by a wooden bulkhead to allow for future extension, which is contemplated at an early date. The power station will be ultimately twice its present size.

The available water supply was a vital factor considered in determining the character of the power-house equipment. The design finally adopted is an interesting illustration of how an apparently hopeless situation from the viewpoint of efficiency can sometimes be forced to give highly economical results by a careful study of requirements and by harmonizing these into a satisfactory working plan.

It was found that all water would have to be drawn from deep artesian wells and that a large supply of water was required for the locomotive roundhouses, which water would have to be chemically treated in a water-softening process to make it suitable for boiler feed. It was therefore decided to make the main generating units in the power house condensing by passing all the cold water direct from the wells through surface condensers, where its temperature would be raised from about 55° to about 90° F., then to the water-softening tanks, where the treating process is more effective with warm water, and finally to the roundhouses and boiler-feed pumps. By this plan abundant condensing water is secured without the need of a cooling tower. The condensing feature made the use of steam turbines advisable, and this resulted in the choice of three-phase alternating-current generators. The use of treated water permitted the selection of high-capacity water-tube boilers.

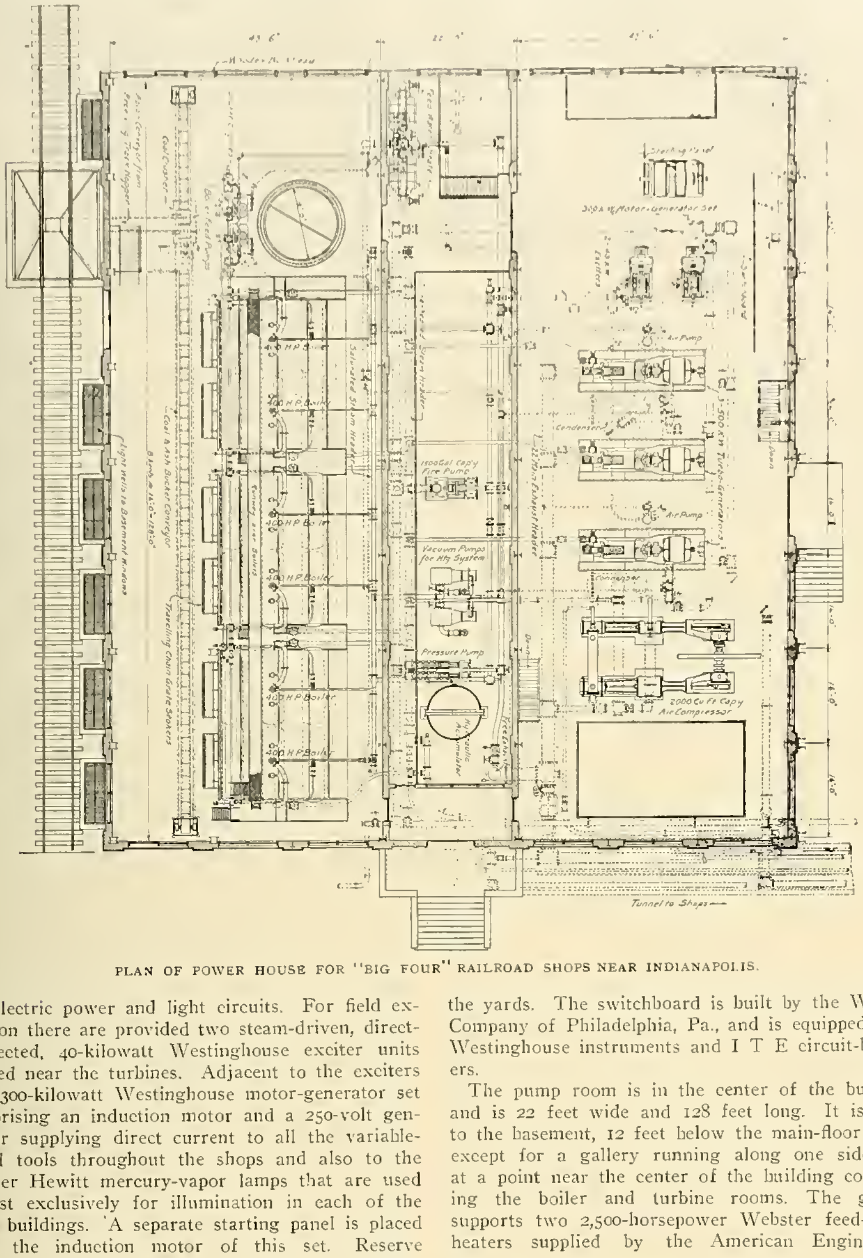
The boiler room is 46 feet wide by 128 feet long and contains three batteries of two 413-horsepower Stirling boilers each. Each of these is equipped with Foster superheaters and with chain-grate stokers, the latter being furnished by the Greene Engineering Company of Chicago. The flue gases from the boilers are led through a reinforced-concrete smoke duct directly beneath the boilers to a concrete-steel chimney 12 feet in diameter and 200 feet high, built by the Weber Concrete Steel Chimney Company. This stack is equipped with lightning conductors installed by Carl Bajohr, St. Louis, Mo.

Coal is first received in a track hopper adjacent to the building, from which it is carried to a coal crusher in the basement by means of a small apron conveyor. After passing through the crusher the coal falls directly onto an endless-bucket conveyor, which carries it to the end of the basement and then up and over the coal bunkers, into which the coal is automatically dumped. These bunkers are located over the boilers and are built of reinforced concrete. From the bunkers the coal is fed to the stoker hoppers by means of steel spouts. Ashes are fed, by means of spouts, from the doors in the ash bins of the boilers into the same conveyor used for coal. The ashes are lifted up and dumped into overhead ash pockets, located directly in front of the stack, from which they may be loaded through spouts into empty cars on the track adjoining the building. All the coal and ash-handling machinery was furnished by the Link Belt Company, Chicago.

The boiler-feed pumps are placed in front of the stack on the boiler-room floor to make them readily accessible to the boiler-room attendants without going any distance from their posts of duty in front of the boilers. The pumps are of the duplex upright Admiralty type, supplied by the Dean Bros. Steam Pump Works of Indianapolis. The stoker engines are located near the feed pumps and are belted to the stoker-operating shaft, which is hung from the floor beams in the basement. In the boiler room there are installed numerous structural steel runways, making all piping and apparatus perfectly accessible for repairs.

The turbine room is of the same dimensions as the boiler room and is separated from it by the pump room. At the west end of the turbine room is located the air compressor, furnished by the Laidlaw-Dunn-Gordon Company of Cincinnati, Ohio. The compressor is of the cross-compound two-stage type and has a capacity of 2,000 cubic feet per minute. Alongside of this compressor is a reserve space for the installation of a similar unit whenever the needs of the plant require it.

Next to the compressor are located the three main generating units, each consisting of a Westinghouse-Parsons steam turbine, direct connected to a 500-kilowatt, 60-cycle, three phase, 480-volt Westinghouse generator. These machines are to run at 3,000 revolutions per minute and will supply all the electric power and light circuits. For field excitation there are provided two steam-driven, direct-connected, 40-kilowatt Westinghouse exciter units located near the turbines. Adjacent to the exciters is a 300-kilowatt Westinghouse motor-generator set comprising an induction motor and a 250-volt generator supplying direct current to all the variable-speed tools throughout the shops and also to the Cooper Hewitt mercury-vapor lamps that are used almost exclusively for illumination in each of the shop buildings. A separate starting panel is placed near the induction motor of this set. Reserve space is provided nearby for the future installation of another motor-generator set and one more exciter.



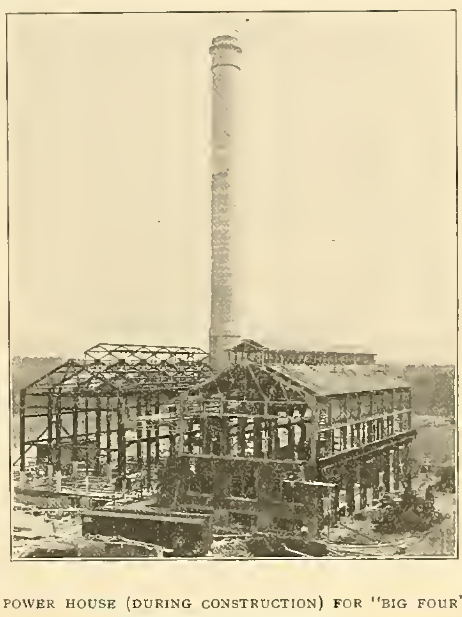
PLAN OF POWER HOUSE FOR "BIG FOUR" RAILROAD SHOPS NEAR INDIANAPOLIS.

The turbines and compressor are arranged to be run condensing almost all the time, but the exhaust can also be turned into the heating system for the buildings, if the exhaust from the steam hammers in the forge shop, which will be normally used for heating, should prove insufficient on exceptionally cold days. Two wet-vacuum system condensing outfits are being furnished by the Wheeler Condensing and Engineering Company. Each consists of an Admiralty type surface condenser and a steam-driven air pump. These condensers are so arranged that each takes care of two units. The exhaust steam from all the auxiliary engines and pumps is carried to the boiler feed-water heaters by a separate system of piping.

From each of the various generators lead-covered rubber-insulated cables are carried to the switchboard in tile ducts laid in the concrete floor. All these ducts lead to a slate-covered trench 14 inches wide by 8 inches deep, running back of the entire length of the switchboard. All the cables pass through this trench and turn up through switches in the slate cover to the circuit-breakers. All feeders go out at right angles to the switchboard in clay ducts in the floor to the north basement wall, where they drop six feet in split-tile ducts laid in chases in the wall, to the underground distributing system which runs out at right angles from the north wall to the numerous shop buildings. These underground conduits are separate from the pipe tunnels. No overhead transmission is used.

The switchboard consists of 15 panels, each two feet wide, which includes, besides the generator and exciter panels, alternating current and direct current feeder panels, three blank panels for future generators and exciter, and a panel for the series alternating current arc-lamp system for lighting all the yards. The switchboard is built by the Walker Company of Philadelphia, Pa., and is equipped with Westinghouse instruments and I T E circuit-breakers.

The pump room is in the center of the building and is 22 feet wide and 128 feet long. It is open to the basement, 12 feet below the main-floor level, except for a gallery running along one side and at a point near the center of the building connecting the boiler and turbine rooms. The gallery supports two 2,500-horsepower Webster feed-water heaters supplied by the American Engineering Specialty Company of Chicago. These heaters are equipped with purifying, filtering and oil separating accessories and are automatically operated.



POWER HOUSE (DURING CONSTRUCTION) FOR "BIG FOUR" SHOPS NEAR INDIANAPOLIS.

On the floor of the pump room is located nearly all the pumping apparatus that supplies the shop buildings. There is a 1,500-gallon Underwriters' fire pump, furnished by the George F. Blake Manufacturing Company of New York. Next to it are located two Marsh vacuum pumps for the heating system, which discharge the heating returns from the entire system into the feed-water heaters. There is also installed in this room a hydraulic pump and accumulator, designed to furnish water at a pressure of 1,500 pounds per square inch to the hydraulic riveters in the boiler shop. These pumps are all steam driven.

At the end of the pump room is the entrance to the pipe tunnel, which carries all compressed air, live-steam, exhaust-steam-heating and low and high-pressure water piping to the different buildings for shop and roundhouse service. The pumps drawing the supply water from the three artesian wells are five motor-driven deep-well pumps made by the George F. Blake Manufacturing Company. Each of these pumps has a capacity of 250,000 gallons per 24 hours. They are located in little rooms off from the pipe tunnel and deliver the water to the condensers in the turbine room, as already described.

The steam piping of the power house consists of two separate and distinct systems, superheated steam being supplied to the turbines and compressor only, and saturated steam being furnished to all auxiliaries. There is, however, a cross-connection between the two steam headers for use in case of emergency. In all steam leads from the boilers are placed automatic stop and check valves, and in all steam leads to units, except those to pumps, are placed receiver type steam separators. Wherever possible the use of long-radius pipe bends will be employed to give flexibility and to provide for expansion without the use of expansion joints. Wrought-steel flanges have been used throughout on the high-pressure steam piping.

Traveling cranes are provided for the turbine and pump rooms. The former is a 15-ton crane furnished by the Niles-Bement-Pond Company of Philadelphia, and the latter a five-ton crane supplied by the Niles Tool Works of Hamilton, Ohio.

The complete plans of this power station, including the building, as well as of the shops as a whole, were designed by The Arnold Company of Chicago, subject to the approval of the motive-power department of the Cleveland, Cincinnati, Chicago and St. Louis Railway Company, represented by Mr. William Garstang, superintendent of motive power, and of Mr. B. D. Lockwood, mechanical engineer.

A Curious Proposal in England.

"I have frequently called attention to the extremely unsatisfactory conditions, both industrial and financial, which exist in the electrical industry here," writes the London correspondent of the Western Electrician under date of October 4th, "and it is not surprising to hear that some effort is being made to put the industry upon a better footing. I hear that with the object of finding a remedy for the present state of things it is suggested that a union of electrical interests should be formed. I believe that the editors of the electrical journals have been approached to take the initiative and to act as an organizing committee until sufficient support has been obtained to enable a representative council to be constituted. This part of the programme of the organizers of the movement, however, has not met with complete success. The idea is that everyone interested in electrical undertakings, whether as shareholder, employer or employe, should join, the annual subscription to be 50 cents. This is as much as is known at the moment, beyond the fact that the union will start without political bias and with neutrality in relation to municipal ownership and other like matters. The modus operandi has yet to be explained."

Annual Report of Western Union.

In the annual report of the Western Union Telegraph Company, just issued, the total revenues show a fair increase, but expenses increased to a greater extent than the increase in income, with the net result that revenue income was $746,372 less than the previous year. The report states that contracts covering 19,213 miles of railroad were closed during the year, compared with 8,311 miles in the previous year. There was issued during the year $7,200,000 of the $25,000,000 four per cent. convertible redeemable bonds due November 1, 1936. The total revenue for the year ended June 30, 1907, was $32,856,406 and the total expenses $26,532,196.

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CORRESPONDENCE relating to electricity or any of its practical applications is cordially invited, and the co-operation of all electrical thinkers and workers earnestly desired. Clear, concise, well written articles are especially welcome; and communications, views, news items, local newspaper clippings, or any information likely to interest electricians, will be thankfully received and cheerfully acknowledged.

ADVERTISING.—THE WESTERN ELECTRICIAN—**the only general electrical paper published in the West**—thoroughly covers a territory *exclusively its own*. THIS IS A CLAIM WHICH CAN BE MADE BY NO OTHER ELECTRICAL JOURNAL IN THE UNITED STATES. Electrical merchants and manufacturers *desiring western trade* will appreciate the UNEQUALED VALUE of this journal as an advertising medium in its special field. Advertising rates are moderate, and will be furnished on application.

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CONTENTS OF THIS NUMBER.

DEPARTMENTS.

AN IMPORTANT contribution to the literature on illumination is the paper recently read before the Chicago Section of the Illuminating Engineering Society by Mr. F. J. Pearson on "The Lighting of a Large Retail Store," summarized in this issue. Since the subject of illumination came so prominently to the front a few years ago, considerable discussion has been indulged in on the subjects of residence and factory lighting, but comparatively little consideration has been given to more efficient methods of store illumination.

This is an important field for investigation, and it is gratifying that the management of the great establishment with which Mr. Pearson is connected undertook such exhaustive tests before adopting a new lighting scheme. This fact makes the conclusions reached of much more value than would be the case if an arbitrary choice had been made, although it is to be remembered, of course, that the individual conditions of merchandising governed in the selection. This retail store, which is perhaps the largest in the world, has done a great service to electrical men in making these tests. Mr. Pearson's paper should prove interesting reading for both store managers and central-station men as well as all interested in more efficient and effective store lighting.

SELENIUM CELLS are now engaging more attention than for some time past, owing to the increasing possibilities of varied application in the industrial arts, instead of being confined chiefly to laboratory experiments. It is therefore interesting to note the statement of R. Marc in a German chemical journal that gray crystalline selenium exists in two distinct polymorphous forms, which may be distinguished as A and B. A is a non-conductor, B a good conductor of electricity. The transition from the A form at 140° to the B form on heating to 200° has now been observed microscopically. It has also been found that there is a difference in the solubilities of the two modifications. B is probably rather less soluble in carbon bisulphide than A. The equilibrium mixture at the ordinary temperature is sensitive to light, which displaces the equilibrium from A to B, just as does rise of temperature. The action of the light is, however, a photo-chemical and not a calorific effect.

Mr. Marc makes the following recommendations for those interested in the construction of sensitive selenium cells: (1) An addition of 0.1 to 0.5 per cent. of silver or other efficient catalytic agent; (2) the complete transformation (preferably in an oxygen-free atmosphere) at 200° (this can be best traced by the use of a galvanometer); (3) the establishment of a complete equilibrium at the ordinary temperature; (4) the employment of as thin a film of selenium as possible; (5) the arrangement of the electrodes should be such that the rays of light fall upon the places of greatest current density; (6) access of moisture is to be prevented.

SHALL the neutral of alternating-current high-tension systems be grounded, and if so shall it be through a resistance or direct? This is an important question, and it was discussed at the New York meeting of the Institute last week. Much valuable material was brought out on which the Western Electrician draws to some extent in this issue. As was to be expected, no definite conclusion was reached. After listening to the discussion, Dr. C. P. Steinmetz confessed that he knew less about the advisability of grounding the neutral than before, because every statement on one side had been paralleled by another of directly opposite effect. However, he thought the system should not be grounded where grounding is not necessary, as opposed to the idea of grounding everything unless there is a special reason to the contrary. It may make a difference whether the system is an overhead transmission system or an underground cable system in city streets. Resistance in the grounding is used where it is judged unsafe to ground without.

In concluding his discussion of the subject, Dr. Steinmetz gave his hearers some advice of a quite unusual nature. We quote it:

"I desire to draw your attention to the general principle of all human nature where the trend of the times is very strong in one direction, as, for instance, in favor of using induction motors instead of synchronous motors, or vice versa, or grounded neutrals instead of running ungrounded neutrals. Under such conditions, wherever you meet a case in which it is doubtful if you should do one thing or another, it is usually safe to decide on that which is against the favored practice, for the reason that nobody can remain entirely unbiased in his judgment if the general trend of sentiment is in a certain direction. Therefore, where he thinks the advantage about equal he unintentionally, in most cases, favors that side which is the fad of the time. Consequently, it would be fairly safe to decide in favor of the other side."

Other things being equal, then, decide against the trend of the times in questions of engineering judgment. This recommendation is rather risky, for it uniformly prefers the opinion of the minority to that of the majority. The minority may be right, and it is well to be on one's guard against mere popular clamor; nevertheless, it would appear to be an unwise plan to decide always against the trend of events when the scales appear to be pretty evenly balanced. This "trend of events" has brought us where we are, and the fact that a majority favors a certain course should have due weight.

Perhaps the preponderance of opinion, in this particular case, favors grounded neutrals; perhaps not. But in either case the engineer will do well to study his own particular problem in the light of all information he can get, and then decide for himself without any fear of faddism on the one hand or of lack of progressiveness on the other.

INDUCED ELECTROMOTIVE FORCE in an alternator shaft is the subject of an interesting article by F. Punga and W. Hess recently published in our German contemporary Elektrotechnik und Maschinenbau and summarized by Science Abstracts of London. It is pointed out that in the case of certain high-speed alternators the bearings have been found to wear away very rapidly, and a difference of potential of a few volts has been found to exist between the shaft and the bearings. At first sight it might be supposed that the film of oil surrounding the shaft would form a sufficient insulating barrier, but practically such has not been found to be the case, and where the trouble alluded to has been experienced it has become necessary to insulate completely the bearing pedestals from the bedplate. The trouble arises from the presence of an electromotive force induced in the alternator shaft.

In order to account for this electromotive force the author considers a turbine-driven alternator having a four-pole revolving field and a stationary armature divided into two parts by a horizontal plane. The joints between the upper and lower halves of the armature, even if made with the utmost care, are magnetically imperfect and offer an appreciable reluctance. Hence the field flux will vary between certain limits for different positions of the armature. Since part of this flux passes through the shaft it follows that during the rotation of the field a certain fraction of the field flux will periodically move across the shaft sideways (i. e., along radial planes) in opposite directions, thereby inducing an alternating electromotive force along the shaft whose period is equal to that of the main current. The effect can only occur in 4m-pole machines, where m is an integer. It would obviously not occur in a two-pole alternator.

The author's theory is confirmed by some results obtained with a four-pole machine, in which the reluctance of the joints was progressively increased by widening the gaps between the two halves of the armature. The electromotive force measured across the ends of the shaft was found to increase with increase of the reluctance of the joints, and its value agreed fairly well with the calculated value.

There is a possibility of turning this effect to useful account in the construction of alternators required to furnish very large currents at a pressure of only about 20 volts or so (as in certain electrochemical operations), and the authors develop the theory of this peculiar type of alternator, in which there would be no special armature winding, the shaft of the machine taking the place of such a winding. The current would be collected by a sufficiently large number of brushes applied to the end portions of the shaft. It is the fact that the design of such low-voltage machines on ordinary lines presents formidable difficulties.

FOR the many kind words and congratulations which it has received on the occasion of the recent appearance of its Twentieth Anniversary Number, the Western Electrician returns appreciative thanks. We are pleased that our effort to make the issue worthy of the occasion and of the industry has been recognized by our co-workers in the electrical field.

The Street-railway Conventions.

[Special dispatch to the Western Electrician.]

Atlantic City, October 15.—The street railway convention special which left Chicago on Sunday noon by the Pennsylvania lines made an uneventful but very delightful trip to Atlantic City, arriving there in about 22 hours. The delegates in all numbered 76 individuals, and the Pennsylvania Railway, as represented by City Passenger Agent Frank S. Bamford, was indefatigable in its efforts to make this convention trip a pleasant one.

The St. Louis special train, in charge of Arthur S. Partridge, arrived at Atlantic City on Sunday also. Among the well-known street-railway people on board were President John I. Beggs of the American Association and Richard McCulloch. This train also brought representative street-railway men not only from St. Louis and Illinois points but from as far west as Oklahoma, Texas and Indian Territory. The passengers numbered 60 in all.

Perhaps the first thought that struck many of those attending the street-railway convention of 1907 at Atlantic City related to the fitness of the place for such a large gathering of representative Americans. For years the street-railway convention has, so to speak, been wandering from place to place, and after its many vicissitudes in its yearly work of obtaining a suitable meeting place, it would seem as though the ideal is found in Atlantic City's qualifications.

Convention exhibits are admitted nowadays to be almost equal in importance to discussions of policy, management and technical matters. At Atlantic City the Steel Pier presents admirable advantages for large exposition purposes. This steel structure extends from the Board Walk out at sea for more than a quarter of a mile, and with its four enclosed halls, large arcade and broad promenades, now all fitted with permanent booths, presents strikingly suitable facilities to the street-railway manufacturers and supply men.

Comparatively speaking, the exhibits at Atlantic City, in so far as the number is concerned, are only slightly in advance of the Columbus convention of last year. The exhibits at Columbus numbered 195, while the booths on the steel pier at Atlantic City under a hurried count show a figure of 210.

This convention was made remarkable by the fact that as early as Sunday night practically all the 210 booths were ready for visitors. This celerity and promptness is to be highly commended, especially when one remembers how unwieldy and very heavy as a rule are the supplies and machinery presented for the inspection of street-railway men.

For such exhibits as those appertaining to rolling stock, track welding and the like, a comparatively large area of ground is available just across the Board Walk from the Steel Pier. In this open-air exhibit space a switch is installed to connect the exhibition tracks with the existing tracks in the street, so that the rolling-stock exhibit can be operated on its own wheels. This 500 feet or so of track also affords facilities for demonstrations of welding.

While last year at Columbus red, white and blue were the standard convention colors, this year at Atlantic City green predominates as the basic color use for decorating. The floors are covered with green matting and the green burlap backgrounds in the booths are a most satisfactory adjunct in the general color scheme.

The Engineering Association.

The opening session of the American Street and Interurban Railway Engineering Association was called to order yesterday (Monday) afternoon by President H. H. Adams of Baltimore at 2:40, introducing John I. Beggs, president of the American or parent association. Mr. Beggs, as usual, made a business-like and well-pointed address. He prefaced his remarks by emphasizing the advantage that had obtained in the division of the association into parts, so that the engineering association could devote itself more particularly to its special work, leaving the American association to its more general work.

Mr. Beggs called attention to the incalculable benefit of this convention work to all the street railways in the country, whether they hold membership in the association or not. He deplored that all the street-railway companies throughout the country could not be brought to a realization of the great advantage to themselves in taking membership in these associations. If there ever was a time when it was imperative that the representatives of these properties should stand shoulder to shoulder, now is that time. Mr. Beggs stated that the work of the committee on standards had appealed to him very strongly, dwelling somewhat at length upon his own efforts in obtaining the advantages from standardization.

President Adams, at the conclusion of Mr. Beggs' remarks, made a short address thanking the speaker. C. L. S. Tingley of Philadelphia, president of the Accountants' association, was then called upon. Past president Olds of Milwaukee then made a speech of reminiscence, following which President Adams delivered his annual address.

Mr. Adams said that the advantage of committee work in connection with their association had been impressed upon the executive committee even more forcibly during the last year than ever before. He too emphasized the importance of the work of the standardization committee. This had become so large that it is now necessary to subdivide and appoint sub-committees to handle various parts of the equipment. He pointed as an example the practice of steam roads in this respect, and that it was the practice of the latter to have standing committees.

Reverting to the report as submitted by the standardization committee, Mr. Adams characterized it as the most important one that has been presented in the history of the association. This report shows that steps have been taken toward uniform practice in gearing for motors. The committee had met a cordial response from motor designers. Further steps in the question of uniform design in certain of the motor parts is only a question of time. Consequently he felt that it was exceedingly desirable that a good foundation be made through the taking of definite action at this meeting on this report.

Mr. Adams illustrated the importance of the adoption of the recommendations by stating that the brake shoes and heads that are recommended will reduce to a minimum the number of patterns required and accomplish several other economies.

Referring to the report of the committee on "Maintenance and Inspection of Electrical Equipments," the speaker stated that the report showed the necessity of still further investigation and recommended the appointment of several standing committees.

Returning to the question of standardization, which is unquestionably near to his heart, President Adams referred in a most complimentary manner to the co-operation of the manufacturers in this work. He stated that manufacturers were always welcome at conferences on standardization.

Claim Agents.

The claim agents' convention was opened yesterday afternoon. Mr. H. C. Bradley of Chicago, the acting president, made an address replete with interest to the claim agent of any public-service corporation, whether street railway or electric light. He said that in his own city not only is the number of claims per annum increasing very rapidly, but there is a very constantly increasing difficulty in successfully resisting fraudulent claims in the courts. Long agitation against franchises, etc., added to the ordinary prejudices which exist against corporations, the work of hostile newspapers, etc., are year by year making the claim agent's work harder and harder and of much more importance.

The speaker directed attention to the report of a well-known transportation company, recently published, which, he stated, shows that the enormous increase of money expended on personal-injury claims running progressively through several years had at last caused a deficit in the finances of that company. This report, according to the speaker, shows that the personal-injury expense had increased during the last few years from about 2½ per cent. of the receipts to about seven per cent. of the gross receipts. Mr. Bradley referred also to the personal-injury tramp that goes from city to city, and he suggested co-operation in the matter of intercommunication between the members of the association in order to head off such fraudulent work.

General Outlook.

It is estimated that there are as many as 2,000 traction officials in Atlantic City. It is said that one of the important matters to be taken up is the creation of a special course of university training for the traction experts of the future, and that Prof. H. H. Norris of Cornell University is or will be here to outline a plan through which this result may be accomplished.

Another subject that will receive much attention relates to more comprehensive adoption of the turbine engine for electric traction service. In the engineering session of yesterday afternoon the belief was expressed that in the comparatively near future trolley trains of [illegible] will supersede single cars in all large [illegible].

After dinner last evening a series of [illegible] recitations was given by Miss Kitty Cheatham in the solarium of the Marlboro-Blenheim. Afterwards the ladies and delegates indulged in informal dancing. For this afternoon a roller-chair parade is scheduled, and as the weather is all sunshine this delightful function will doubtless be carried out.

This evening will be held the annual reception in honor of the president and other officials and their ladies. This also in the solarium of the Marlboro-Blenheim.

Tuesday's Sessions.

The Accountants' convention was called to order this morning according to schedule and opened with an address by President John I. Beggs of the American association. This was followed by the annual address of the president, Mr. Tingley. The reports of the executive committee and of the secretary and treasurer were presented. This was followed by several interesting papers, and in the afternoon there was a lunch and a social in the Chevy Chase room at the Marlboro-Blenheim Hotel.

At the meeting of the Engineering association there was a paper on "Care of Electric-railway Tracks," by George L. Wilson of Minneapolis. This was followed by various reports of committees. This concluded the morning session. The afternoon session was occupied in part with reports of committees on standard traction and on open versus closed terminals for car storage.

In the Claim Agents' association papers were read by R. R. Schoenen, H. K. Bennett, Harry H. Vories and E. C. Carpenter. F. L. P.

Kansas Gas, Water and Electric Association.

The tenth annual meeting of the Kansas Gas, Water and Electric Association, held in the Commercial Club rooms, Topeka, Kan., on October 9th and 10th, was the best meeting ever held by the association. From an educational viewpoint the proceedings were of great value to central-station men. Eleven new central-station managers were elected to membership, and the general discussion of the various topics was of great interest and value to all present. The association seems to have taken on new life and the addition of valuable new members will be of much benefit to the association.

President E. S. Springer of Leavenworth was in the chair. In his annual address he reviewed the improvements and changes made during the last year and spoke of the work done by the association.

The first paper was by E. L. Callahan of the Chicago office of the General Electric Company, on "Commercial Importance of Heating Devices to the Central Station." Mr. Callahan gave a practical paper on the introduction of heating devices and how they could be used to make money for the plant.

W. E. Sweezey, superintendent of the Junction City Electric Railway, Light and Ice Company, gave an offhand talk, which was very practical, on the management of a small plant, and spoke especially of how the management should treat the public and its customers.

One of the best papers presented was by J. S. Skinner, superintendent of the Lawrence Electric Light Company, on "Increased Sales to Present Consumers."

"The Underground Water Supply for Municipalities of Kansas" was a tabulated statement of the recent investigation made under a recent act of the Legislature, and showed what good work had already been done.

Prof. B. F. Eyer of the State Agricultural College gave "Economies of High-efficiency Lamps," and supplemented a paper on the same subject by F. W. Willcox of the General Electric Company. This subject interested every member present greatly.

"The Benefits of the Association" were to have been set forth by F. W. Mackey of St. Joseph, Mo., but he was detained. The paper will be published in the proceedings.

"Electric Law" was treated by John C. Nicholson, president of the Electric Light Company of Newton. The subject was discussed, first, as to the relation of the company to the public; second, the relation of the company to third persons, and third, the relation of the company to its employes, with special emphasis on the law of damages.

"Natural Gas vs. Electricity" was the subject of John T. Huntington, superintendent of the Topeka Edison Company. Mr. Huntington showed how electric companies could and should succeed where there is natural-gas competition. This was especially valuable to many members of the association who have natural gas to meet.

"Municipal versus Private Ownership of Public Utilities" was the subject of a well-digested paper by Jesse Shaw, superintendent of the city waterworks of Topeka, and who was formerly superintendent of the same plant under private ownership.

The discussions were animated and very interesting, and in nearly every case confined strictly to practical suggestions on points brought out by the paper read.

The following-named officers were elected for the ensuing year:

President—C. L. Brown, Abilene.

First Vice-president—A. L. Newman, Arkansas City.

Second Vice-president—W. A. Scouthern, Hutchinson.

Third Vice-president—W. R. Murrow, Independence.

Secretary and Treasurer—James D. Nicholson, Newton.

Executive Committee—W. S. Grosvenor of Kingman, J. N. Wells of Pittsburg and Willis Watson of Dodge City.

The Topeka Edison Company, the Topeka Railway Company and the local entertainment committee made things pleasant for the visitors. The local committee consisted of A. M. Patten, L. G. Trealeaven, John T. Huntington and Jesse Shaw.

The Lighting of a Large Retail Store.

On the evening of October 10th was held the first meeting of this season of the Chicago Section of the Illuminating Engineering Society, and it proved to be the best attended meeting in the history of the Chicago branch. After the customary dinner at a downtown restaurant the meeting adjourned to the auditorium of the Commonwealth Edison Company, kindly placed at the disposal of the society. Shortly after 8 p. m. Chairman Keech rapped for order and introduced Mr. Frederick J. Pearson, electrical engineer for Marshall Field & Co. of Chicago, who read an interesting paper on "The Lighting of a Large Retail Store," from which the following facts are taken:

About two years ago Marshall Field & Co. began to investigate the newer systems of illumination with a view of adopting more efficient illumination for their large retail store. Extensive rebuilding operations were in progress and it was desirable to adopt a more satisfactory lighting system than that then in use, which consisted of enclosed arc and old-style carbon-filament lamps. At that time the connected lighting load amounted to the equivalent of 32,000 16-candlepower incandescent lamps. At the present time this has been increased to the equivalent of 57,000 such lamps.

Manufacturers of the various illuminants recently brought forward were invited to submit samples of their lamps for competitive tests, and the tests instituted were carried on during a period of 18 months. Laboratory results were discarded and the experiments were carried out with lamps actually installed in the store under regular merchandizing conditions.

The fundamental requirements that all the lamps submitted should possess were laid down as the following: Efficiency, low-energy consumption per candlepower; color, nearest to that of the spectrum; low maintenance cost; high intrinsic light source to decrease the number of units required and to permit placing the lamps nearer the ceiling; units to be obtainable in different sizes; flexibility, an illuminant suitable for the large variety of merchandise handled, there being 350 different sections in the store, representing nearly as many classes of merchandise; accessibility for repairs; adaptability to present wires; low first cost of lamps; low first cost of fixtures; absence of bare light sources.

The lamps tested were: Gem metallized filament, tantalum, Nernst, diffusing arc, tungsten and carbon filament. The last lamp was put in only for comparison; the tungsten was so fragile that its filament was soon broken, and the diffusing arc, while giving excellent efficiency results, met with little favor from the store management. Thus the three active competitors were the Gem, tantalum and Nernst lamps.

The principal tests were 10 in number. The tests were conducted as nearly as possible under similar conditions. Representatives of the different interests were present on all occasions. The photometric instruments used were a Weber photometer from the laboratories of Armour Institute of Technology and a luminometer from the Chicago Edison Company's laboratory. Each of these as well as the electrical instruments used had been carefully calibrated and were in the hands of expert operators. All photometric observations were taken at a distance of 32 inches above the floor, this corresponding to the standard height of counters. All observations were repeated a great many times and average results recorded. As much, if not more, importance was placed on visual tests of the quality and color value of the lights as upon the actual candle-foot illumination and efficiency data. This was to give the 350 section managers an opportunity to express their opinions on the value of the different illuminants for their particular needs.

All the lamps met some of the fundamental requirements previously mentioned, and the three principal competing lamps met nearly all in varying degrees. The lamps giving the higher intrinsic brilliancy gave the best results. The average results given by these three lamps are summarized as follows:

Lamp.	Size.	Watts per Sq. Ft. at Counter Plane.	Candle Ft. at Counter Height.
Gem	137 watt	1.42	3.96
Tantalum	85 watt	1.12	3.15
Nernst	3 glower	1.09	3.42

The life tests gave the following average results:

Lamp.	Rated Candle-power.	Watts per Mean Horizontal Candlepower. Initial.	After 200 Hours.	Useful Hours' Life.	Ultimate Hours' Life.
Carbon	16	3.1	3.25	480	600
Gem	125	2.55	2.75	375	550
Tantalum	40	2.10	2.68	325	490
Tungsten	50	1.29	1.56	...	...
Nernst	50	2.51	2.65	471	560

The first four lamps were run at 114 volts, the last at 228. The tungsten lamp gave out during the test. After 700 hours the tantalum was black.

As a result of all these tests it was decided by the store management that the Nernst lamp gave the best results, for it had shown a good efficiency, was guaranteed to require the lowest maintenance cost and above all had the best color of the several illuminants.

It was therefore decided to adopt the Nernst multiple-glower lamp for the entire store lighting. A direct-current lamp was preferred, as the store gets all its current from the Edison direct-current mains, and the installation cost and operating losses of rotary converters were sought to be avoided. The manufacturers of the Nernst lamp had just perfected a lamp that they were willing to guarantee on direct-current, and this was the first large installation of this type of lamp.

The illuminating intensities decided on at the counter level in general were the following:

First floor, 4.5 to 5 candle-feet.

Upper merchandizing floors, 2.5 to 3 candle-feet.

Merchandise basement, 3.5 to 4 candle-feet.

Sub-basement, packing and storage rooms, 2.25 to 2.5 candle-feet.

The requirements in the different sections varied, some wanting more and others less illumination than the average. For instance, in the millinery salesrooms an intensity of 1.5 candle-feet was regarded as sufficient. In some of the workrooms, where operators worked on sewing machines, individual drop lamps had to be retained. In others with ceiling lights an intensity of five candle-feet was deemed necessary.

In general Marshall Field & Co. wanted more light for the same money rather than the same light for less money, and therefore had adopted higher intensities than those customary for this service. Except in a few sections they had replaced practically all the old incandescents and arc lamps by installing something like 5,200 new Nernst lamp fixtures in about 40 days. They had the courage to adopt a practically new type lamp on a large scale and were entirely pleased with the results.

In the beginning of the discussion of the paper Mr. Pearson was asked a number of questions. In answer to some of these he said that in a dry-goods store the illumination should be of such a character that colors appear in their true shade, which was the particular feature that gave the Nernst lamp the preference. Moreover, it was the lamp that had met the approval of nearly all the section managers and was the best suited therefore to meet their different requirements, and thus do away with the multiplicity of systems that had been in vogue. A uniformity of system was desirable even as to the workrooms.

J. R. Cravath said the test results showed that the height of the lamps above the floor cuts little figure if proper reflectors are used to throw the light downward where it is most desired. Differences of less than 25 per cent. in efficiency could be remedied by the selection of proper glassware. The old-style fixtures threw the light largely to the walls and ceilings. By turning these wasteful rays into useful directions the lamps could be raised to a higher level so as to get a more uniform distribution on the working plane.

G. H. Stickney of Lynn, Mass., thought that this store was not typical of most large department stores; the size of the bays was uncommon. Arc lamps have been mostly used for store lighting, even in stores of the highest grade, with very good results. The color of the light should be as near as possible to daylight, as matching of goods is difficult if any part of the spectrum rays is absent. The diffusing arc lamp gives all that can be desired in that respect, and he would have liked to have seen it given more consideration.

Mr. Pearson replied that merchandizing conditions are different from what an engineer can govern. He was highly pleased with the efficiency of the arc lamp, but that was not the main thing to be considered. He said that no 10 out of the 350 section managers of the store wanted to use the arc lamp, and if this meant anything it showed that experienced merchants did not think the arc lamp suited to bringing out delicate tints.

Max Harris of Pittsburg said that the general use of arc lamps was because high-candlepower incandescents and more efficient illuminants had not been perfected until a few years ago, so that store managers had not much choice to select from.

R. F. Schuchardt of the Commonwealth Edison Company said it should be noted that the plan of illumination was selected by merchandise men and not by illuminating engineers. He would advocate the use of lamps corresponding to the kind of illumination used where the goods purchased are to be utilized; for instance, incandescents for the sections where evening clothes are sold. Personally he thought the incandescent light was more pleasing and restful to the eye than that of the Nernst lamp.

Mr. Harris asked whether ceiling lights could not have been used exclusively even in rooms where sewing machines were used. He knew of some firms that had done so with good results and great economy of current.

Mr. Pearson answered that they had experimented with the use of ceiling lights for even the sewing rooms, as they had desired to use them throughout the buildings if possible. They found, however, that the operators claimed shadows were cast by the arms of the machines, and they protested so much that the individual drop lights had to be restored.

George C. Keech said that it was largely a matter of education, and cited the mercury-vapor lamp as an illuminant that one had to get accustomed to before the prejudice against it could be overcome.

Mr. Naylor of Marshall Field & Co. facetiously remarked that no doubt a great many tailors would work contentedly at home sitting near a kerosene lamp, but when working for Marshall Field & Co. they would demand about six arc lamps apiece.

E. W. Lloyd of the Commonwealth Edison Company said that when working on white goods, ceiling lights were amply sufficient, but for dark browns or blacks individual lights were necessary.

Mr. Pearson was asked why the rapid improvements in the tungsten lamp had not caused them to pause before selecting a less efficient lamp. In answer the representative of Marshall Field & Co. said they had looked hopefully on the tungsten lamp, but came to the conclusion that the present installation would pay for itself before an entirely satisfactory tungsten lamp was put on the market.

Lightning Arresters and Protection Discussed at Purdue.

The Purdue University branch of the American Institute of Electrical Engineers held a meeting in the Electrical Building at the university on October 8th, the discussion centering on recent Institute papers on the protection of electrical construction from lightning. Professor Plumb, speaking of the number and placing of arresters, brought out some interesting facts. No arresters are in use at Purdue, and as a result the three-kilowatt transformer in the science building was put out of commission during a recent storm, due, probably, to surging on the line which created enough pressure to jump a ¾-inch air-gap.

The various kinds of lightning arresters were described by Professor Esterline, who said that expounding a theory of lightning was a bold move. The higher voltages and longer lines of today have changed conditions, existing in the earlier days, when little trouble was encountered. The meeting was favored with an address by Professor Benjamin, the new dean of the engineering school, who expressed an interest in the Institute.

Chicago Street-railway Situation.

A draft of a new plan for the reorganization of the financial system of the Chicago Union Traction Company has been prepared by representatives of the various interests who met in New York. The plan will be submitted to representatives of the bondholders and later will be submitted to the bondholders for approval. As the bondholders learn of the need of their individual action through default on their interest, they are expected to communicate with their trustees, and then, it is said, they will be urged individually to accept the plan of reorganization.

The Board of Supervising Engineers says that 45 miles of new track has been laid in the city under the direction of the board. New rails are being laid in all parts of town, but the South Side is receiving slightly more attention because the City Railway Company has accepted its ordinance. Meanwhile work also is progressing on the North and West Sides, with the traction board under virtual supervision.

Telegraphers' Executive Board Suspends Union President.

The general executive board of the Commercial Telegraphers' Union has summarily suspended Samuel J. Small, president of the union, for advising a surrender in the strike. This action was taken at a meeting in Chicago on October 14th. The executive board intends to conduct the strike with renewed vigor and will handle the situation until a successor to Mr. Small shall be elected at a meeting to be held in Milwaukee on October 23d. It is said that local unions throughout the country generally favor the action of the board.

In the face of this demonstration the telegraph companies say they received more applications for work on the day following the suspension than on any day since the strike began.

ELEMENTS OF ELECTRICAL ENGINEERING.

By Geo. R. Metcalfe

XXXVIII.—Electric Railways.

Electric Car Lighting.

The lighting circuit of a trolley car is generally taken off from the trolley circuit before it reaches the main fuse or circuit-breaker. This is done so that if the fuse blows or the circuit-breaker opens the lights in the car will not be extinguished. The lighting circuit, however, is protected by its own fuse box, and each circuit of lamps has its separate switch. As the standard trolley voltage is from 500 to 550 volts, and ordinary incandescent lamps are made for about 100-volt circuits, it is necessary to wire five of these lamps in series across the 500-volt circuit, and in large, well-lighted cars four or five or more of these circuits are used.

It is obvious that if one lamp in a circuit is broken or burned out, the circuit will be opened and the other four lamps extinguished until the defective lamp is replaced.

It is not advisable to use lamps of very high efficiency for car lighting, as the constant jarring of the car tends to destroy the filaments rather rapidly. As has been explained in a previous chapter, the higher the efficiency of the lamp the more brilliantly it burns, because of the small diameter of the filament. By using a lamp of lower efficiency which has a correspondingly thicker filament a more reasonable length of life is obtained. Filaments for street-car lamps should preferably be made with several convolutions, or should be anchored to the bulb by means of a short piece of wire looped around the filament at one end and attached to some part of the glass bulb at the other end. The object of these devices is to secure a short stiff filament which will not be broken by the jarring of the car, or will not be sufficiently flexible to come in contact with the glass bulb.

In addition to the lamps for interior car lighting, platform lights, sign lights and headlights are generally necessary. These lights are generally wired so that the platform light on the front end and the sign lights and headlight on the rear end will be extinguished on turning a switch, and the corresponding lights on the rear and front end will be lighted. No general rule, however, can be laid down for car-lighting circuits, as the number of lamps and their location vary greatly with the style of the car, the number and size of the illuminated signs and the kind of headlights used. The only general rule to be followed is so to arrange the circuits that five lamps will always be connected in series.

In many cases arc headlights are used, especially on interurban cars, and to a more limited extent these are also used for interior car lighting. If a four-ampere enclosed arc is used alone for a headlight it will require about 70 volts, and the difference between this and the 500 volts of the trolley circuit must be lost in a resistance which is placed under the car and connected in series with the headlight. It is apparent, therefore, that very much more energy is absorbed by the reistance than is utilized by the headlight, and this arrangement is therefore very inefficient from an electrical viewpoint.

A more economical arrangement, which, however, makes considerable complication in wiring is to arrange a number of the incandescent lamps in the interior of the car in series with the arc headlight. In this way the energy wasted in heating the resistance is utilized for interior lighting. Where the interior of the car is lighted with enclosed arc lamps a number of these can be wired in series with the headlight, thus avoiding the use of a resistance.

Arc headlights are almost always attached to the car dash by means of brackets, which are grounded to form one terminal of the lamp, and the other terminal consists of a plug which fits into a socket on the car dash. The switch is placed between the trolley circuit and the lamp resistance, so that when the headlight is turned off the resistance is dead. The switches on all the light circuits should be placed between the trolley and the first lamp, so that if a ground occurs on any part of the lamp circuit the current may be cut off from the entire circuit.

Car Wiring.

Only the most substantial methods of car wiring should be permitted on trolley cars, as owing to the jolting of cars, the splashing of mud and water and the rough usage to which cars are subjected, unusual opportunities are offered for grounds, short-circuits, breakage, etc.

The exposed wires underneath the car running from the controllers to the motors are bunched into cables and frequently covered with a canvas hose, which is made waterproof by several coats of insulating paint. On some cars special boxing is built under the car to accommodate the wiring, and the very best practice, although rather expensive, is to provide iron conduits heavily enameled both inside and out.

As the car body which carries the wiring rests on springs there is often considerable movement between the body and the trucks, which must be allowed for in connecting the motors to the cable. This is done by making several coils in the connecting wires, which permit the motion of the car without bringing any strain on the connections.

If soldered joints are required the wire should be securely cleated beyond the joint so as to prevent any motion of the jointed part. The vibration of the car tends to crystallize the solder and eventually open the joint, so it is important to keep all soldered connections as free from vibration as possible.

Where conduits are used the conduit is not depended upon for insulation, but its chief function is to offer mechanical protection for the wires. These conduits should be grounded so that in case any wire becomes grounded upon the conduit it will be short-circuited and thus blow out the fuse or open the circuit-breaker, thus preventing any further damage.

Trucks.

All electric cars are mounted on trucks, which are either single or double, according to the length of the car. The short cars used in city service are generally mounted on single trucks, while the long cars are mounted on double or swivel trucks. Trucks consist of iron structures which carry the journal boxes, wheels and axles, the motors, the brakes and the brake rigging, and they are built so as to constitute complete units, independent of the car body.

In single trucks the car body is simply laid upon the upper frame of the truck, so that whatever strains or distortion occur within the frame of the truck are not transmitted to the car body. The truck frame holds the journal boxes and consequently the wheels and axles at a fixed distance apart, although the journal boxes have a slight vertical movement, due to being supported on springs which prevent the vibration of the wheels being transmitted to the car.

The wheel-base is the distance between the centers of the journal boxes, and this distance is limited to about seven feet on single-truck cars, and is considerably less on double-truck cars. This limit in the length of the wheel base is necessary on account of the curves around which the cars have to pass. It is evident that if the road bed was always a straight line, any length of wheel base would be permissible; but as trolley cars pass around curves of quite short radius and the axles are held rigidly parallel, the wheels cannot accommodate themselves to the curvature of the track and would not be able to travel around a curve at all if the wheel-base were too long.

The greatest difference between trucks of different manufacture consists in the arrangement of the springs which are interposed between the car body and the truck frame. Both spiral and elliptical springs are used for this purpose, and various combinations of both kinds are used, as either kind alone permits too great an oscillation of the car bodies.

Double-truck cars have small swivel trucks located near each end of the car, and the car body is mounted upon them in an entirely different way than that used with single trucks. Swivel trucks are connected to the car only by means of a kingbolt in the center of the truck, around which the truck is free to turn, thus permitting it to accommodate itself to any curvature of the track. These trucks are very similar in general construction to the standard type of truck used on steam-railroad cars, but are usually arranged so as to permit the car body to be hung much closer to the ground than are the steam-railroad cars. There are two crossbeams under the car known as the car body bolsters, and an iron beam across the center of each swivel truck and the truck frame. Each car body bolster rests upon a truck bolster, the kingbolt passing through the middle of each. Side bearings are also provided between the car body and the ends of the bolster to prevent the body from tipping over when the car is unbalanced. Springs are placed between the bolster and what is called a spring plank, and the latter is suspended from the truck frame by means of links which permit a certain amount of side motion. Other sets of springs are located between the truck frame and the journal boxes, so that all shocks to the wheels are transmitted to spiral springs first, and then through elliptical springs before reaching the car body.

Most of the trucks in use have four wheels of equal diameter, but there is one type of truck known as the maximum traction truck which has two large wheels on one axle and two considerably smaller wheels on the other. The large wheels carry about three-quarters of the weight of the car and the small wheels the balance of the weight. In this type of truck the motors are mounted on the axles carrying the large wheels.

Car Wheels.

Most of the car wheels in service are made of cast-iron, although within recent years solid steel wheels and wheels with steel tires and cast-iron or wrought-iron centers have been introduced to some extent. That part of the wheel which rests upon the track is called the tread, and the part which extends below the track and which prevents the wheel from leaving the track is called the flange. In all cast-iron wheels the tread and flange are chilled in order to make them extremely hard. The tread of car wheels is made slightly cone-shaped, which assists the wheels in passing around curves.

The chief difficulty in the maintenance of car wheels is to keep the tread and flange in proper shape. The wear on the flanges soon reduces their section, and if allowed to wear beyond a certain limit the flanges are liable to break off, permitting the wheels to leave the rail. It is therefore necessary after the car has made a certain mileage to remove the wheels and turn the flanges and treads down to proper shape again.

Steel wheels are initially much more expensive than cast-iron wheels, but they maintain their shape very much longer, so they are able to make a far greater mileage than cast-iron wheels. If the expense of removing and turning down each of these kinds of wheels is taken into account the cost of steel wheels during their entire life is probably not much in excess of cast-iron wheels, owing to the reduced cost of maintenance of the former.

When steel-tired wheels are used the tires can be removed and new ones substituted. These tires are shrunk on to the centers and may be removed by placing them in a specially constructed furnace, in which they are heated up until they expand sufficiently to drop off.

Where grooved rails are used in city streets the wheel flanges are made smaller than the standard flanges for steam-road service, as the rail grooves are not large enough to accommodate the standard-sized flanges. There is a tendency, however, to increase the size of the flanges on electric car wheels on account of the number of high-speed interurban cars which operate on city streets. The standard-sized flanges are very much safer in high-speed service.

Car wheels are fastened rigidly to the axle. The seat on the axle is turned a few thousandths of an inch larger than the bore in the hub of the wheel, and the wheel is then forced onto its seat by means of a hydraulic press.

[To be continued.]

Note.—This series of articles, intended to survey, briefly, the whole field of applied electricity for light, power and heat, was begun in the Western Electrician of February 2, 1907.

To Prevent Telescoping.

General Manager Frank Hedley of the Interborough Railway Company of New York city has invented a simple device for preventing telescoping of cars in wrecks. Generally cars are telescoped by the end of one car rising above the platform of the next car, in which position the raised car can go easily through the woodwork above the platform. Mr. Hedley's device is an attachment adapted to be secured to the end of the car platform which has three prongs on its outer surface. When two cars come together these prongs interlock and prevent either car from rising above the platform of the other. A number of cars on the Interborough system are equipped with the device.

The Peterson Heat, Light and Power Company of Des Moines, Iowa, is applying for a franchise in Aberdeen, S. D.

SOME CONGRATULATIONS.

H. McL. Harding, New York: "I desire to congratulate you upon your twentieth anniversary."

William J. Hammer, New York: "I congratulate you upon your Twentieth Anniversary Number."

Hugo Reisinger, New York city: "I have looked over your Twentieth Anniversary Number, and I wish to say that I consider it a very interesting and handsome number."

Elihu Thomson, General Electric Company, West Lynn, Mass.: "You are to be congratulated on getting together such an amount of interesting historical material for the Twentieth Anniversary Number, which I have just read."

E. E. Keller, vice-president Westinghouse Machine Company, East Pittsburg, Pa.: "You certainly have reason to feel proud of your Twentieth Anniversary Number, and I congratulate you on the success that has met your efforts."

Ralph W. Pope, secretary American Institute of Electrical Engineers, New York: "Kindly accept my congratulations for the continued success of the Western Electrician, which I have watched with much interest since its first issue in 1887."

Charles A. Brown, patent attorney, Chicago: "I wish to congratulate you on the completion of the second decade of your paper. I have been very much interested in the commemoration number, and compliment you on the high character of the issue."

C. E. Flynn, president Conneaut and Erie Traction Company, Erie, Pa.: "I remember the first issues of the Western Electrician and congratulate you on the successful life of the paper. 'Many happy returns of the day.' May we all be here twenty years hence!"

B. F. Stewart, Chicago: "The Twentieth Anniversary Number of the Western Electrician is a 'crackerjack' and covers so much of interest that I shall preserve it for the pleasure of rereading from time to time and for reference. May you live long and prosper!"

Charles E. Gregory, president Guarantee Electric Company, Chicago: "I read your Twentieth Anniversary Number of the Western Electrician, and wish to compliment you on the interesting character of the whole publication. I shall preserve my copy for its historical value."

George A. McKinlock, president Central Electric Company, Chicago: "I read the Twentieth Anniversary Number of the Western Electrician with considerable interest and profit. The story of the time was told fully and completely in that number. I congratulate you on having put out such a successful number."

C. A. Tupper, Allis-Chalmers Company, Milwaukee: "We examined with much satisfaction the Twentieth Anniversary Number of the Western Electrician, and desire to congratulate you upon its appearance. The articles bear evidence of careful selection and are replete with information of interest to the trade."

W. S. Bissell, The F. Bissell Company, Toledo: "We congratulate you not only on your twentieth anniversary, but on your issue commemorating the event as well. This number appealed to us as being particularly interesting, although we feel that this is a characteristic that may be applied to all issues of your publication."

John P. Barrett, Chicago: "I have read your anniversary issue from cover to cover and am free to say it is the most complete electrical production I ever saw. It is impossible for me to mention individually the many splendid papers therein. They were all good. As for the photograph gallery, it is the best that was ever bunched."

Charles D. Shain, New York: "Permit me to congratulate you and your staff on your Twentieth Anniversary Number. It is indeed a pleasure to me to see again the faces of the boys of twenty years ago. God bless them all! I wonder how many of us will be left twenty years from now! I trust the Western Electrician, in any event, will go on forever."

Chicago Evening Post: "The Twentieth Anniversary Number of the Western Electrician, just from the presses, contains matter of great interest to the field. There are 98 pages and 140 illustrations, about half of the latter being portraits of men who have been identified with the electrical development of the West. There are also a number of articles reviewing the various features of electrical activity."

Prof. H. S. Carhart, University of Michigan, Ann Arbor, Mich.: "The Twentieth Anniversary Number of the Western Electrician contains a variety of most interesting history and reminiscence. It presents a fascinating epitome of the astonishingly rapid advances in the applications of electricity for the last quarter of a century. In this connection I am reminded of the fact that the first incandescent lamps that ever came to Chicago, so far as I know, were sent to me in Evanston by Mr. Edison in May, 1881. They were not mounted, and I connected them in circuit by means of the loose terminal copper wires, and lighted them with a Grove battery imported from London. There are doubtless persons still living in Evanston who will remember these pioneer lamps. You deserve congratulations for your success in assembling papers from such an array of contributors in your excellent anniversary number."

Alex Dow, vice-president Detroit Edison Company, Detroit: "Your Twentieth Anniversary Number was exceedingly interesting to me, as it must have been to all of us who knew our Chicago 'before the Fair.' Some of the reading matter, and particularly some of the illustrations, brought back warm memories—so warm that I forgive you for making me realize that I am getting old."

Chicago Record-Herald: "The Twentieth Anniversary Number of the Western Electrician has just been issued. Mr. Samuel Insull contributes 'Some Recollections of Central-station Development,' Bion J. Arnold 'The Rise of the Electric Railway' and B. E. Sunny 'The Electrical Upbuilding of the West.' The issue contains 140 illustrations, including portraits of many men who have been identified with the electrical development of the West."

P. C. Burns, president American Electric Telephone Company, Chicago: "I have read the Twentieth Anniversary Number of the Western Electrician with much interest and pleasure. The historical feature of it was particularly interesting to me. Time certainly flies. It does not seem possible that twenty years have passed since Mr. Kreidler first started the Western Electrician. I remember with pleasure the first visit he made me at St. Louis some time previous to your publication's birth."

Elmer W. Gillmer, secretary and treasurer Peerless Electric Company, Warren, Ohio: "I have read with a great deal of interest the articles presented by the various men who have been and are prominent in the electrical industry, and I have no doubt that these articles will prove very interesting to all of your readers. What strikes me forcibly, in addition to the above, is the number and character of the advertisements contained in your paper, and I must congratulate you on the very evident success of this number."

A. O. Kuehmsted, vice-president Gregory Electric Company, Chicago: "So far I have had only time to glance at your anniversary number, but I have decided to take it home and read it at my leisure. It is the most interesting number of any trade journal I have seen in years, and personally I am very much interested in the historical articles dealing with the men who have been prominent in electrical affairs in this vicinity, and I feel that everyone in the electrical business will feel the same interest that I do. I shall keep it in my library for future reference."

B. E. Sunny, vice-president General Electric Company, Chicago: "I congratulate the Western Electrician and yourself on the twentieth anniversary of the publication, and I also congratulate you on the Twentieth Anniversary Number, which, aside from being full of interest to the people who have known the Western Electrician and yourself for so long, is a masterpiece of the publisher's art. The Western Electrician has filled a very important position in the development of the art all of these years, and has been exceedingly helpful. I sincerely hope that its prosperity, as well as your own, will be continuous."

F. S. Terry, first vice-president National Electric Lamp Company, Cleveland: "A letter from your office calls my attention to the fact that the Western Electrician will this year have its twentieth birthday. Time does certainly pass along rapidly, and it is hard to realize that twenty years have passed since the day you came into my office on Randolph Street, and showed me the dummy of the Western Electrician. You certainly have given reasons for congratulations, and can take credit to yourself for your uninterrupted success. I trust that you will be able to look back upon your next twenty years with equal satisfaction."

George A. Damon, managing engineer The Arnold Company, Chicago: "Your very interesting and valuable Twentieth Anniversary Number brought considerable pleasure into our office. Individually for myself and collectively for The Arnold Company, we wish to congratulate you upon this fine issue. We feel sure that everyone connected with the electrical art will thank you for the very valuable articles contained in the issue. We can testify that your work is an added inspiration for further efforts in the constantly growing electrical field. May we all have something worthy of record in your Thirtieth Anniversary Number."

Chicago Daily News: "The Twentieth Anniversary Number of the Western Electrician is an enlarged number, containing 98 pages and 140 illustrations, about half of the latter being portraits of men who have been identified with the electrical development of the West. It contains also a number of valuable articles reviewing the various features of electrical activity. Among the notable contributions are: 'Some Recollections of Central-station Development,' by Samuel Insull, president Commonwealth Edison Company, Chicago; 'The Rise of the Electric Railway,' by Bion J. Arnold, chairman Board of Supervising Engineers, Chicago Traction; 'Electric Power Transmission,' by Charles F. Scott, consulting engineer, Westinghouse Electric and Manufacturing Company; 'Dynamo-electric Machinery and Its Evolution During the Last Twenty Years,' by B. A. Behrend, chief engineer and chief designer, Bullock Works, Allis-Chalmers Company, and others equally authoritative."

George Cutter, South Bend, Ind.: "I wish to express my great appreciation of your Twentieth Anniversary Number. It was quite a surprise to me, as I did not anticipate you were going to give such charming little histories of development of different branches during the last twenty years. It is through such concise historical sketches that we appreciate forcefully the wonderful progress made in our loved profession in a short time. It makes one feel proud of the achievements of the past and hopeful for the future. I must repeat that I consider your Twentieth Anniversary Number, as you got it out, a valuable publication, and I extend to you my heartiest compliments."

B. A. Behrend, chief engineer Bullock Electric Manufacturing Company, Cincinnati: "I have been greatly interested in this anniversary issue, and I sincerely congratulate you upon the excellent work done by your editors in making the number a worthy commemoration of the twenty years of the existence of your paper. Those of us who have been instrumental, during the last ten years, in the building up of the electrical industry of the Middle West appreciate the existence of a journal of your standing with a power for good which is considerable. If the management and editorial direction of your paper stand for the expression of independent views; if you support, without bias, the interests of the public at large against individual interests; if you make yourself the mouthpiece of those who have something to say, although their opinions may not meet with favor and applause from certain influential persons, your paper will fulfill a great mission in the development of this western country. We are only just beginning to realize the enormous potential wealth and possibilities of the states commonly termed the Middle West. The eastern states which are bordering upon our territory are the great industrial states of the Union; the western states which are bordering on our territory are the great agricultural states of the Union. The Middle West is a gigantic clearing-house, through which the products of industry and agriculture are passing. The future of the manufacturing industry, and of the electrical industry in particular, in which we are interested in this section of the country, is bound to be tremendous. You and ourselves, and all those who have chosen this part of the country for their field of work, have great problems to solve and great responsibilities. There is grandeur in the vista of the future of the Middle West, and your paper will, I earnestly hope, be a power for good in this development. I congratulate you upon the excellent issue in which you commemorate the coming of age of your paper."

Portland and Salt Lake City May Be Connected by Electric Railway.

The Los Angeles Herald of recent date, printing what is said to be information emanating from the office of E. P. Clark, the prominent electric-railway man of Los Angeles, says that Portland, Ore., and Salt Lake City are soon to be connected by a modern electric-railway system to be built by Los Angeles men and operated by electric power generated by the snows of Mount Hood.

"Mr. Clark and his associates," says the Herald, "have control of the waterpower of Mount Hood, have an immense electric plant under way and have about 25 miles of the new system graded. The latent power of Mount Hood will eventually be to the Pacific Northwest what the power of Mount Whitney (first made feasible by John Hayes Hammond) is to Central California and the San Joaquin Valley, and what the Sierras will be to the Los Angeles-Owens River aqueduct."

"Originally the Mount Hood enterprise was stated to be merely a plan for getting tourists to the peak —a sort of Mount Lowe inclined-railway arrangement. This has secretly developed into a plan by which Central Oregon and later Northwestern Nevada and Northern Utah will be put in close touch, and that by electrically operated trains, the biggest electric scheme in America today."

"Completion of the through line by the shortest most practicable line is now the main object of the locating engineers who are secretly working for the Mount Hood Railway and Power Company. With a stealth of movement seldom surpassed by right-of-way men, these agents of Los Angeles have completed their lines over the eastern slopes of the Cascades, thence southeasterly into Nevada as far south as Winnemucca, and then almost due east to the metropolis of Utah. Because of the activity of Harriman engineering parties in that country the Clark men easily masked their purposes. It is stated that the heaviest work in the ascent of Mount Hood will be done this winter by the construction forces."

The Grounded Neutral, With and Without Series Resistance, in High-tension Systems.[1]

By Paul M. Lincoln.

The object of this paper is to raise for discussion the question of grounding the neutral, a question that continually confronts the engineer operating an alternating-current generating, transmitting or distributing system. The writer wishes to consider this question from the viewpoint of the operating engineer, since it is naturally he who is most interested.

The questions that would arise in the mind of the operating engineer would probably be these:

1. Why should the neutral be grounded? What advantage would be gained, if any? And what disadvantages would be encountered?

2. If a ground is used, shall it be at one point of the system, or several?

3. Shall a resistance be used between the neutral and the ground? and, if grounded at several points, shall a resistance be used in each place?

4. If a resistance is used, how much? and what shall be its current-carrying capacity?

5. What character of resistance is best?

Let us begin at the beginning of this list of questions and itemize, so far as possible, the advantages and disadvantages of a grounded neutral. The first part of this discussion will deal with the general question of ground versus no ground. Later in this discussion the modifications introduced into this general discussion by use of resistances, multiple grounds, etc., will be briefly treated.

Advantages.—(A) Electromotive force between conductor and ground remains fixed and constant.

(B) Prevents abnormal static induction on neighboring circuits.

(C) Provides opportunity for using the ground as a working conductor.

(D) Makes possible the detection (and immediate removal, if desired) of any grounded portion of the system.

(E) Insures equality in the condenser current drawn from each phase.

Disadvantages.—(F) One ground disables a part or the whole of the system.

(G) A proper ground is difficult to obtain.

Discussing more in detail these points of advantage and disadvantage, we find:

(A) In practically every transmission system the greatest danger of breakdown of insulation exists between line and ground, rather than between lines; it is therefore highly important that the voltage from line to ground be permitted to assume no abnormal or excessive value. The higher the line voltage the greater becomes the importance of this point, since the factor of safety of insulation naturally decreases with increasing line voltage. With the neutral fixed at ground potential, it is impossible to obtain, between any conductor and the ground, more than a certain definite proportion of the maximum line voltage. In a three-phase system—including as it does practically all transmitting and distributing systems—the voltage between the neutral and ground is about 58 per cent. of that between conductors. If, therefore, the neutral be connected permanently and solidly to ground, the maximum potential that can develop between the line and ground is about 58 per cent. of the voltage between the conductors. With an ungrounded system a ground on one conductor will cause full line potential to develop between the two remaining conductors and ground.

On further analysis it is doubtful if all the advantage apparent at first sight is really obtained, for it can safely be asserted that in the large majority of cases it is not the action of the steady line voltage that causes breakdowns in the insulation of transmitting or distributing system; the voltage strain necessary to cause breaks in insulation is usually very much higher than the normal voltage applied, even in the case where a system is operating with one conductor grounded. The condition giving rise to trouble is to have superimposed upon the normal line voltage a so-called "surge" of such value that when added to the normal strain their resultant causes sufficient strain on the insulation to break it down. Lightning is the usual cause of surges, although they may be caused by many other things; for instance, by switching, or a partial ground, or a broken conductor, or a heavy short-circuit. Insulation being once broken down, the normal voltage is usually sufficient to maintain an abnormal flow of current through the break. With the neutral grounded, a momentary break in insulation at one point on one conductor gives rise to opportunity for a destructive arc at that point. With the neutral ungrounded, before a destructive arc can take place there must be simultaneous breaks on the insulation of two separate conductors. The use of a resistance between the ground and neutral modifies these conditions, as will be discussed in a later paragraph.

A very material advantage incident to this fixing definitely the maximum potential of conductors above ground is that it allows a much closer adjustment of lightning arresters than would otherwise obtain; that is, the arresters can be adjusted so that a comparatively small rise above normal potential to ground will discharge across them. In an ungrounded transmission system it is not safe to adjust for a discharge potential materially [illegible] than line voltage; otherwise, in the event of one conductor becoming grounded, the constant [illegible] charge which necessarily occurs over the lightning arresters between the two good conductors and ground will destroy the arresters within a short time.

(B) An advantage incident to keeping the neutral of a transmission system at ground potential is to prevent abnormally large static induction by a transmission line on neighboring circuits. Those who have endeavored to operate a telephone line in proximity to a transmission line will realize the importance of this point. It is evident, without further explanation, that so long as the neutral of a transmission line is at ground potential its static influence on neighboring circuits is practically negligible. If, however, one of the conductors of the line is grounded, the static induction of the remaining two is usually sufficient to prevent the satisfactory use of telephone circuits strung on the same right-of-way. Grounding the neutral will prevent such a condition.

As to electromagnetic induction, it is evident that the grounded neutral can have no influence unless the ground is carrying current. In that event, electromagnetic induction on neighboring circuits is increased. This increase is due to the fact that the return circuit through the ground, instead of being in close proximity to the outgoing circuits, thereby neutralizing most of its action, is at a comparatively great distance, making the inducing loop of large area and comparatively great power.

(C) In a three-phase transmission system with the neutral grounded both at the generating station and a sub-station, it is perfectly possible to continue the transmission of power with one of the conductors out of commission. In this case, if the phases remain balanced, the ground will carry a current 1.73 times that in each of the two remaining conductors. Furthermore, it is perfectly possible to continue to transmit single-phase power with only one of the three conductors remaining. In fact, some transmission plants make a practice of running but a single wire to some customers using single-phase current, and but two of their three conductors to other of their customers using polyphase currents, relying in each case on the ground to act as a return conductor for the normal operating current. Still other plants make use of the ground as a working conductor only in emergency.

It must be counted as a distinct advantage in favor of the system with a grounded neutral that it makes available at any time the use of the ground as a working conductor. This does not mean that the ungrounded system cannot make the ground available, but in the latter case special switching arrangements must be provided, while in the former its action as a working conductor is practically automatic.

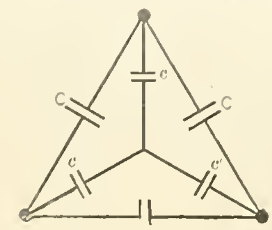
The practicability of using the ground as a working conductor is also dependent upon the ground resistance. This is an element that varies largely with geological formations, soil, season, moisture, parallel return circuits, and construction of ground plate; it is therefore difficult to make any general statement covering this matter. However, there seems to have been no difficulty in using the ground as a conductor for moderate amounts of power at pressures of 20,000 volts and above.

(D) and (F) With a grounded neutral, a ground on any conductor will cause a short-circuit. This fact may be regarded as an advantage or a disadvantage, depending upon circumstances, and also upon the point of view of the operator. If it is possible by use of the grounded neutral automatically to cut out the damaged conductor, and continue service to the affected part of the system over other lines, the grounded neutral may undoubtedly be regarded as an advantage. If, however, the grounding of the neutral means an interruption of service which could be avoided with an ungrounded neutral, the grounding may be justly regarded as a disadvantage. Protection of service is of great importance to the operator, and he is willing to run very considerable risks in order to give continuous service. That certain portions of his system are temporarily overloaded, or that part of his line conductors are temporarily undergoing an abnormal insulation strain to ground, is of no particular moment so long as service is being rendered and the abnormal condition does not give rise to further trouble. When considering questions of protection of service, the use of resistance in the ground connection is at once involved; the discussion of this phase will be treated in subsequent paragraphs.

(E) All alternating-current transmission lines take from the generators a condenser current whose volume depends upon the size, length and disposition of the transmitting conductors and upon the voltage and frequency supplied to them. These currents may be considered as flowing over two paths, as follows:

[illegible] Through the [illegible] formed [illegible] the conductors [illegible] as shown at (c), and [illegible] Through the condensers formed [illegible] ing the conductors [illegible] plate and the ground [illegible]

[illegible] currents through the [illegible] independent [illegible] grounding [illegible] The currents through the condensers (c), however, depend upon the potential of the neutral with respect to ground. With the neutral at ground potential, the condenser currents through (c') are taken equally from each of the three conductors. Assuming an extreme case, one of the three conductors grounded, all the currents through (c') are taken from two of the conductors, and, further, the total kilovolt-amperes represented by these currents is double what it would be with the neutral at ground potential. A moment's investigation will show this latter point. With the grounded neutral the total kilovolt-amperes, taken through capacities



CONDENSER CURRENT ON TRANSMISSION LINES.

(c'), may be assumed as proportional to $3\ c'\ E_1^2$, where E_1 is the potential between any conductor and the neutral. Grounding one conductor has the effect of short-circuiting one of these condensers and throwing a potential of $E = \sqrt{3}\ E_1$ upon the other two. In the latter case the total kilovolt-amperes taken by condensers (c') is $2\ c'\ E^2 = 6\ c'\ E_1^2$.

When the charging current is large compared with the generator capacity, it is probable that such an increase in its volume, as well as taking it largely from two of the three conductors, would cause a serious unbalance in voltage between phases. This seems to be a good, though not controlling, reason for maintaining the neutral at ground potential.

(G) A satisfactory ground is very difficult to obtain. The antiquated idea that the ground is of zero resistance, because it is of practically infinite cross-section, has long since been recognized as an error. In case of grounding to a buried plate, most of the resistance of the ground occurs in the immediate neighborhood of the ground plate, and the ground resistance depends upon the character and condition of the soil in the immediate neighborhood. This is to be expected on account of the fact that it is only in the immediate neighborhood of the ground plate that the cross-section of the ground, considered as a conductor, is sufficiently restricted to give rise to any appreciable resistance. The conditions other than the character of the soil that make for a low-resistance ground are moisture and the exposure of a large surface of ground-plate; the larger the exposed surface the lower the resistance. It is this reason that makes water-supply systems good grounds.

Even where good engineering practice dictates a resistance in the neutral, the unavoidable resistance in the ground connection is not so valuable as it might be, because of its extreme variability. The difference of the seasons, as well as the drying-out action of any ground current that may flow, will cause large variations in ground resistance. However, on high-potential systems the presence of even the maximum amount of resistance that is contingent upon good construction is rarely sufficient to cause trouble.

Modifications Due to Use of Resistance and Multiple Grounds.

If an operating engineer has come to the conclusion that his neutral should be grounded, the next question is, naturally, that concerning the number of places to ground—whether it shall be at his power plant or plants only, or at other points where neutrals can be obtained. The answer to this question usually depends upon the object sought in grounding. If it is the use of the ground as a working conductor, there must naturally be grounds both at the generating and receiving points. On the other hand if the object is to prevent an abnormal voltage rise on any conductor, due to the grounding of another, then the grounding of the neutral at one point is sufficient and in most cases preferable.

In some methods of connection the problem is still further complicated by the entire absence of an available neutral. In any three-phase system a delta connection of transformer or generator windings gives no opportunity of obtaining a neutral. A delta connection requires the use of a separate auto-transformer connected across proper points of the delta, from the winding of which a tap may be brought out for the neutral connection. A three-phase star-connected generating system has of

1. A paper presented at the meeting of the American Institute of Electrical Engineers in New York, October 11, 1907. The author is engineer of power division of the Westinghouse Electric and Manufacturing Company.

course the neutral at the star connection. If, however, a bank of transformers has both the primary and secondary connected in star, the star connection is not necessarily at the neutral point. In this case the neutral is practically free to move around anywhere within the three-phase triangle; in case of a dead short-circuit on any transformer, the voltage on that particular one disappears and the two remaining transformers assume the whole potential of the line, being then virtually connected in V. If, therefore, the star connection of a star-to-star group of transformers be connected to ground it does not follow that the neutral is grounded; if one side is connected in delta and the other in star, then the star connection can be treated as a fixed point at the center of the three-phase triangle. In a star-to-star group proper conditions can be assured only by connecting the star point on either side to a fixed neutral—such, for instance, as the connection of the star of the transformers to the star point of the generating system. The star point of the generating system being fixed at neutral, this also fixes the transformers.

The question as to how many points of a system shall be grounded is naturally influenced by the above considerations. The final answer, however, must be dictated by considerations which depend upon the reason leading to making any ground connection.

Probably the most important question in connection with this whole matter of grounding the neutral is that as to the use of resistance between the neutral and ground and the amount of resistance that is best. In considering this question the following analysis is pertinent: In any polyphase system, so long as each conductor has the same capacity and ground, the same insulation from ground and a balanced load, the neutral will remain at ground potential, whether it is connected to ground or not. In other words, so long as conditions on the transmitting or distributing system remain normal there is no occasion for grounding the neutral, as nothing will be accomplished thereby. The object sought in grounding the neutral is to take care, not of normal conditions, but abnormal ones. It is the first thought of the operating engineer to maintain his service, and he therefore installs automatic circuit-breakers and other devices to protect his system in case of an abnormal condition arising. The abnormal conditions that may arise are: First, short-circuits; second, open circuits, and third, grounds.

1. Short-circuits.—By short-circuit is meant accidental connection in any manner between conductors of opposite polarity. It is evident that under this condition the behavior of automatic devices is in no way influenced by grounding the neutral, so that the consideration of this contingency is not pertinent to this paper.

2. Open Circuits.—In a three-phase line, with the neutral grounded at both generating and receiving stations, the ground will, under normal conditions, carry no current, even though the ground be of zero resistance. If, however, one of the conductors should break, the ground immediately begins to carry current. If induction or synchronous motors are being used at the receiving end, the three-phase relation will be approximately maintained, the degree of approximation depending upon the ground resistance and upon the relative motor load to non-motor load. If the neutral is grounded at one point only, an open circuit in one conductor will have an effect no different from that which would take place if the neutral were not grounded, except that the distribution of charging current between conductors will be somewhat disturbed and more or less of this current would pass through the ground connection.

3. Grounds.—A ground is the most frequent abnormal condition that is encountered, and also is the one most affected by grounding the neutral. With the neutral connected direct to ground, another ground on any conductor means a short-circuit; the action of automatic circuit-breakers will then take place accordingly. The amount of current that will flow through such a short-circuit can be limited by inserting resistance, and practically the only object of resistance is to cause such a limitation of current.

The flow of excessive currents, such as would take place were there no resistance, is detrimental for several reasons. It throws an unnecessarily great strain upon the circuit-breakers which are called upon to interrupt the current. The large current flow which takes place may cause a phase distortion and drop of voltage which may, in turn, be sufficient to cause synchronous apparatus on the line to drop out of step. Almost invariably an arc takes place at the point of grounding of conductors, and an excessive current will cause excessive destruction at this point. A dead short-circuit on any system causes a heavy shock, due to the tremendous currents, and a consequent tendency to distort the windings of any synchronous apparatus connected to the system.

All of these objections can be overcome to a greater or less degree by resistance in the neutral. Increased neutral resistance, however, while it limits the current flow through a grounded conductor and overcomes the above objections, can do so only by allowing an increase in the potential of the two good conductors above ground while the current flows. If the object in grounding is to prevent such an abnormal rise, the inserting of resistance tends to defeat that purpose. The choice of the proper resistance becomes a question of compromise between the disadvantages of going to either extreme. There seem to be good reasons for adopting a ground resistance which will lie between the following limits; on the one hand, large enough to prevent a severe shock to the system; or the voltage on the affected phase dropping to a point where the synchronous apparatus will drop out of step. This consideration will dictate a resistance that will not allow more than, say, three times full-load current at the most to flow through the armatures of the generators supplying the circuits. On the other hand, the resistance must be small enough to permit sufficient current to flow to trip the heaviest circuit-breaker on the system.

In all alternating-current circuits there is present a condition equivalent to a neutral grounded through a certain amount of resistance, in that static capacity exists between any conductor and ground. The longer the line and the higher the voltage and frequency, the lower the resistance in the equivalent circuit having a resistance in grounding connection. The effect of a grounded neutral, either with or without resistance, is, in case a conductor becomes grounded, to pass a current of greater or less volume through the affected conductor and into the ground. The effect of the static capacity of conductors to ground is exactly the same, the difference being that no current passes into the ground at the generating station, and that the phase relation of the current through the capacity to the electromotive force producing it is not the same in both cases. The static capacity of an overhead conductor to ground is, with ordinary line construction, from 30 to 50 per cent. greater than that between conductors. Assuming a fault that makes the affected conductor of the same potential as the ground, the affected conductor will take roughly 50 per cent. more charging current than the unaffected ones. It may be noted also that the total kilovolt-amperes of charging current in all conductors will be increased about 33 per cent. Where the normal charging current amounts to a considerable percentage of the total generating capacity, as it will in long, high-voltage, high-frequency lines, it will be seen that the condenser effect has the same action as a moderately low grounded resistance.

If a ground resistance be used the question of its current-carrying capacity is an important one. Since current is drawn through the ground resistance only during emergencies, its capacity should be chosen to meet the maximum that any emergency can throw upon it. Usually the time during which current will flow is limited to the time required to trip a circuit-breaker, probably not more than a few seconds at most. The quantity of current that will flow as a maximum is also fixed as that which is required to trip out the heaviest set circuit-breaker. The question of current-carrying capacity is therefore one which depends upon the character and setting of the safety devices used.

As to the character of resistance, permanency is the most essential. Considerable latitude is allowable in the amount of resistance, but that latitude does allow variations of many hundred per cent., such as past experience has shown is apt to take place with graphite mixtures of similar structures. A metallic resistance is satisfactory, but has the objection of being expensive and bulky when the voltages involved are high. This problem has not yet been satisfactorily solved, but it seems probable that where high resistances are demanded—200 ohms or more—some form of non-metallic resistance will be found of sufficiently permanent character to be satisfactory.

In the preceding matter the writer has endeavored to present some of the considerations to be taken into account when this question of grounding the neutral arises. There are so many variables connected with this matter that it is impossible to draw any conclusion that will be general in its nature. The proper action to be taken depends upon the specific conditions surrounding each individual case.

Electrical Operation of Sarnia Tunnel.

Machinery in the electric power house of the Grand Trunk Railway in Port Huron, Mich., was started up for the first time a few days ago. This power house, a part of the electrical equipment in the electrification of the Port Huron Tunnel, is 100 by 100 feet, two stories high, and of concrete, brick and steel construction. Two turbine-generator units of 2,500 horsepower each are installed. The boilers, coal handling apparatus and auxiliaries are of the most modern type.

Current from this power house will be used for operating trains through the tunnel between Port Huron and Sarnia, a total of nine miles of track, including side tracks. Besides, it will furnish light and power for pump houses, round houses and yards in Port Huron and Sarnia, and the shops, customs offices, sheds, etc. Arrangements have been made for 500 electric lights in the tunnel proper, and in the yards there will be 27 arc lights, and many incandescents in the buildings.

The electrification of the tunnel and the installation of the power house, distributing system and locomotives has been in progress the last year under the direction of the Westinghouse company. At present there are three large electric locomotives. All electric wires from the power house are led through a shaft into the tunnel. Bion J. Arnold was the consulting electrical engineer of the Grand Trunk Railway.

Industrial Education.

The first monthly meeting this season of the American Society of Mechanical Engineers was held in the main auditorium of the Engineers' Building, New York city, on the evening of October 8th. A little over 100 members were in attendance and the subject of the evening, "Industrial Education," was well presented. A short business meeting preceded the presentation of papers. A motion was made and carried that the Mechanical Engineers' Library Association and the American Society of Mechanical Engineers be consolidated into the one society, to retain the name of the latter.

The first paper of the evening, "College and Apprentice Training," giving the relation of the student engineering courses in the industries to the college technical courses, was by Prof. John P. Jackson of the State College of Pennsylvania. Its purport was set forth in the Western Electrician of last week.

Prof. Dugald C. Jackson of the Massachusetts Institute of Technology then spoke of the conditions in the college, how the men were already worked to over their limit and could not give thought to other lines than study, but that this is a serious fault and is being realized and rectified partially by some of the colleges. Professor Jackson then spoke upon post-graduate work. It was desirable to extend the four years' course into five or six. Very few of the engineering schools, however, possess facilities successfully to carry on this extension work with ample space and laboratory facilities. The Davis bill now pending in Congress allows money for each of the manual training and agricultural colleges in the several states. The money to be spent, however, is determined by an expert educational commission in each state. This question is of considerable moment, and influence should be brought to bear upon the respective representatives from the several states to modify this act.

Announcement was then made that Dr. Henry S. Pritchett, president of the Carnegie Foundation and also president of the Society for the Promotion of Industrial Education, was unable to be present, as had been announced.

The next paper was by Prof. C. F. Parks of Lowell Institute, who spoke upon the desirability of the education of the foreman, under whose care came so many young men, and also of the courses which had been established for their training. The courses require the attendance of the young man two hours on three or four evenings each week and an equivalent amount of study at home. The course extends over two years and includes the more elementary studies—mathematics, drawing, etc., and lectures illustrated with problems and tests on the work in hand. A large proportion of the men are draftsmen and mechanics, whose average age is about 27 years. Professor Parks concluded by stating that it was this kind of material that we needed in our industries and that it was desirous to educate them along these lines.

Mr. A. A. Hamerschlag next spoke upon the individual and the necessity of not forgetting the student in all of this development. He spoke very discouragingly of the apprentice courses as given in several large manufacturing companies, and stated that these courses were run to the financial betterment of the company, and that the returns to the student were far from satisfactory and did not represent the returns which the student gave to the companies. The apprentice gets into a certain restricted set, makes the foreman resentful, and upon the completion of the course is very narrow in his experience with any apparatus but that manufactured by the particular company under which he has labored.

A number of other speakers gave their views upon these courses, and the matter was left with many distinct views standing, representing the several interests at stake. Secretary Calvin W. Rice then requested that the matter be presented in a more definite form so that an expression of the society might be made.

Mr. F. W. Taylor of Philadelphia then spoke upon the condition of the student as he left college and compared his mind to a sponge. While at college he is taught to absorb all the knowledge that he can and as he leaves he still has this idea with him, that he must keep right on absorbing all the information that is possible. What he really needs is to be put at some real, hard, long, monotonous work, something that is dull and disagreeable but which will bring him into touch with what men of the business world have to contend with. It is this sort of training which is of value to the young graduating engineer. S.

The Grounded Neutral.[1]

By F. G. Clark.

During the consideration of the design of one high-tension installation the question of grounding the neutral was investigated and resulted in a decision to ground the neutral points of the generators through a limiting resistance. It was my privilege to contribute to that design and to recommend that this resistance be omitted. The reasons for grounding, the reasons for and against the resistance, and facts relatively to operation covering a period of over two years may therefore be of interest in connection with this discussion.

The installation comprises a power station centrally located for the ultimate conditions prescribed, but unfavorable to the preliminary electrification of a steam railroad requiring seven sub-stations, and underground and overhead transmission of three-phase current at 11,000 volts and 25 cycles. Fig. 1 will give an idea of the present and ultimate conditions. The future circuits from the power station will be underground cables. There are now five 250,000-circular-mil three-phase circuits leading from the station underground to No. 1 cable house. From there the feeders are aerial to sub-station No. 3. This will be seen to be the distributing point for the present installation. Two aerial circuits lead to sub-station No. 5. At cable house No. 2 the circuits are submarine, and again at cable house No. 3 submarine cables are used from the north end of the draw to the sub-station.

The feeders leading east and west from sub-station No. 3 are underground. Three circuits lead to sub-station No. 2, and from there two circuits lead to sub-station No. 1. Three circuits lead to sub-station No. 4 and are overhead from cable house No. 4. From No. 4 sub-station one circuit leads direct to sub-station No. 6 and another to portable station No. 1, and from there to No. 6. At portable station No. 1 a three-phase No. 2 conductor branch leads to sub-station No. 7. One circuit leads from sub-station No. 4 to portable station No. 2, and from there a single-phase No. 1 conductor circuit leads to transformer station No. 1. A typical location of this system and length of feeders is shown in Fig. 2.

The protective features are low-equivalent lightning arresters, inverse time-element relays on circuit-breakers, a peculiar method of operating exciters, and the grounded neutral. A voltage regulator has lately been installed and has a bearing on the situation.

The lightning arresters are used in connection with choke coils at the ends of all overhead feeders. They tend to protect the underground feeders, the station apparatus, and to a certain extent the aerial transmission lines from the effects of lightning and from static strains due to switching, grounds or short-circuits. The arresters are set to discharge at 8,500 volts. The pressure between the ground and two conductors of the 11,000-volt three-phase system, with one conductor grounded, is 11,000 volts when the neutral is not grounded; it is 6,380 volts when the neutral is dead grounded; it is between 6,380 volts and 11,000 volts with resistance in the neutral conductor. The locations of the lightning arresters are shown in Fig. 2.

The inverse time-element relays afford protection against overloads and are used in connection with the oil circuit-breakers on all feeders. The speed in opening the circuit-breaker varies with the increase of current in the circuit controlled.

The relays at the power-station ends of the feeders are set to allow a maximum of current to flow for a period of five seconds before they actuate the control circuits to open the circuit-breakers. This is just above the amount of current allowed as a maximum per feeder. The relays at the nearest sub-station are set to open the circuit-breakers on feeders to more remote sub-stations in four seconds for the same current. The relays in the sub-station next in progression are set for three seconds with the same current, and so on. The relays are connected with series transformers, one on each leg of the circuit controlled, to open the circuit in the event of one leg grounding.

The excitation of the generators depends upon induction motor generators, with no steam exciter or battery reinforcement, although both are available for starting up in case of an interruption. The induction motors are supplied from the main generators through transformers and have about 25 per cent. slip. The output of the exciters depends upon the power factor, which decreases with the voltage. The excitation automatically ceases whenever the bus-bar voltage goes below 5,000.

A voltage regulator tends automatically to increase or decrease the generator excitation as its voltage lowers or rises. The effect of this is to increase the intensity of the accidental overload and therefore hasten the automatic interruption. This is a radical change from the usual practice of holding up the exciter voltage under all conditions. It means a few more power-station interruptions, but less damage when short-circuits occur and less time lost in sub-stations.

The foregoing explanation of the protective features of this installation may appear to be irrelevant to a discussion of the grounded neutral, though it has a bearing which should not be overlooked. The neutral point of each generator is led to a bus-bar through a fourth pole of the generator circuit-breaker. The neutral bus-bar is connected to one end of a cast-grid resistance suitably insulated. The other end of the resistance is connected to a ground plate located in earth, kept moist with salt water. There is 6.7 ohms resistance, or sufficient to allow 1,000 amperes in the neutral circuit in the event of a ground. A current of 1,000 amperes will raise the temperature of the resistance approximately 1,000° F. in one minute. An ammeter on the switchboard indicates the amount of current in the neutral connection. A pilot lamp lights whenever 50 amperes or more flows through the resistance. This lamp remains lighted until an auxiliary circuit is opened and has been instrumental in determining the number of short-circuits that were also grounds.

The grounded neutral affords protection against rises in potential and high-frequency oscillations, due to grounds. An accidental ground will establish a power circuit supposedly sufficient in all cases automatically to open the circuit-breaker. Were the neutral not grounded, the accidental ground would allow the charging current to be discharged through it, tending to burn the insulation and cause a short-circuit in the case of an underground cable or burn off the conductor in the case of an aerial line. The electrostatic change would also tend to cause oscillations in the case of underground cables and possible breakdowns at various points of the system. This has occurred during the operation of several high-tension systems.

Grounding the neutral has the disadvantage of increasing the number of short-circuits and consequently the interruptions of service. These short-circuits are dangerous to power-station apparatus, as they may cause breakdowns involving greater expense and loss of service than the possible resonance troubles. There are conditions peculiar to each installation which have a bearing on this question, and these conditions determine the necessity of a resistance in the neutral circuit, the amount of resistance to be used, whether more than one generator should be grounded.

In systems where synchronous converters have low synchronizing power the voltage drop due to grounds will cause the converters to drop out, and a limiting resistance must be placed in the grounded neutral. In other systems the generator coils are insufficiently braced, and resistance in the neutral is a preventive for generator breakdowns. In stations where the generators are driven by slow-speed reciprocating engines the neutral points cannot be connected to a common bus-bar on account of cross-currents. A resistance would be required for each generator [illegible] neutral grounded.

A consideration of these [illegible] to [illegible] resistance of 6.7 ohms [illegible] that of the installation described. It was anticipated that the resistance would allow sufficient current to flow through the ground to clear the system of that ground, and that grounds on two legs or short-circuits would be cleared by the inverse time-element relays, or, if very close to the power station, by an interruption of service due to the "killing" of excitation. The events of operation indicate that the neutral ground is essential and that the other protective features perform their function suitably.

Conditions obtain, however, which [illegible] the proper operation of the protective feature. One instance will serve to illustrate this point. A wire-rigged sloop which had been anchored near the cable house No. 2 draw (Fig. 1) drifted out of the channel until a stay-line connected with one leg of the transmission circuit, causing a ground. The ground held for about three minutes, when the boat shifted and another part of the rigging connected with a second leg, causing a short circuit which opened the circuit-breaker. The current in the ground circuit was approximately 400 amperes, which was not sufficient to open any of the circuit-breakers between the ground and the power station. It was enough, however, to burn off an anchor chain and several of the wire stays on the boat and to raise the temperature of the neutral resistance to that of a bright-red heat.

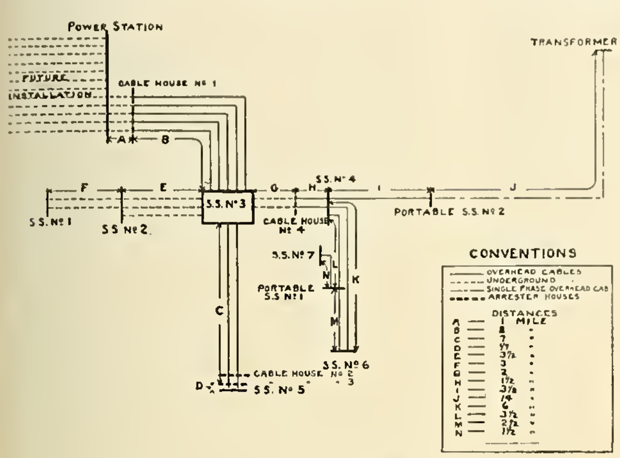


FIG. 1. POWER HOUSE CONNECTIONS.

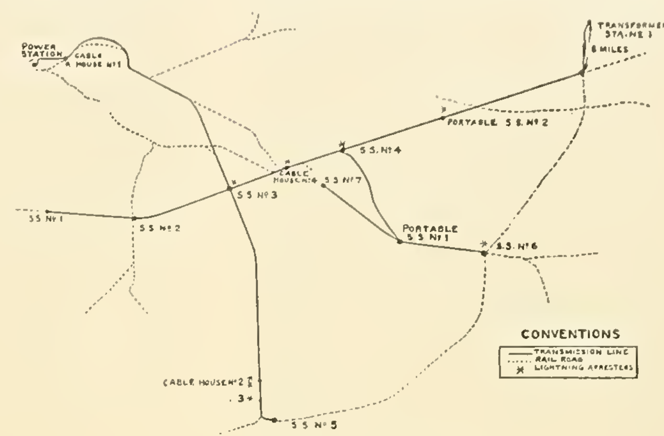


FIG. 2. FEEDERS FROM POWER HOUSE.

When the ground occurred the neutral point rose from 0 to about 2,700 volts, and the two ungrounded legs were approximately 9,000 volts to ground. The electrostatic condition very nearly approached that which would obtain in an ungrounded system. The lightning arresters being set at 8,500 volts, began to discharge, and oscillations were a possibility.

The inductive drop and the resistance of the ground added to the set resistance of 6.7 ohms were sufficient to limit the current to 400 amperes. With the 6.7-ohm resistance out, the current would have been above 650 amperes, or sufficient to have opened the nearest controlling circuit-breaker in less than one second. The inductive drop was about 1,000 volts and the resistance through the ground sufficient to divert the current to the numerous telephone lines as paths of least resistance. The fact that telephone troubles are not coincident with grounds of short duration would seem to indicate that induction is not an important factor in this particular case. There have been no indications of trouble in telephone or telegraph lines, due to induced potential.

Some action must be taken to prevent this ground current from causing trouble. The grounded neutral is a preventer of electrostatic troubles and therefore should be retained. The resistance is a positive detriment to receiving the full benefit of this effect. It should, therefore, be omitted whenever the local conditions will permit. In the case described, this can be done without perceptibly increasing the hazard to apparatus. This would enable the relays to clear any of the grounds that have occurred within five seconds.

A transmission line may be so long that its total drop and the resistance of the ground will produce a condition analogous to that described. Such a case would require special treatment, as, for example, providing a low-resistance neutral conductor leading to a point safely within the area normally protected by the neutral ground at the station and equipping the feeders to points beyond, so that they may be open by a relay. The relay could be actuated by a small current flowing in this extension of the neutral and in phase with current flowing in one leg of the feeder. Such a condition does not obtain on the system described, and we can therefore be reasonably assured that in removing the neutral resistance we will have removed the cause of trouble incident to the grounded neutral.

During two years' operation there have been over 70 short-circuits. About 25 of these have caused sub-station interruptions and six have been close

[1] A paper presented at the meeting of the American Institute of Electrical Engineers in New York, October 11, 1907. The author is superintendent of power station of the Pennsylvania Tunnel and Terminal Railroad Company at Long Island City, New York.

enough to cause power-station interruptions. About one-half of these short-circuits showed a ground connection. There have been 10 grounds, of which the neutral ground cleared eight. One held for four minutes and one for three minutes, both developing into two-wire short-circuits.

It is quite probable that in a system operating with underground cables only there would be no outside disturbances in connection with sustained grounds. The lead sheaths which are generally bonded together in manholes would provide the path of least resistance for the ground circuit. The ultimate installation will require underground cables, and except for the greater power effects and greater charging current will alter the present situation but little.

The American Institute of Electrical Engineers.[1]

By Henry G. Stott.

The American Institute of Electrical Engineers has over 5,100 members, of whom approximately 90 per cent. are residents of this country and 10 per cent. residents of foreign countries. Of the 4,600 domestic members, approximately 22 per cent. reside within one hour's travel of our national headquarters, and 70 per cent. within a distance which can be covered in twelve hours or less.

Our proceedings and transactions, available to all, undoubtedly are the most valuable asset of membership, but next to that may we not say that the social side ranks next in value? It is obviously impossible for us all to meet one another, as our domestic membership alone is distributed over a territory of 2,970,000 square miles. To meet this difficulty, however, the sections and university branches have been organized, so that now besides the national headquarters in New York, we have 20 sections and 17 university branches located at all great centers of membership. At these sections and branches not only are the papers presented at the New York meetings discussed, but original papers are also presented and discussed.

It will thus be seen that we are gradually evolving an organization somewhat similar to that of our state and federal governments, and as the process of evolution goes on, the constitution may have again to be readjusted to meet the new conditions.

Article I. of our Constitution speaks of the "advancement of the theory and practice of electrical engineering and of the allied arts and sciences."

When we look back over our Transactions for the last ten years, we cannot help being struck by the admirable way in which we find there recorded almost everything of note which has contributed to "the advancement of the theory and practice of electrical engineering," but so rapid has been the evolution of the theory and practice of electrical engineering, that the "allied arts and sciences" have been to a large extent squeezed out.

With every new application of electricity comes the demand for men who are not only specialists in that particular art, but who at the same time are electrical engineers, as, for example, in the applications of electricity to electrochemical processes, railways, illumination, transmission of power, mining, utilization of electricity in the numberless manufacturing processes, all of them calling for highly specialized knowledge in the allied arts.

It would therefore seem as if the time is now ripe for carrying out all the objects mentioned in our Constitution, and the papers committee is now endeavoring to broaden the scope of the Institute work without allowing their efforts to scatter too much. In order to assist in this work, some of the committee work has been reorganized. For example, the old high-tension transmission committee, which has done such excellent work, now becomes a sub-committee of the papers committee, and a new sub-committee on railways has been formed. Additional sub-committees will be appointed as necessity seems to require.

In accordance with the unanimous vote at the last annual convention, the board of directors has authorized the appointment of a committee on education to co-operate with other education committees in recommending a syllabus of studies for electrical engineers at our universities.

In furtherance of this work, a special meeting devoted to educational subjects will be held toward the end of this year, when those in charge of educational work will be free to devote some time to this most important subject.

In connection with educational work, we have available to our members not only our own library, but also those of the American Society of Mechanical Engineers and the American Institute of Mining Engineers, aggregating approximately 30,000 volumes, and forming the most valuable collection of technical works in the world. This joint library, however, is only open from 9 a. m. to 5 p. m.; but a movement is now on foot to change the present organization so as to make the library available up to 10 p. m.

When distinguished foreign engineers visit this country we have had no person or persons who could officially welcome them in the name of the American Institute of Electrical Engineers, so that this duty or pleasure has fallen heavily upon a small number of members, who have on numerous occasions acted as an unofficial reception committee. It would therefore seem as if it would lend to the dignity of these receptions, while giving authority to our members who are willing to incur the necessary expenditure of time and money, if a strong representative reception committee were appointed in each large city, so that our guests could be passed on from one city to another and thereby be saved a great deal of trouble, by finding immediately where they could see the particular apparatus or get the information they desired.

In conclusion, it now seems probable that our annual banquet will be held in January when we hope to have several distinguished guests address us, and I trust that the members of the Institute will remember that not only in our technical work, but in our social work, your officers whom you have elected need your constant support and encouragement.

1 Inaugural address (somewhat condensed) of the new president of the American Institute of Electrical Engineers, delivered the meeting in New York on October 11, 1907

Test of 7,500-kilowatt Westinghouse-Parsons Steam Turbine.

The following data comprise the principal results obtained during the eight-hour economy test on September 1, 1907, upon a turbine installed earlier in the year at Waterside Station No. 2 of the New York Edison Company. This test was conducted entirely by the New York Edison Company, under the direction of Mr. J. P. Sparrow, chief engineer. The various arrangements therefor were carried out in accordance with the mutual agreement between builder and operator entered into previous to the test, and the results, as herein given, were obtained by independent computation.

The turbine unit tested is of standard Westinghouse construction throughout. It has a maximum rated capacity of 11,250 kilowatts and was built to operate on 175 pounds steam pressure, 26 inches vacuum and 100 degrees superheat. Under these conditions, the turbine unit was guaranteed to have a minimum steam consumption of 15.9 pounds per kilowatt hour at the generator terminals with a normal speed of 750 revolutions per minute. Incidentally, the electrical efficiency of the generator was guaranteed to be 97.8 per cent., exclusive of friction and windage, at a load corresponding to that sustained during the test. The results of the tests, detailed below, show an economy about 7.5 per cent. better than the guarantee.

Methods of Conducting the Test.

Load.—During the test period, No. 2 Waterside Station sustained practically all of the 25-cycle load on the system, of which the unit under test carried practically 70 per cent., the remainder by the other turbine units in the station. This load was maintained as constant as possible by remote control of the turbine governor by the switchboard operator. Between the first and the last hours of the test, the maximum variation in load was held within 4 per cent. above and below mean. During the last hour, however, the load decreased somewhat. Previous to the test this turbine unit had been running on a load of 7,000 kilowatts, which was increased to its test load 10 minutes before the start.

Calibration.—Three-phase electrical load was measured by the two-wattmeter method, using two Weston indicating wattmeters of the standard laboratory type. These instruments were calibrated at the New York Electrical Testing Laboratories immediately before and after the test. Power factor was maintained substantially at unity, and all electrical readings were taken at one-minute intervals.

Steam Consumption.—As a surface condenser was used in connection with this turbine unit, the water rate was determined by weighing the condensed steam delivered from the condenser hot well. This condensation was weighed in a tank mounted upon platform scales, with a reservoir above large enough to hold the condensation accumulating between each weighing. These weighings of 12,000 to 13,000 pounds each were made at intervals of five minutes.

Gland Leakage.—By the loop method of connecting the gland water supply, the necessity for correcting condensation by an amount equivalent to the weight of the gland water used is avoided. It will be noted that a continuous gland water circuit is used entirely outside of the weighing apparatus, and that all overflow from the standpipe returns to the hot-well delivery.

Condenser Leakage.—As the circulating water is quite salt, any condenser leakage may immediately be detected by the salinity of the condensed steam, which should be pure distilled water. On this account, condenser was determined entirely by chemical analysis, employing the silver-nitrate test with a suitable color indicator. This method proved extremely sensitive, and possessed a decided advantage over the ordinary method of weighing the leakage accumulating during a definite period when the condenser is idle and under full vacuum. As samples of circulating water and condensed steam could be taken at the same time, this method made it possible to discover any change in the rate of condenser leakage taking place during the test, while the method of weighing, above described, provides only an average result during the period.

Hot-well Correction.—In this condensing plant the delivery of the hot-well pump is automatically controlled by a float valve in the interior of the hot well. This maintains the water level therein at a practically constant point, and hence no correction had to be made for difference in level of water in the hot well before and after the test.

Steam Supply.—Steam pressures and temperatures were determined close to the turbine throttle. As usual, the degree of superheat was obtained by subtracting from the actual steam temperature the temperature of saturated steam at the corresponding pressure carried at the time. All gauges and thermometers were calibrated previous to the test at the U. S. Testing Bureau. Both pressure and superheat were somewhat below the guarantee.

Vacuum.—Vacuum was measured directly at the turbine exhaust by means of a mercury column with a barometer alongside for reducing to standard barometer—30 inches. This also obviated the necessity for temperature correction between the two mercury columns. During the test the vacuum was not maintained quite up to normal.

Results of Tests.

The following data represent the results of the tests, calculated for the conditions as actually run; i. e., for instrumental errors only:

Duration of test	9:30 a. m. to 5:30 p. m.
Average steam pressure at throttle, lbs., per sq. in. gauge	177.5
Average superheat at throttle, degrees F.	95.74
Average vacuum (referred to 30 in. barom.) in. mercury	27.31
Average load on generator, kw	9,830.48
Average steam consumption, as tested, lbs., per kw. hour	15.15

Test Corrections.—Owing to the departure, during the test, from specific operating conditions upon which guarantees were based, it was necessary to correct the observed results by the following amounts:

Pressure (2.5 pounds high) correction, 0.25 per cent.; vacuum (0.69 inch low) correction, 1.84 per cent.; superheat (4.26 degrees low) correction, 0.29 per cent.

These corrections were mutually agreed upon previous to the test as representative of this type of turbine. When applied to the observed steam consumption given above, the following results, representing contract conditions, are obtained:

Av. corrected water rate during 8-hr. test	14.85 lbs. per kw. hr.
Guaranteed water rate	15.9 lbs. per kw. hr.

Log.—It is interesting, as a check upon the average figures above presented, to observe the results segregated into hourly periods. The load was considerably lower during the first and last hour than during the main part of the test. Neglecting, therefore, these two hours and considering only the six-hour period from 10:30 a. m. to 4:30 p. m., the results are as follows:

Average corrected water rate, six hours	14.8 lbs. per kw. hr.
Equivalent water rate	10.65 lbs. per bhp. hr.
Equivalent water rate	9.8 lbs. per ihp. hr.

The two latter quantities are determined by applying conversion factors for generator efficiency and for internal losses.

In connection with these tests, a noteworthy agreement exists between the results noted and those previously obtained from tests of machines similar in design installed in the Manhattan Station of the Interborough Rapid Transit Company, New York, and the Long Island City Station of the Pennsylvania Railroad. At the same loads and with equivalent operating conditions, the performance of the machines is almost identical. These economic results, while not exceeding in actual steam consumption the best records of European practice, yet are extremely good in view of the moderate operating conditions under which the test was conducted.

Rapid Building Operations.

There has recently been completed at Newark, N. J., a lamp factory for the General Electric Company. On the 24th of one month ground was first broken by the contracting firm doing the work, and on the 23d of the following month the building was finished and the manufacturers' machinery was being installed—a period of 29 calendar days—with no night or Sunday work, and a half holiday on Saturday for the skilled labor.

The cost of the factory was approximately $50,000, with a bonus and forfeit clause, and in one week of five and a half days the pay-roll amounted to $6,000. About this time 400,000 bricks were laid in 11 working days, or an average of some 36,000 bricks a day. It is interesting to note that 280 men were employed in building this factory.

Salmond Bros. of Newark, N. J., were the contractors for this work, and Messrs. Wilson, Harris and Richards of Philadelphia were the architects for the General Electric Company.

It is pointed out that the new metallic-filament lamps are particularly well adapted for the well-known portable self-contained electric lights, or so-called "electric torches."

The Direct-current System of Power Transmission.

A critical consideration of the high tension direct-current system of power transmission appeared recently in the Zeitschrift für Elektrotechnik und Maschinenbau of Potsdam, Germany. It is stated to be due to a well-known English engineer, who does not wish his identity to be disclosed. The author discusses the paper read recently by Mr. Highfield (briefly referred to in the Western Electrician of March 30, 1907, page 277) before the British Institution of Electrical Engineers, and objects to the relation obtained for the effects of insulation for direct and alternating current. He also contends that Mr. Highfield's figures for the erection and working costs are on the wrong basis, and makes out a much better case for the three-phase system. The following abstract of the paper in the German publication is taken from the Electrician of London:

It is a general characteristic in all tests on insulating materials that the disruptive voltage increases at a less rate than the thickness of the material. If a sheet of insulating substance breaks down at a certain voltage, the voltage required to break down a sheet double the thickness is much less than double that in the former case. This law is also applicable to liquids and gases. In all cases the proper relation between voltage and thickness is hard to determine, as it depends on the form, nature and size of the electrodes as well as on the temperature and general properties of the material. According to Baur, who made tests on a large number of materials, the relation may be expressed by the equation: $D = Kt^{2/3}$, where D is the effective voltage, t the thickness in millimeters, and K a constant which must be determined for each material. The specification of the Engineering Standards Committee for three-core cables with a working voltage of 11,000 between the cores requires an insulation thickness of nine millimeters between copper and lead. The three-core cable used by the County of Durham Company, whose working voltage is 20,000, has insulation 13 millimeters thick. The factory of safety for a power transmission cable is hard to determine, owing to the considerable influence which the length of time the current is flowing and other practical factors have on the result. It may be supposed, however, that under certain conditions the breaking-down voltage in these cables is about three times the working voltage. K then becomes in the first case 7,600 and in the second 10,800, or a mean value of 9,200.

It may, therefore, be admitted that with the present-day methods of manufacture, and using ordinary materials, the value of K for a finished cable is about 10,000. These relations, however, appear in a new light when it is stated that a sheet of insulating material of given thickness requires a voltage 2½ times as great to break it down when direct current is used instead of alternating. For the proper discussion of this question it may be supposed that a continuous voltage has half the disruptive strength of alternating. A cable was shown before the Institution of Electrical Engineers which was in use on a 50,000-volt direct-current system. This cable had an insulation thickness of 14 millimeters between conductor and lead sheath. The cable could, therefore, only be used for 25,000 volts alternating. The factor of safety would be 3, and K would be equal to 13,000. From further data given on this subject by the author it is shown that no such general law for insulation thickness at different voltages and with a certain factor can be given. The equation is of the order $D = Kt^n$, K being a constant depending on the insulating material. The exponent n is always less than 1 and decreases rapidly with increasing diameter of conductor. No such law can be established for cables insulated with different materials.

In the sketch of the typical bulk-supply area given by Mr. Highfield the direct-current system working at 100,000 volts requires 84 miles of cable 0.1 square inch in cross-section. The system can be earthed at the middle point, so that there is only a pressure of 50,000 volts betwen conductor and earth. Trenching running to 84 miles is also required. The three-phase system working at 20,000 volts between conductors requires 52 miles of three-core cable, each core having a cross-section of 0.75 square inch, and 66 miles 0.5 square inch in cross-section. Earthing the neutral point requires the insulation between conductor and lead sheath to withstand 11,500 volts. Trenching amounts to 85 miles in this case.

Mr. Highfield put the total cost of the direct-current cable at £580 per mile, which is 1.57 times greater than that for the material alone. This factor will be greater for the three-phase cable, and may be taken as 1.8. Mr. Highfield puts the cost of the two three-phase cables required at £1,050 and £900 per mile. In reality they only cost £784 and £608 per mile. The costs for trenching were given as £900 per mile for direct current and £1,000 per mile for three-phase. These two items were shown in the discussion to be too high; they are sufficiently covered by £700 per mile, even taking into account the special conditions prevailing in the neighborhood of London, where the requirements of the property owners have to be considered. The total cost for mains in this scheme would be £107,000 for direct current and £141,000 for alternating, a difference of 32 per cent. According to Mr. Highfield, the amounts would be £124,320 and £199,000, a difference of more than 60 per cent.

The employment of direct current is, accordingly, only to be recommended from a commercial point of view when the network expense are small compared with the three-phase system. The greater part of these economics are, however, imaginary, and in nowise cover the higher costs of the direct-current generating station.

The following points in the paper are open to criticism: The units chosen for the three-phase system should be larger and those for the direct-current system smaller. The largest units at present working on the direct-current system are only 600 kilowatts (Moutiers-Lyons), and, except for these, the largest is 400 kilowatts. The buildings costs will, therefore, become smaller in the case of the three-phase and larger for the direct-current system. This also applies to the cost of the machinery proper and to the switch gear. The costs for boilers, auxiliary machinery and coaling arrangements given by Mr. Highfield for the direct-current system are too low, as the greater number of smaller units increases the steam consumption. The lower efficiency of the direct current system requires that a greater number of units must be generated for the consumer to receive a specified amount than if a constant-voltage system were employed.

Owing to the peculiar conditions of the direct-current system, the distribution losses are always the same. Therefore the efficiency of transmission is low at light loads and high at full load. As far as upkeep costs are concerned, direct current is at a disadvantage for the following reasons: The distribution losses are the same at all loads, and therefore the percentage loss increases as the load decreases. On a constant-voltage system the reverse is the case. The percentage loss on the direct-current system may be very small, being placed by Mr. Highfield at three per cent. at full load.

The author concludes by stating that no great future can be predicted for the direct-current system.

Arc and Incandescent Lighting Compared.

By W. D'A. Ryan.

The only logical comparison of candlepowers for various illuminants, particularly for interior lighting, is the mean spherical, whether it be that of incandescent, arc, mercury or other lamp. Suitable reflectors may be used to change the distribution of the light on any of the lamps to meet the conditions, with the possible exception of one which has such a strong vertical distribution that it is difficult to change its direction without serious loss. The common practice of figuring illumination on the initial candlepower basis should be discouraged. Some poor examples of illuminating engineering are monuments to this practice, and the arc is frequently discredited by a false conception of this important point.

Briefly, in figuring illumination, about 10 per cent. should be added to the initial illumination of the arcs, and about 20 per cent. to the incandescents to cover depreciation, globe deposit, etc., thereby representing service conditions.

Over a period of 1,000 hours, under all conditions of operation, we can say that the multiple enclosed arc lamps, whether alternating or direct current, will run between two and three watts per mean spherical candlepower. This covers a wide range of currents, and also the variations due to carbons, feeding, globe deposit, etc. Compare this, for example, with the standard incandescent lamp of 3.1 and 3.5 watts per horizontal candlepower, with clear bulbs. The former has a mean spherical efficiency of 3.76 watts, initial, and the latter 4.24, initial. After the lamps have burned to the limit of their so-called useful life, namely, to the point where the candlepower is 80 per cent. of the initial, the efficiency of the former is 4.5, and of the latter 5.1 watts per mean spherical candlepower. If these lamps were frosted to conform with the prevailing demand, the figures would stand nearer 5 for the former, and 5.5 for the latter. Furthermore, it is not customary immediately to remove lamps when they reach 80 per cent. of their initial candlepower, so it is safe to say that the standard incandescent lamps, of the initial efficiencies mentioned, will average, over a period of 800 to 1,000 hours, anywhere from four to six watts per mean spherical candlepower, with a renewal cost of from one-half to six-tenths of a cent per kilowatt-hour, as compared with 0.2 to 0.3 cent per kilowatt-hour for the maintenance of the arc lamp. This gives for the arc lamp practically double the light under service conditions, over the period of time mentioned. Notwithstanding the difference in efficiency, there are many cases where arcs are used when incandescents would give better results, and vice versa. It is not altogether a question of efficiency and cost, but a question of adaptability to surroundings.

Now, while the Gem lamp with clear bulb shows [illegible] an improvement [illegible] to 20 per cent [illegible] lamp [illegible] somewhat [illegible]

The tantalum lamp [illegible] limitations, the cost is relatively high [illegible] under the circumstances, the improvement in efficiency is not sufficiently great to warrant its replacing Gem lamps to any considerable extent, especially where the cost of current is low.

The tungsten lamp promises to rival the arc in initial efficiency. We have no evidence as to whether or not it will be its equal or superior under running conditions, that is, the service condition, with the time factor introduced. Furthermore, we know that where a white light is necessary, the tungsten cannot compete with the carbon arc, notwithstanding the somewhat general impression to the contrary, based possibly upon casual observation of exposed lamps, and not on actual color-selection test. On the other hand, the light is rather cold for domestic purposes. It promises, nevertheless, to revolutionize commercial lighting, but there is no reason why we should surrender the advantages of the arc lamp for all classes of lighting until we actually have a fair substitute.

I might state that it is the purpose of the illuminating engineering department of the General Electric Company to disseminate accurate and useful information in connection with the subject, and to be absolutely impartial in specifying apparatus, whether incandescent, enclosed arc, magnetite, tungsten, or other illuminants; it is only on this basis that illuminating engineering can properly progress.—From the General Electric Review.

Western Society of Engineers Discusses Telephone Rates.

The first regular meeting of the Electrical Section of the Western Society of Engineers for the 1907-08 session was held in the society's rooms in Chicago on the evening of October 11th. The meeting was devoted to the reading of a paper on the subject of "Telephone Rates for Large Exchanges," by Mr. W. H. Crumb of Chicago. There was not a large attendance, but the paper was attentively listened to by those present, and was briefly discussed by K. B. Miller, consulting electrical engineer; W. F. Burgess of the Chicago Telephone Company; C. A. S. Howlett, chairman of the Electrical Section, who presided; Prof. C. E. Freeman and others.

Mr. Crumb made no pretense of a suggestion as to what particular telephone rates should be, as such a determination is only possible after careful consideration of the many questions which must be given attention in order properly to establish equitable rates for large telephone exchanges. Much of the information and the charts and curves given in the paper were included in the report made by the special commission which recently reported on the telephone situation in Chicago to the City Council.

It is the duty, the speaker said, of any corporation giving telephone service in a large city, thoroughly to develop the territory and give good service at reasonable rates. This duty involves a problem in many respects more complex than that of any other public-utility corporation, partially because of the personal element, partially because of the varied classes of service necessary and partially because of the intangible character of the electric medium with which the telephone business is carried on, the delicacy of the apparatus used and the wide difference in the manner and extent of the use of the apparatus by the various subscribers.

The great problem which confronts all telephone companies, Mr. Crumb said, is that of supplying a good quality of telephone service to the small user at a price which he can afford to pay and still leave a fair margin of profit for the company. The price must be so graded that the large user shall not pay less than his fair share of the expense of maintaining the service and that the small user shall get service at a price within his means, the figures for both classes to leave reasonable remuneration. After going thoroughly into the engineering and business requirements necessary to successful and efficient operation of a telephone system in a large city the speaker outlined the two systems of charging—the flat-rate method and the measured-service method, the latter being favored by the speaker as the solution of the rate question in large exchanges.

In the interest of good service, economy of production and uniform justice in charging for the different classes of service, Mr. Crumb said that the measured-service plan is much to be preferred to the flat-rate plan. Maintenance expenses are very largely directly due to traffic, and all maintenance expenses must be considered as being directly or indirectly due to traffic and therefore distributed in proportion to the traffic. The same was said to be true of general expenses and fixed charges.

Depreciation and insurance on portions of the plant which are not economically underwritten by insurance companies are items of expense in producing telephone service which are often neglected or underestimated in the consideration of rates. Much of the depreciation on a telephone plant is directly caused by traffic. This is especially true of the depreciation of equipment; also depreciation due to the advancement of the art, as traffic often demands that present equipment and methods be replaced by more modern ones before those in use are worn out. The depreciation on parts of the plant which cannot be directly traceable as a result of traffic are indirectly due to it, as the object of the plant is to provide for traffic, and therefore depreciation charges should be classified in proportion to the traffic.

In order, therefore, to determine the proper rate to charge, Mr. Crumb said, the cost must first be ascertained for each class of service offered, and to do this means a careful investigation and determination of many questions. It means particularly that telephone companies must pay more attention to the results of their peg counts, and that they must be made in such a way that they will furnish the information necessary for the accurate fixing of rates. This complex problem offers many interesting opportunities to the telephone engineer, and Mr. Crumb hoped that the great telephone companies of the large cities would soon set about a means of determining the exact cost of the different classes of telephone service, so that it may be furnished without discrimination in charges to any class. "Not until our great telephone companies can truthfully say from their own knowledge that they are doing this can they claim to be discharging the duty which they assumed upon entering the telephone business."

In the brief discussion of the paper measured service was generally favored. One speaker believed that in working out a system of rates it would eventually be found advantageous to bring in a consideration of time unit and wire unit, but others thought that this would mean a complex system of individual rates; a classification of individuals charged on a measured-service basis would be complicated enough without involving the units of time and distance for each message.

Indiana Telephone Items.

The Richmond Home Telephone Company has moved into its new building and put its new automatic system in operation on the 15th inst. The Central Union Telephone Company, which has maintained a small exchange in Richmond, may turn over to the Richmond Home company all of its business and retire from the field.

The City Council of Martinsville will take steps toward inducing the Martinsville Telephone Company to make improvements necessary for an improved service. The company is owned by the New Long-distance Telephone Company, and the managers say they are quite willing to put in a new system in consideration of the city granting an extension of franchise for 25 years after the termination of the present franchise, 12 years hence. The company also asks to be permitted to increase the rates.

The filing of a suit in the Superior Court of Indianapolis by the New Long-distance Telephone Company against the Citizens' Telephone Company of Kokomo and the Central Union Telephone Company of Indianapolis, seeking an injunction and recovery of damages, is said to be the beginning of a big legal battle between the two big companies operating in the state. The New Long-distance Telephone Company, complaining of the two defending companies, alleges that it has an exclusive contract with the Citizens' Telephone Company of Kokomo to handle all of its long-distance business during the life of that company's franchise in Kokomo. It further alleges that in July, 1906, the company began affiliating with the Central Union Telephone Company and giving a portion of its business to that company in violation of the exclusive contract. S.

Telephone News from the Northwest.

The State Telephone Board of South Dakota has ordered a connection between the long-distance lines of the Independent Telephone Company of Yankton, S. D., and the Elk Point Telephone Company of Elk Point.

The State Railroad Commission of Wisconsin has ordered free telephones furnished to railroads to be discontinued, on the ground that such procedure is a discrimination in favor of the railroads and against the people who pay for their telephone service.

The Enderlin Telephone Company, Enderlin, N. D., has been incorporated with $50,000 capital stock.

Officers and managers of local branches of the Northwestern Telephone Exchange Company met at Fargo, N. D., to consider matters pertaining to the business. There was an attendance of 20. A banquet marked the closing of the meeting.

The Wisconsin Telephone Company has merged the Eau Claire and the La Crosse districts into the larger Eau Claire district with P. J. Skolsky as district manager with headquarters at Eau Claire as formerly. The new district comprises 23 counties and portions of two others, and has 17,000 instruments in 144 cities and villages.

L. A. Little has sold the Missouri Valley (Iowa) telephone exchange to W. A. Smith. R.

Independent Telephone Growth in Texas.

Austin, Tex., October 10.—The Independent telephone movement is having a steady growth in Texas. In addition to the long-distance and local telephone lines already in operation, applications for franchises for the establishment of systems are now pending in a number of towns and cities of the state. Franchises have been recently granted at Amarillo, McKinney and Granbury.

A syndicate has made application to the city commissioners of Dallas for a franchise for an Independent telephone system for that city. The applicants announce that they are prepared to expend from $1,500,000 to $2,000,000. The applicants are Captain A. J. Brown, John A. Barnard and C. F. Freeman of Dallas, and E. L. Swaine and F. J. Norris of Los Angeles. Mr. Swaine was formerly general manager of the Home Telephone and Telegraph Company of Los Angeles, Cal. Mr. Norris was formerly general auditor of the Los Angeles Independent Company. These two men are now in Dallas.

In their petition to the city commissioners for a franchise in Dallas the applicants call attention to the phenomenal development in the telephone field since the Independents gained a footing. They say that Independent systems are now in operation in many towns and cities of Texas, among them being Fort Worth, Waco, San Antonio, Abilene, Ennis, Waxahachie, Hillsboro, Weatherford, Sherman, Paris, Denison, Gainesville, Cleburne, Denton and Palo Pinto, and the building of an Independent telephone system in Dallas will aid in the development of the city to a greater degree than any other public utility at the present time. H.

International Independent Telephone Convention.

The annual convention of the International Independent Telephone Association will be held at the Coliseum, Chicago, on January 21, 22 and 23, 1908. This date is during the period of the third annual Electrical Show, and in connection with the exhibit of other electrical lines the Independent telephone manufacturers have arranged to make a large combined exhibit of telephones and telephone apparatus and will occupy the entire annex, containing over 10,000 square feet of floor area. This, it is said, will be the largest and most complete exhibit of telephones and telephone devices ever held at any one time.

GENERAL TELEPHONE NEWS

The Home Telephone and Telegraph Company of Lemmon, S. D., has been incorporated.

The Dakota Central Telephone Company seeks an extension of its franchise in Huron, S. D., and contemplates installing an automatic system.

The Michigan State Telephone Company reports a total of 130,884 subscribers as of July 31st, an increase of 499 subscribers for the month of July.

Frank Hafliger of Pekin, Ill., has been appointed manager of the Delavan office of the Pekin Telephone Company, succeeding W. K. McQuown, who is transferred to the office at Havana.

Among the telephone companies recently incorporated are the Stakes Plains Telephone Company of Lubbok, Tex., the Manitou Telephone Company of Manitou, Okla., and the Miller Telephone Company of Miller, Neb.

The Chicago Telephone Company reports a net gain of 1,923 in September in the number of its telephones in service, 1,325 being installed in the city. At the end of the month the company had in service 196,022 telephones, of which 140,770 were in the city.

The Salt Lake Telephone Company is exerting itself to get a permit to erect poles in Carson, Nev., and the Nevada Consolidated Company, organized by men of Carson, is also working for a telephone franchise there. The Sunset company has heretofore been the only one in the field.

Telephone users in Milwaukee representing various lines of business have forwarded a complaint, with 42 signatures, to the State Railroad Commission, asking for remedies for alleged "poor, insufficient, inadequate and unreliable telephone service" furnished by the Wisconsin Telephone Company.

When Charles Sumner, president of the Home Telephone Company, reaches Spokane from the East early in November it is given out that a contract will be entered into with the Interstate Telephone Company for local and long-distance connections, thus furnishing lively competition for the Pacific Telephone and Telegraph Company. The Interstate lines now reach a large number of points in the Spokane country, an area of 150,000 square miles in Eastern Washington, Northern Idaho, Northeastern Oregon, Southeastern British Columbia and Western Montana, and as soon as the lines now under construction and projected are completed the company will cover the bulk of the Pacific field in the Inland Empire.

CORRESPONDENCE.

Continental Europe.

Paris, September 28.—The new Lötschberg electric railway and tunnel, which is now in construction in Switzerland, will rival the Simplon line in interest, and will no doubt carry a heavy freight and passenger traffic. As upon other main lines, there will be run trains of different classes which will be distinguished by their destination, weight and speed. Among these will be trains designed for passengers only and for loads which do not exceed 300 tons. There will be a class of local passenger trains and also freight trains. As to the express and freight trains, they will use electric locomotives, according to the present project, but it is possible that motor cars may be used for some of the passenger trains. The system of electric traction which is to be used on the Lötschberg road is not as yet decided upon, and the choice now lies between the direct-current, three-phase or single-phase systems. On the Simplon road three-phase current at 3,000 volts is employed, but it is to be remarked that the choice was made simply because there were locomotives at hand which had been built on the type of the Valtelline locomotives, and it was desired to use these, otherwise the line could not be set working within a reasonable time. Neither technical nor economic reasons therefore led to the use of the present locomotives, so that for the Lötschberg road the question can be looked into much more carefully before coming to a definite decision. At the same time the Swiss government commission is collecting data on the same subject with a view to applying electric traction on the main lines throughout the country, and it will be an advantage to wait for the result of their researches.

As to the expense of operating the line, the comparative data indicate that the cost, compared with steam locomotives, which, besides, cannot be used here upon the 27 per cent. grade, will be somewhat lower, allowing for a heavy traffic, in spite of the higher first cost. According to estimates, the annual traffic on the new line will no doubt be at least 277,000 passengers and 500,000 tons of freight, counting one direction.

Among the new electric systems which are now being installed on the Continent I may note the new plant and line construction under way at Ougree, Belgium, where the municipality decided not long ago to operate such a plant by contract with a private company. The latter is known as the Liège Electric Company, and is to furnish the needed current at 6,300 volts. This current is delivered at a certain point in the town, and the municipality will undertake the rest of the work, including the transformation and the city lines for public and private lighting and motor current.

The postmaster-general at Adelaide, Australia, is to receive bids up to the end of the year for a central telephone outfit and 3,000 subscribers' instruments.

Preparations are being made at Lyons for an exposition and concourse of electric motors, to be held next year. The object is to bring out the best types of motor for use in small shops and for domestic purposes, and the Agricultural and Scientific Society is taking it in charge. An exposition of this kind was held in 1906 and was quite a success. Agriculture is to be one of the leading points to be considered this time. Lyons is the center of a region in France which is covered with networks of lines from hydraulic plants, so that motor current can be had at a low rate, and this gives a great field for the use of small motors.

A. DE C.

Great Britain.

London, October 4.—The Victoria Falls power scheme is always interesting, and that is the excuse for mentioning some remarks which have been made by Mr. Ralph D. Mershon, one of the consulting engineers, on his arrival in this country from South Africa. Mr. Mershon has not the slightest doubt that such a transmission scheme can be made profitable, an opinion based to some extent upon experiments with high voltages in 1897 and again three years ago. He further stated that everything that has occurred in connection with transmission at high voltage since his first report to the Victoria Falls Power Company has confirmed his first opinions as to the practicability and economy of the project. It cannot help being remarked, all the same, that the company continues to extend its steam stations. The enormous possibilities of the Victoria Falls, however, are such that from a personal inspection Mr. Mershon is satisfied that 300,000 horsepower is available, and if means were taken to conserve the water some little distance back from the falls there would be a further large addition to the power.

An interesting case of co-operation on the part of shopkeepers to improve the lighting of their thoroughfare and at the same time to make this of commercial value comes from Newcastle. A number of the shopkeepers in a prominent street joined hands and ordered 40 flame-arc lamps primarily to light the thoroughfare, but also incidentally to attract business. This action has been taken quite independently of the street-lighting authority, in fact the order has been given to a local power company.

Two further reports of British manufacturing companies are interesting in the present condition of affairs. The British Thomson-Houston Company shows a trading profit for the year ended March 31, 1907, of $75,000, but the whole of it, with the exception of a small sum carried forward, has had to be applied to various depreciations. Willans & Robinson, on the other hand, continue to draw themselves out of the financial troubles which threatened to extinguish them a few years ago, when the popularity of the steam turbine first had a detrimental effect upon the use of reciprocating engines. Having been driven to the necessity of reducing their capital, the company is able for the half year ended June 30, 1907, to pay a dividend of six per cent. upon its preference shares and 10 per cent. upon the ordinary shares. The net profit amounted to $80,000.

At the end of last week the subscribers, numbering about 20,000, on one of the largest London telephone exchanges were transferred to a new exchange building and plant within 15 minutes. To effect this without appreciable interference with the subscribers it need hardly be said that months of preparation had been required.

Inasmuch as a general railway strike would affect electric as well as steam railways, the position as between the railway directors and the men's union is of interest. The point under discussion is that the Amalgamated Society of Railway Servants demands to be recognized as the medium for laying the men's grievances before the directors, and the latter reject any such idea. Since the present acute position arose none of the directors has expressed any views but Sir George Gibb, the successor to Mr. Yerkes, upon the board of the Underground Electric Railways Company of London, has definitely declined to receive any deputation from the society at present. G.

Dominion of Canada.

Winnipeg, Man., October 12.—The ratepayers of Kenora, Ont., passed the by-law authorizing the expenditure of $75,000 for the completion of the waterworks and power plants. C. S. Draper can give information.

Cecil B. Smith, who has charge of the construction of the $3,000,000 power plant to be built by the city of Winnipeg, states the tenders received are satisfactory and are now being tabulated. Under the agreement, the successful bidders will be required to have the work completed within 27 months. The dam will be built so as to give 60,000 horsepower, but for the present machinery will only be put in for a 25,000-horsepower development. It is understood that the Anglo-Canadian Engineering Company of London, England, has bid on the work in bulk and offers to take Winnipeg debentures at 90 in payment for the work if its bid is accepted.

The gross receipts for the Toronto electric street railway for the financial year ended August 31, 1907, were $3,349,819.94, being an increase of $372,280.85 over the gross receipts for the previous year. The percentage paid to the city for the fiscal year ended with August 31st last was $409,964, as against $336,630.86 for the previous year. The gross increase in the receipts amounted to 11 per cent. and the city's percentage was increased 21 per cent.

Several weeks ago the Town Council of Revelstoke, B. C., advertised tenders for an auxiliary power plant of 300 horsepower. A large number of tenders were received from all over Canada, as well as some half dozen from American firms. The contract has been awarded to the Canadian General Electric Company, the price being $25,764. The new generator will be 60-cycle, 150-kilowatt, making 600 revolutions per minute. Superintendent Holden will have charge of the work of installation on behalf of the town.

The Bell Telephone Company has put in a large switchboard at the Canadian Pacific Railroad depot at Winnipeg. In future all the offices and yards of the company will receive telephonic communication from this switchboard. R.

New England.

Boston, Mass., October 12.—The receivers of the National Wire Corporation of New Haven, Conn., state that they expect to be able to realize $1,000,000 from the sale of the property and from the cash on hand. The liabilities of the company amount to $3,000,000.

The Connecticut Street Railway, which is practically a holding corporation for the New York, New Haven and Hartford Railroad, now operates 640 miles of street railways in Connecticut. Four hundred and eleven miles are owned outright, while 229 miles are leased. It serves 15 cities and 35 towns in Connecticut and five towns in New York state.

The express business is soon to be increased on both the Connecticut and Rhode Island street railways. Together with the express business, a development of freight business is contemplated. The companies will work in connection with the steam system of the New Haven Railway Company.

The Chicopee Manufacturing Company of Chicopee, Mass., is installing new spinning frames and a new generator of 800 horsepower. These new machines are to be driven by electricity. Twenty have been installed and 30 more are being prepared for use. Each machine has an individual electric motor. These machines will increase the output of the mill about 50,000 pounds a week. B.

New York.

New York city, October 12.—An important decision was handed down by the Supreme Court last week by which it is held that the Interborough Rapid Transit Company and the New York City Railway Company must pay the city of New York for the electric current used by the latter company in running the surface cars operated in connection with the subway. The court also restrained the Interborough Company from delivering power to the City Railway Company and the latter company from using, disposing or selling the current so obtained. An interlocutory judgment was also issued on condition that an immediate appeal be taken by the two railway companies from the decision. This action was brought last November by the Board of Rapid Transit Commissioners, which asserted that the Interborough company, which operates the subway, was violating the provisions of its contract with the city in supplying electricity to a subsidiary corporation which operates surface cars running from the Bronx to the upper part of Manhattan.

Next week the Public Service Commission will begin its investigation of the electric-lighting and power companies, paying particular attention at the first meetings to the methods of the New York Edison Company in dealing with its customers. It is expected that the investigation will last several weeks. Since its inception the commission has been in receipt of complaints from consumers of electricity, who assert that it is impossible for them to get fair treatment from the supply companies. Some of the questions that will be brought up will be the right of the supply company to turn off the service whenever a controversy arises and not restore the same till all questions in dispute have been settled; the right of the supply company to require the consumer to sign up a contract for one year or other specified period before service is given them, and other questions which the consumers desire to have settled to their satisfaction.

Lieutenant-commander Davis, the wireless expert of the United States Navy, has just returned from Norfolk, where he has been inspecting the wireless telephone installations, and he appears to have been favorably impressed. At present the Connecticut and the Virginia are the only ships equipped with wireless telephonic transmitting apparatus. It is also reported that the wireless-telegraph operator on one of the Old Dominion lines picked up the wireless telephonic waves when off shore about 20 miles. The cruiser Tennessee also was able to keep in touch with the instruments of the Navy Yard at a distance of 12 miles. The report that the regular wireless communication with the New York Navy Yard had been established through the completion of the Wallabout Bay station is rather premature, but Commander Davis expects to have it ready within a short time. The De Forest system is the one employed in all of this work.

Work of concreting the interior of the second or south tube of the Belmont Tunnel under the East River at Forty-second Street is about completed, and it is expected to run a car through this tube within the next few days. An experimental car is now running in the completed north tube, and has been for some time, and it is expected to switch this experimental car over to the south tracks when completed.

The Jersey City terminal station at Exchange Place, Jersey City, of the McAdoo Tunnel, is practically completed in the rough, and the tunnel through to Cortlandt Street has been driven about 85 per cent. of the distance between the two terminals. The date for completion is fixed at September 1, 1908. Exchange Place station has been cut out of solid rock to a depth of 85 feet below the surface of the street. Thousands of pounds of dynamite have been used in this blasting, but not one life has been lost. The station will be 150 feet in width and 1,000 feet long, counting the approaches. There will be four and in some cases five parallel tracks, two for express and two for local trains. E. H. S.

Ohio.

Toledo, October 12.—Conditions generally are rapidly resuming a more prosperous outlook here and it now seems probable that the latter part of the season will make up in some sense for the depression that has been prevalent here this summer.

The laying of rails on the Bucyrus-Marion electric railway has begun, the work being started at the Forks just north of Marion. Grading is progressing satisfactorily, although the company needs about 20 more teams.

A new electric sign has been installed at the People's Credit Clothing Store at Dayton. It is out of the ordinary and is the first to contain McDougall's latent patent feature of reflecting the light, making a saving in current.

A contract has been entered into with the Grave Electrical Company of Dayton for the extending of electric lights on all streets of Fort McKinley subdivision. This is the only suburb lighted with electric lights from its own plant.

Herbert C. Warren, new general manager of the Toledo and Indiana Railway Company, has strictly forbidden the use of liquor by employes while on or off duty.

The Marion Electric Supply Company installed two attractive signs in that city last week—one for William M. Jackson, in the Huber block, and one at its own establishment on Main Street.

The city of Mansfield is constructing a number of electric arches for street-lighting purposes. It is hoped to have the work completed by the time for holding the Feast of Ceres in the near future.

Dayton is fast becoming noted for its beautiful electric signs. The latest and one of the most beautiful is now being erected on the Krug Building on South Main Street. Nearly 1,000 red, white and blue electric lamps are so arranged and operated by a specially built electric machine that the waving of a United States flag is represented.

According to the first report from the office of the State Railway Commission, there are in Ohio 2,646 miles of interurban railway. Their capital stock is $114,216,225, and funded debt $82,926,000. The total cost of construction and equipment was $171,463,925, and their gross earnings for the year were $12,256,659, with net earnings of $4,885,334.

A complete new system of fire alarms is being installed at Canton, Ohio, by the Gamewell Fire Alarm and Police Telegraph Company.

A meeting of the Sixth District of the Ohio Independent Telephone Association will be held at Toledo on December 3d. Officers will be elected and delegates chosen to the conference of the international association, which will be held in Chicago in January. H. L. S.

Illinois.

Peoria, October 12.—The McMeen Electric Company of this city has been incorporated with a capital of $10,000 to manufacture electrical supplies. The incorporators are Roland C. Becker, J. E. McMeen and R. P. Squires.

The Antioch Electric Company of Antioch has been granted incorporation papers, to manufacture and sell electricity. The capital is $15,000 and incorporators, Hiram H. Kellogg, Jay R. Cribb and John K. Cribb.

The Ajax Battery Company of Chicago has been incorporated with a capital of $25,000 to manufacture and sell batteries. The incorporators are W. B. Davis, C. E. Gaylord and W. T. Jones.

A report comes from Dubuque that the Illinois Traction Company is planning to build a road from Galena to that city. The proposed line is to be an extension of the line from Freeport.

The village of Peoria Heights is now without street-railway service as a result of the failure of the Peoria Railway Company and the village to agree on a franchise. A compromise ordinance will undoubtedly be agreed upon before the time limit to remove the tracks expires.

The Brinkerhoff ordinance has been laid over for a week by the Springfield City Council, as the committee wished to make some changes as to the rates to be charged. V. N.

Northwestern States.

Minneapolis, October 12.—Work has been completed on the Fort Dodge, Des Moines and Southern Interurban line from Des Moines to Fort Dodge, Iowa.

The Boone-Webster City (Iowa) Interurban Company will file articles of incorporation shortly, capital $600,000. J. S. Crooks of Boone is secretary.

The Waterloo, Pella and Southwestern Railway Company is being organized with the intention of building an electric railway from Waterloo to Chariton.

Plans are on foot at Aberdeen, S. D., to construct trolley lines into the country surrounding that city.

The new street-railway system at Sioux Falls, S. D., has been placed in operation.

Grading is practically finished on the new "Arrow Line," which is to be built from the twin cities to the head of the lakes by the Twin City and Lake Superior Electric Railway Company.

W. A. Marin has been granted a street-railway franchise at Crookston, Minn.

W. M. Barnes of Des Moines, Iowa, is investigating conditions at Aberdeen, S. D., and may apply for a lighting franchise. R.

Pacific Slope.

San Francisco, October 9.—The strike of linemen and outside electrical workers which threatened for a time to tie up the operations of all the hydroelectric plants of the Fleischhacker system in the state of California as well as to prevent the starting up of the new City Electric Company of San Francisco, has been settled by the signing of an agreement which gives the employes $4.50 a day of nine hours.

There is no foundation for the reports recently published in local papers to the effect that Colonel Holbrook had received an offer from the Southern Pacific Railroad Company for natural gas from tracts of oil land eight miles north of Oakland, Cal., for the purpose of generating steam in a large electric power plant.

One million dollars' worth of instruments and equipment for the Home Telephone Company's system in San Francisco were purchased by President A. B. Cass of this company, who recently returned from the East. The goods will require some time to prepare, but will be rushed forward as soon as possible. Mr. Cass says that all instruments are automatic, and that San Francisco will have the best modern service in the country, notable improvements having been made in the equipment since the early systems were installed.

The extension work of the Pacific States Telephone and Telegraph Company between Fresno, Cal., and points on the west side of the San Joaquin Valley, suspended a year ago when the Sunset Telephone Company was absorbed by the Bell Telephone Company, will now be continued. The extension work is to make a long-distance connection between Fresno and several points not now in direct touch with that city. The cause for suspension is given as the introduction of new methods and complete reorganization of the system. New estimates are nearly completed, and other extensions are planned in the direction of Stockton and Lodi.

It is now announced that the California Gas and Electric Company's big power plant on Deer Creek, near Nevada City, will not be finished until next spring, though it was expected that it would be in running order early in December. The cause of delay is lack of steel pipe, as only 900 of the 6,400 feet required has been delivered.

Work on the large power plant being built on the Klamath River, near Klamath Falls, Ore., as a part of the Southern Pacific's proposed electric system over the mountains between California and Oregon, will be continued all winter. Great difficulty has been experienced in securing labor, but the work will be carried on as fast as possible under existing circumstances.

Plans are being made for an electric power plant for the Telluride Power Company in the Bear River country, Utah, which, when fully developed, will have a capacity of 40,000 horsepower.

L. D. Macy of Chico, Cal., is planning to build and operate an electric-light system in that town, to be run by waterpower.

Following the report of Supervisor Sachs and Light Inspector Byrne of San Francisco, the lighting committee has ordered the installation of about 60 arc lamps for the Mission, Ashbury Heights and Sunset districts.

The San Francisco supervisors have passed an ordinance appropriating $15,000 for a central fire-alarm station.

At a meeting of the directors of the Ocean Shore Railway Company, held October 4th, an assessment was levied of $5 per share, payable November 21st.

A break has been reported in the Alaska cable. It is apparently at a point about 200 miles south of Valdez. The United States cable ship Burnside has been dispatched to locate the break and make necessary repairs. A.

PERSONAL.

Harrison W. Smith, formerly assistant professor in electrical engineering at the Massachusetts Institute of Technology, has been made an associate professor. George B. Thomas has been appointed an assistant in electrical engineering.

Thomas P. Robb has resigned as president of the Northwestern Interurban Railway Company, which will build a trolley line from Fargo, N. D., to Detroit, Minn. Mr. Robb will act as constructing engineer. Jas. J. Lambrecht succeeds him as president.

C. D. Phillips, who has been trainmaster of the Peoria Terminal Railway of Peoria, Ill., has resigned and accepted a position with a new electric railway in Oregon, which is under the management of Guy Talbot, formerly manager in Peoria of the Terminal road.

Carl J. Printz, who for over 17 years was connected with the Allis-Chalmer Company and its predecessors, and for the last year and a half has been superintendent with the Milwaukee Electric Railway and Light Company of Milwaukee, Wis., has taken a position as chief engineer with the John Inglis Company, engine builders, in Toronto, Ont.

M. A. Beal, manager of the Rockford (Ill.) Edison Company, resigned that position on October 1st, after a connection with the company and its predecessors lasting 20 years. It is said that Mr. Beal will spend most of his time in the East, where he has property interests. He made a decided success as manager of the central-station business in Rockford.

Mr. Bion J. Arnold of Chicago is reported to have been selected by the Public Service Commission of New York as consulting engineer on certain transportation problems. Besides reporting to the commission on the equipment, service and power houses of the Metropolitan system, Mr. Arnold in this position would give his views on the subway problem, it is said.

R. F. Landis has been made general contract agent for the Northwestern Telephone Exchange Company of Minneapolis. He has been state contract agent for the Wisconsin Telephone Company at Milwaukee for the last eight years.

ELECTRIC LIGHTING.

E. N. Sanctuary and others contemplate the establishment of an electric-light plant in Alvin, Tex.

George R. Cooke and W. B. Johnson, business men of Palestine, Tex., are asking for an electric-light franchise.

Caledonia, Minn., has voted bonds to the amount of $6,000 for the purpose of establishing an electric-light plant.

The Anderson-Lacy Electric Headlight Company of Houston, Tex., has been incorporated with a capital stock of $10,000.

The Hennessey (Okla.) Electric Light, Power and Ice Company has increased its capital stock from $15,000 to $30,000.

The Standard Ice and Light Company of Magnolia, Ark., has been organized with a capital of $25,000 by R. L. Moore and others.

The Ely Traction Company has secured a 10-year lighting contract in Liverpool, Ohio, at a rate of $66 for arc lights and $28 per year for 50-candlepower incandescent lights.

Through the efforts of City Electrician Hughes and associates of Joliet, Ill., arrangements are being made for a big electrical show to be held in Werner Hall, Joliet, the first week in December.

Sealed bids will be received by the comptroller of the city of Bay City, Mich., until October 30, 1907, for supplying the city of Bay City with steam and electrical machinery to re-establish the city's electric plant according to the specifications on file in the office of the superintendent of electric light. C. J. Barnett is comptroller.

Stockholders of the Hartselle (Ala.) Electric Light and Power Company have elected officers and directors, with J. J. Cudd as president. A purchasing committee was also elected by the company and a suitable plant will be purchased at once and installed. The stock of the new company was readily taken up by business men.

The Citizens' Electric Company of Eureka Springs, Ark., has been reorganized, and the company now owns all the public utilities of the city. George Sengel of Fort Smith is president of the new organization. About $600,000 will be spent in extensions and improvements of the properties, which include electric railways, lighting, ice plant, opera house, amusement parks, etc.

The new power house of the New Orleans Railway and Light Company, at the head of Market Street, said to be the best equipped in the entire South, containing machinery valued at $2,500,000, was inspected a few days ago by city officials. On the first floor of the plant are the engines and generators, one-half of the space being devoted to the generation of current for the street-railway lines and the other half supplies commercial and city lighting.

A dispatch from Mexico City says that two strong groups of American, Canadian and British capitalists have effected a combination for the construction and operation of electric-lighting, traction and power systems in Mexico which will represent an initial investment of fully $15,000,000. Among the captalists interested in the project are William Lanman Bull of the banking house of Edward Sweet & Co., New York; Frederic S. Pearson, formerly chief consulting engineer for the Metropolitan Street Railway, and Sir William C. Van Horne of Montreal.

At Batavia, Ill., the City Council has just corrected a technical defect in the electrical inspection ordinance and its enforcement will be undertaken at once. The city operates the lighting station and has planned a complete rebuilding of its overhead lines and service wires. The superintendent of the station will make an examination of every electrical installation in the city to determine the condition thereof, and those which are found to be defective will be required to be overhauled or cut off. The underwriters' electrical bureau inspector has offered to assist in properly starting this inspection.

ELECTRIC RAILWAYS.

Plans for the consolidation of the four elevated railways in Chicago are being revived, and from the character of the renewed negotiations it is considered more than likely that something tangible will result. Conferences between representatives of the different companies have been held and long discussions indulged in. A factor that may force a union of conflicting interests is the Union Loop problem which is getting more aggravated every year. An immediate result of consolidation would doubtless be through routing of trains across the city, which would increase the loop capacity to nearly double that of the present arrangement.

In line with the recent message of Mayor Busse of Chicago, in which he recommends the electrification of the steam roads in the city, a tentative draft of a statute to prohibit railroads from using steam locomotives on suburban trains within the limits of cities of more than 200,000 population has been prepared by the corporation counsel's office, to be sent to the State Legislature.

Work of connecting the Evanston line of the Chicago, Milwaukee and St. Paul Railroad with the Wilson Avenue (Chicago) branch of the Northwestern Elevated Railway has been started. The first trolley pole was set at Ainslie Street. Stations will be established at Argyle, Edgewater, North Edgewater, Hayes Avenue, Rogers Park, Birchwood, Howard Avenue, Calvary, Dempster Street, Main Street, Noyes Street and Central Street.

In order to put the Mont Cenis Tunnel in a condition to maintain more effective competition with the other tunnels it has been decided to equip it for electric traction. After communications with the Italian government, the president of the council of the Mont Cenis Tunnel has announced that the line will be electrified between Bussoleno and Mendane and that a second track will be laid between Turin and Mont Cenis.

A report from Mount Holly, N. J., says that the Pennsylvania Railroad proposes electrifying more of its lines in South Jersey. According to the information, the roads from Camden to Mount Holly and Camden to Burlington are the routes selected for electrifying, and the work will be started after the completion of the electric road in Camden. The routes selected are thickly populated, and in many of the towns through which the third-rail would pass the principal business thoroughfares are along the railroads.

A Tacoma (Wash.) dispatch says that there is a strong probability that the Tacoma Eastern Railway Company will within a year or such a matter be operating its trains by electricity. The Nisqually Power Company, an auxiliary organization of the road, and John Bagley, general manager of the Tacoma Eastern, began condemnation proceedings recently against the syndicate owning the waterpower at the falls of the Nisqually, and Judge Reid has ordered that a jury be drawn to appraise the valuation of the water rights.

Within a year, it is said, electric cars can be run between St. Louis and Chicago by way of Springfield, Bloomington and Joliet, but this will not be on one system. The Pontiac Construction Company will commence the building of two lines or extensions of the present line between Pontiac and Dwight. The extensions will be made from Pontiac to Bloomington and from Dwight to Joliet. Fisher Bros. will finance the proposition. The line between Joliet and Bloomington will be operated as an independent line but will give direct communication with Chicago at Joliet, through the Chicago-Joliet line, now running.

The City Council of Chicago is considering an ordinance granting the Northwestern Elevated Railroad the right to build a stub-end terminal spur along North Water Street from Wells to Clark streets to be used during the rush hours to relieve the congestion on the Union Loop. Mr. B. J. Arnold, the city's traction expert, recommended the plan and sought to have the efficacy of a noiseless construction tested on this branch, so that, if practicable, it could be applied to the whole loop structure. There seems to be no opposition to the building of this short spur. It will probably serve also as the terminal of Chicago and Milwaukee electric trains when the extension to Evanston of the elevated road is completed.

A Milwaukee (Wis.) paper says that the Milwaukee Northern Railway Company will commence operations about November 1st, on Sixth Street from Wells north to the city limits. According to its franchise provisions, tickets will be sold eight for a quarter. The line has been practically completed to Port Washington. The interurban cars will be run once an hour at the outset and will be used for local traffic as well as the city cars, passengers being permitted to ride on them for as long or short a distance as they please for five cents within the city limits. The local cars will be run on a headway sufficient to accommodate the demands. The schedule and rates of fare and all other details of operation have been filed with the Railroad Rate Commission at Madison preparatory to opening the line.

PUBLICATIONS.

The Curtis steam turbine is said to be well adapted for driving horizontal-shaft electric generators. In bulletin No. 4534, recently issued by the General Electric Company, horizontal-shaft type steam-turbine sets up to 300-kilowatt capacity, both direct current and alternating current, are described. These units can be arranged to operate either non-condensing or condensing, those built for condensing service being suitable for non-condensing work in case of necessity.

The C. A. Manufacturing Company of Austin, Texas, has just published its new catalogue on wood preservation. The "C. A. wood preserver" (carbolineum America) is manufactured for this company exclusively in Manheim, Germany. It is a heavy dark brown oil stain, which impregnates all kinds of wood to a remarkable degree upon application without forming a coating or closing the pores. Its extra high specific gravity forces it into the capillary tubes of the wood. The catalogue will be sent to any address upon request.

Why should Westinghouse motors be used? These are the answers to this question, given by the industrial and power sales department: "Because both mechanically and electrically they are the best that engineering skill, combined with experience in motor building, can produce. Because only the highest grades of material are allowed to enter into their construction. Because our corps of experts is at your service to advise with you regarding your particular requirements." Motor-application booklet "A" will be sent on request.

"Vitrified Fire-clay Conduit" is the title of an attractive catalogue from the Clay Product Company describing the manufacture and styles of clay conduit marketed by the company. The booklet contains instructive tables, giving weights, measurements and freight per duct-foot, which should be useful to engineers and purchasing agents. Several new styles of conduit are described, which are designed to save labor and material in trench construction. The triangle three-way is a new design which has met with considerable success and demand from the largest users of conduit. The booklet may be had by addressing the company at its Chicago office, 48 East Van Buren Street.

The Central Electric Company of Chicago is mailing out to the trade a price list dated October, 1907, which applies to the company's 1906 and 1907 general catalogue No. 24. This price list has been revised to date and contains the very latest market figures in force at this time on all electrical appliances shown in the company's catalogue. The company requests that all holders of its catalogue who have not received a copy should write for one. In the back of the price list considerable space is devoted to the W. U. steel bracket, which is intended to replace the ordinary oak wood brackets. Attention is also called to the Central Electric Company's fixture department. A cut of a very attractive reading lamp is shown, and the company says that this department is carrying a large assortment of the most up-to-date lamps and lighting fixtures and will be glad to submit designs and quotations upon request.

SOCIETIES AND SCHOOLS.

A preliminary count of the enrollment at the University of Illinois, in the departments located in Urbana, shows an increase of at least 10 per cent. in the attendance at that institution. Numerically the largest increase, 180, is in the engineering college.

The American Society of Mechanical Engineers will hold its next regular monthly meeting on Tuesday evening, November 12th, in the building of the Engineering Societies, 29 West Thirty-ninth Street, New York city. The principal address will be made by Mr. Charles R. Pratt and will treat of features of construction and operation of the gearless traction electric elevator, which is being installed in the Singer and Metropolitan Life, New York's two highest buildings. The paper will be discussed by engineers and architects from New York, Philadelphia and Chicago. It is expected that the subject will be very exhaustively treated from the view of the architect and the engineer. The members of all professions are cordially invited to attend.

The University of Illinois branch of the American Institute of Electrical Engineers held a meeting in Urbana, Ill., on October 16th. Prof. Morgan Brooks abstracted the paper of Paul M. Lincoln on "The Grounded Neutral, with and without Series Resistance, in High-tension Systems."

The Minnesota section of the American Institute of Electrical Engineers held its first meeting of the season October 4th in Minneapolis. H. J. Gille presided and papers were read by E. P. Burch, Fred Brown, Prof. Geo. D. Shepardson and I. C. Vincent. The next meeting will be held in St. Paul early in November.

At the regular meeting of the Cornell University branch of the American Institute of Electrical Engineers in New York on October 11th, Prof. V. Karapetoff gave an informal address on troubles in transmission lines. The next meeting will be on October 25th when the paper of P. M. Lincoln on "The Grounded Neutral, With and Without Series Resistance, in High-tension Systems," will be abstracted and discussed.

An outline of the course of lectures on electrical engineering announced in the last issue of the Western Electrician to be given by Prof. Sydney W. Ashe this winter under the auspices of the Association of Employees of the New York Edison Company has been published. These lectures will take up the following 20 topics, each being the subject of a separate lecture: Magnetism; electromagnetism; batteries, primary and secondary; electromagnetic induction, theory of the dynamo; electrolysis and electrolytic corrosion; practical management of shunt motors; practical management of series motors; Ohm's law applied to distribution problems, the three-wire system; Ohm's law applied to electrical measurements, ammeter and voltmeter methods; Ohm's law applied to electrical measurements, galvanometer methods; physics of light; the carbon arc and arc-lamp mechanisms; incandescent lamps; principles of recording wattmeters; elementary principles of alternating currents (two lectures); transformers; alternating-current motors; rotary converters; alternating-current measurements.

The work done by the comparatively new Winona Technical Institute at Indianapolis is attracting considerable attention. This institute comprises the technical branch of the Winona schools at Winona Lake, Ind., and is owned and operated by the Winona Assembly of that place. There are schools of printing, carpentry and woodworking, molding, electrical engineering, pharmacy and chemistry, tile and mantel setting, painting, lithography and also a library school. The electrical engineering department and the department of lithography are of chief interest, the latter because of its being the only school of its kind in America, the former because of the excellent facilities placed at the disposal of the electrical student. Included in the large faculty besides President S. C. Dickey and W. C. Smith, general director, are the following-named of the electrical and engineering department: R. M. Murray and Frank M. Seig, directors; George W. Dinkel, Jr., instructor in applied electricity, and Albert F. Haller, director of chemical laboratories. A handsomely illustrated catalogue will be sent on application.

MISCELLANEOUS.

Mr. Charles A. Brown announces a partnership with Lynn A. Williams, for six years past his assistant, for the practice of patent law, under the firm name of Brown & Williams, with offices at 1550 Monadnock Block, Chicago. Mr. A. C. Bell, who has been in charge of the patent department of the Stromberg Carlson Telephone Manufacturing Company, has taken a position with Brown & Williams, and will give attention chiefly to the work of patent soliciting. Mr. Bell is a graduate of Cornell University and has had practical experience as a mechanical and electrical engineer, in addition to several years' work in soliciting patents.

The London Times Engineering Supplement is responsible for the statement that "it is now possible to purchase liquid air in Berlin for about three shillings (73 cents) a liter, and it can be conveyed over long distances in the well-known double vessels with an intervening vacuum which were designed by Sir James Dewar."

TRADE NEWS.

C. H. and J. S. Warner of Beloit, Wis., and M. E. Palmiter of Rockford, Ill., have incorporated as the Warner Instrument Company, capitalized at $30,000. The company will manufacture electrical instruments and machinery and will locate at South Beloit.

A meeting of the stockholders of the Western Electric Company will be held on November 5th to vote upon the question of ratifying a bond issue of $15,000,000, authorized by the directors. At present the company has no bonded indebtedness. Its authorized capital stock is $25,000,000, of which $15,000,000 is outstanding.

Some months ago the Cutler-Hammer Manufacturing Company announced its purchase of the Wirt Electric Company of Philadelphia. The Wirt business has now been consolidated with that of the Cutler-Hammer New York plant at Park Avenue and One-hundred-and-thirtieth Street, where the manufacture of Wirt apparatus will be continued. Information concerning Wirt apparatus may be obtained from any of the Cutler-Hammer offices. Particular attention is called to the very complete line of battery charging rheostats developed by the Wirt company and to the Wirt field rheostats. Bulletins covering these and other lines of Wirt apparatus will be furnished on application.

BUSINESS.

Much attention has been attracted by the six Beck flaming-arc lamps which illuminated the exterior of the Madison Square Garden during the Electrical Show. The effect of this illumination was favorably commented on. In addition a 12,000 nominal candlepower arc lamp was installed by the New York Edison Company on the corner of Madison Avenue and Twenty-sixth Street. This lamp was suspended about 50 feet above the street level from the small corner tower on the Garden and illuminated a large section of Madison Square. Beck flaming-arc lamps have been ordered for the new Terminal Station in Washington, D. C., by the Pennsylvania Railroad. They will operate two in series on 60-cycle alternating current.

The Wright demand indicator has been extensively adopted in determining load factor, the maximum output of generators, transformers, feeders, etc., and the demands of individual customers. It consists of a small differential thermometer having one of its bulbs surrounded by a heating band carrying all or a definite shunted part of the total current. The expansion of air in this bulb forces the liquid in the "U" tube of the differential thermometer into the opposite leg and causes it to overflow into a central or index tube connected to the upper end of the "U." The height of the liquid in the index tube is read on the indicator scale and marks the maximum demand of the circuit. Bulletin No. 4533 issued by the General Electric Company describes and illustrates the several sizes of instruments manufactured, together with capacities, prices, dimension diagrams, scales, etc.

ILLUSTRATED ELECTRICAL PATENT RECORD.

Issued (United States Patent Office) October 8, 1907.

867,564. Advertising and Illuminating Device. James E. Auclair, St. Marys, Pa., assignor to the Novelty Incandescent Lamp Company, St. Marys, Pa. Application filed February 26, 1906.

An incandescent lamp has a bulb shaped in a striking manner and provided with projections to form feet for it to rest on. A preferred shape is in the form of a pig.

867,575. Process of Reducing Formic Acid. Carleton Ellis, White Plains, N. Y., and Karl P. McElroy, Washington, D. C. Application filed May 2, 1907.

This process of reducing formic acid consists in electrolyzing it in the presence of sulphuric acid, removing a portion of the bath from time to time, distilling out reduction products and returning the residual liquid to serve anew. (See cut on next page.)

867,579. Electrical Condenser. Léon Gerard, Brussels, Belgium, assignor to Percy Thompson, East Orange, N. J. Application filed June 14, 1905.

This condenser is mounted in a cylindrical case filled with oil. The plates are composed of hollow concentric cylinders with outwardly flared ends. The lengths of the cylinders are made progressively shorter as their diameters are increased. (See cut on next page.)

867,608. Photographer's Car. Jean Schmidt, Frankfort-on-the-Main, Germany. Application filed August 16, 1906.

A car equipped with photographic outfit carries a storage battery for propulsion and lighting. A drum carries a conductor wound on it that serves to connect the battery to a distant charging circuit.

867,624. Switch Box. Harry J. Warthen, Washington, D. C. Application filed July 28, 1906.

A wall box adapted to carry switch mechanism has internally and externally screw-threaded sleeves adapted to be adjusted inwardly and outwardly. A wall plate closing the box is secured to the sleeves by screws.

867,627. Induction-coil Apparatus. Ernest C. Wilcox, Meriden, Conn., assignor to the Connecticut Telephone and Electric Company, Incorporated. Application filed June 19, 1907.

The vibrator of an induction coil is provided with adjustments and an indicator for showing the correct adjustment corresponding to normal conditions.

867,635. Electric Sign. William A. F. Becker, Chicago, Ill. Application filed October 26, 1906.

This sign has a base board upon which are supported a number of removable illuminated letters and characters provided with plugs for connection to any sockets of a set of rows of closely spaced sockets mounted on the base board. The letters can thus be grouped to form any words desired.

867,658. Process of Making Electric Conductors. William Hoopes, Pittsburg, Pa., and Norman A. Robertson, New York, N. Y. Application filed January 16, 1905.

This is a process for manufacturing a compound conductor having an envelope of aluminum and a longitudinal reinforcing core of stronger metal and consists in extruding the aluminum upon this core through a die while maintaining the aluminum at approximately a dull red heat and also heating the die during the period of extrusion.

867,659. Electric Conductor. William Hoopes, Pittsburg, Pa., and Norman A. Robertson, New York, N. Y. Original application filed January

16, 1905. Divided and this application filed May 11, 1906.

This is a compound electric conductor and consists of a core of iron wire or wires about which, and in intimate contact with which is an extruded envelope of aluminum.

867,664. Governor. Clinton R. Lanphear, Midland, Mich. Application filed December 6, 1906.

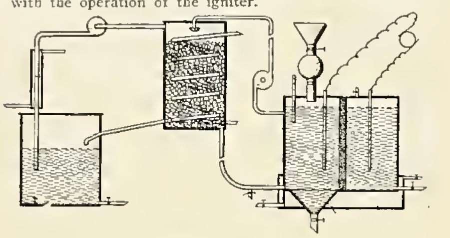
Contacts are mounted on insulating blocks on the base of the governor. As the speed increases and the fly-balls move further out, they raise a rod which closes the contacts at the base.

867,681. Automatic Fire Alarm. Charles Smith, South Croydon, England. Application filed July 9, 1907.

A cord has one end fastened and the other end passing over a pulley and connected to a weight, which is provided with contacts adapted to be closed if the weight descends. Between the ends of the cord is a fusible metallic member, about which the cord is wrapped. In case of fire this melts, the cord is lengthened and allows the weight to drop far enough to close the contacts and ring an alarm.

867,696. Igniting Means for Explosive Engines. Boris Botkowski, New York, N. Y., assignor to the De La Vergne Machine Company, New York, N. Y. Application filed August 27, 1903.

Stationary and movable electrodes are provided in proximity to a supplemental fuel injecting outlet. The valve in this is first opened and then closed simultaneously with the operation of the igniter.



NO. 867,575.—PROCESS OF REDUCING FORMIC ACID.

867,707. Coin Collector. Edward B. Craft, Wilmette, Ill., assignor to the Western Electric Company, Chicago, Ill. Application filed February 11, 1907.

This coin collector for telephones is a combination with coin-actuated toll-indicating mechanism arranged to receive a coin deposited in the coin collector, a line-signaling mechanism and means controlled by a deposited coin, in the operation of the first-mentioned mechanism, for governing the transfer of the coin to the line-signal mechanism.

867,721. Electric Belt and Appliances Therefor. Michael Hatzenbuehler, Chicago, Ill. Application filed January 7, 1907.

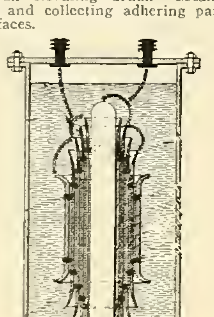
An electric belt is provided with body electrodes connected with studs to which the battery is connected.

867,743. Plug-in Switch. Henry D. Murdock, New York, N. Y. Application filed March 21, 1907.

A circular box has a central contact terminal and spring, and an annular spring contact mounted on an insulating base. A plug provided with corresponding terminals is adapted to fit into the neck of the box.

867,744. Magnetic Separator. James B. McCabe, Buffalo, N. Y. Application filed November 13, 1906.

This separator has a rotatable magnetic drum surrounded by an elevating drum. Means are provided for detaching and collecting adhering particles from the magnetic surfaces.



NO. 867,579.—CONDENSER.

867,746. Coin Collector. James L. McQuarrie, Oak Park, Ill., assignor to the Western Electric Company, Chicago, Ill. Application filed February 11, 1907.

A coin collector for a telephone consists of a combination with a cash box, of coin-actuated toll-indicating and line-signaling mechanisms, means controlled by a coin, in initiating a call for a connection, for governing the transfer of the coin to the line-signal mechanism, or to the cash box, and automatically operated means for preventing the transfer to the line-signaling mechanism of a coin subsequently used in the payment of toll.

867,758. Electric Stop-motion. Frank A. Sandford, Adams, Mass. Application filed June 27, 1906.

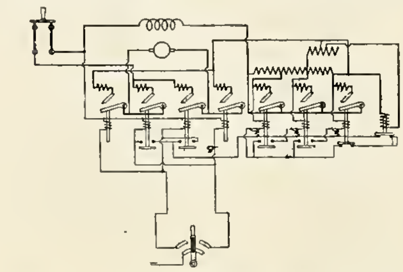
A stop motion for looms is controlled by the filling and has a filling fork and a weft hammer. An electromagnet on the weft hammer attracts the filling fork, and is controlled by a contact in the guide for the warp thread.

867,809. Series-parallel Controller. Arthur C. Eastwood, Cleveland, Ohio. Application filed September 6, 1906.

This is a controller in which the circuit is opened in changing the motor connections from series to parallel. Means are provided for inserting resistance in series with the motors concurrently with the opening of the circuit in passing from series to parallel.

867,810. Automatic Accelerating Controller. Arthur C. Eastwood, Cleveland, Ohio. Application filed January 15, 1907.

An electric controller has a set of resistance sections and a series of separately actuated magnetically operated resistance switches. A relay for controlling the switches has its winding in shunt with a portion of the resistance controlled by the last resistance switch, whereby the winding is short-circuited when this last resistance switch closes. (See cut.)



NO. 867,810.—AUTOMATIC ACCELERATING CONTROLLER.

867,846. Thermo-electric Controlling Mechanism. Harrie C. Smith, New York, N. Y. Application filed October 7, 1905.

A thermostat controls the electrical connections of a motor that is connected to a system of gearing.

867,858. Electrolier Hanger. Robert T. Watt, Laurel Springs, N. J., assignor of one-half to Walter I. Raymond, Collingswood, N. J. Application filed November 8, 1906.

This is a device for quickly mounting a chandelier. The chandelier tube has a T-headed part at its upper end. A ceiling plate has a diametrical slot and it has its upper surface formed into segmental recesses adapted to engage the arms of the T-head when it is inserted through the slot and turned. The chandelier tube can then be adjusted and locked.

867,863. Electric Water Heater. Mendal W. Willson, St. Louis, Mo., assignor of one-third to James R. Walker and one-third to Lewis P. Leathers, St. Louis, Mo. Application filed December 26, 1906.

This heater has a metallic tank, forming one electrode, the other electrode being made up of a carbon jacket mounted upon a central metallic rod. A system of pipes connects this tank with a reservoir.

867,876. Oscillation-responsive Device. Lee De Forest, New York, N. Y., assignor to George K. Woodworth, Boston, Mass. Original application filed February 2, 1905. Divided and this application filed April 4, 1906.

This device is intended to take the place of the coherer in wireless telegraphy. It consists of a receptacle with electrodes containing a gas. This is rendered partly conductive by electric heating, which brings the gas into ionic activity and makes its conductivity sensitive to electrical oscillations.

867,877. Art of Detecting Oscillations. Lee De Forest, New York, N. Y., assignor to George K. Woodworth, Boston, Mass. Original application filed February 2, 1905. Divided and this application filed June 12, 1907.

This patent covers the method of receiving wireless telegraph wave oscillations by placing a gas into a local circuit, the conductivity of which gas is made sensitive to these oscillations by bringing it into a state of intense molecular and ionic activity.

867,878. Oscillation Detector. Lee De Forest, New York, N. Y., assignor to George K. Woodworth, Boston, Mass. Original application filed February 2, 1905. Divided and this application filed June 12, 1907.

This device consists of a Bunsen burner, a local circuit connected on one side with the tube of the burner and having its other end placed in the flame. The flame is sensitive to electrical oscillations.

867,892. Telephone System. Frank E. Mayberry, Medford, Mass., assignor to the Boston Telephone Selector Company, Boston, Mass. Application filed August 11, 1902.

A party-line telephone system has a controlling device at each station and a circuit including all the controlling devices of one line; an electromagnet included in each circuit and means located at the central office for closing these circuits. A second circuit includes another electromagnet, and means are located at each sub-station for closing this second circuit. A signal is operated by current flowing through one of the electromagnet coils and restored by current flowing through the other.

867,895. Wireless Transmission of Sonorous Vibrations. Henry A. McCarty, San Francisco, Cal., administrator of Francis Joseph McCarty, deceased, assignor to the McCarty Wireless Telephone Company, San Francisco, Cal. Application filed September 20, 1906.

An induction coil has two primary windings carrying currents in opposite directions and a secondary with a spark-gap. An interrupter is placed in the circuit of one primary and an arc light in the other. A telephone transmitter is connected in circuit with an electromagnet that is placed near the arc light.

867,896. Wireless Transmission of Sonorous Vibrations. Henry A. McCarty, San Francisco, Cal., administrator of Francis Joseph McCarty, deceased, assignor to the McCarty Wireless Telephone Company, San Francisco, Cal. Application filed September 20, 1906.

This system is similar to the above, except that there is but one primary winding, from the central part of which a return circuit is taken back to the source of energy and in this circuit there is an interrupter. The return from the remote half of the primary contains the arc light, near which is placed the electromagnet in a local circuit with a battery and telephone transmitter.

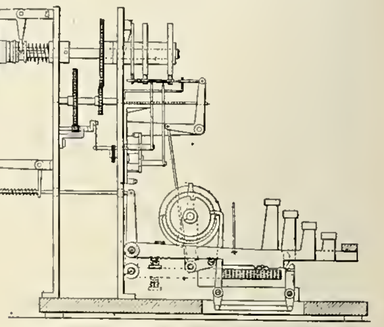
867,898. Space Electromechanical Synchronizing Means. Austin H. Stewart, Nashville, Tenn. Application filed June 18, 1903.

This is a system for synchronizing clocks, somewhat like that used by the Western Union Telegraph Company, but employing space telegraphy. Electric means are provided for winding clock and setting its hands, the latter being done by a local circuit controlled by a coherer.

867,899. Automatic Stopping Device for Internal-combustion Engines. Daniel B. Adams, Summittville, N. Y. Application filed May 23, 1902.

This device automatically breaks the circuit of the igniter when the flow of cooling water around the cylinder ceases. A movable plate in the path of the flow of water carries a contact piece in the ignition circuit.

867,900. Telegraph Transmitter. John C. Barclay, New York, N. Y., assignor to the Western Union Telegraph Company, New York, N. Y. Application filed March 24, 1905.



NO. 867,900.—TELEGRAPH TRANSMITTER.

This telegraph transmitter has a movable carrier supporting circuit-controlling devices. Means for driving the carrier comprise a clutch, finger keys and a selecting mechanism. There are also provided adjustments for the circuit-controlling devices and a master-bar operated by the finger keys and controlling the clutch. (See cut.)

867,901. Insulator. John C. Barclay, New York, N. Y. Application filed July 22, 1907.

A glass insulator for telegraph poles has a screw-threaded pin socket. On the outside the insulator has a channel near the middle of the insulator and extending completely around it to receive a fastening loop for the line conductor. A spiral thread runs upward from this channel.

867,914. Electric Fan. Frederick Diehl and Adolph F. Becker, Elizabeth, N. J. Application filed April 22, 1907.

The motor frame is mounted in pivotal bearings on top and bottom, so that it can oscillate to and fro. The motor itself is of regular fan-motor construction, except that the horizontal armature shaft is provided with an eccentric and a system of gearing to impart the additional oscillating movement referred to.

867,918. Electrically Operated Railway Switch. Frank J. Johns, Scranton, Pa., assignor of one-third to John Nelson Garrett, Scranton, Pa., and one-third to James P. Pulsifer, Philadelphia, Pa. Application filed March 20, 1907.

The movable switch point is carried on a sliding plate above a box containing two electromagnets with an armature between them, which is mechanically connected to the sliding plate. The cars are provided with means for closing the circuit of either magnet when approaching the switch.

PATENTS THAT HAVE EXPIRED.

Following is a list of electrical patents (issued by the United States Patent Office) that expired October 14, 1907.

438,134. Electric Arc Lamp. A. Apps, London, England.
438,145. Regulation and Control of Storage Batteries. S. C. C. Currie, Philadelphia, Pa.
438,167. Circuit Closer. T. Marcher, Neumarkt, Germany.
438,192. Electric Motor Car. J. F. Shawhan, Detroit, Mich.
438,204. Electric Motor. E. Thomson, Lynn, Mass.
438,226. Apparatus for Measuring the Strength of Electric Currents. S. C. C. Currie, Philadelphia, Pa.
438,233. Telegraph Instrument. J. Geary, Philadelphia, Pa.
438,236. Electric Safe Lock. W. H. Hollar, Elizabeth, N. J.
438,262. Electric Railway Conduit System. M. Wheless, Nashville, Tenn.
438,293. Electric Railway System. F. J. Sprague, New York, N. Y.
438,298. Manufacture of Incandescent Electric Lamps. T. A. Edison, Menlo Park, N. J.
438,299. Manufacture of Carbon Filaments. T. A. Edison, Menlo Park, N. J.
438,300. Gauge for Testing Fibers for Incandescent-lamp Carbons. T. A. Edison, Menlo Park, N. J.
438,301. System of Electric Lighting. T. A. Edison, Menlo Park, N. J.
438,302. Commutator for Dynamo-electric Machines. T. A. Edison, Menlo Park, N. J.
438,303. Arc Lamp. T. A. Edison, Menlo Park, N. J.
438,304. Electric Signaling Apparatus. T. A. Edison, Menlo Park, N. J.
438,305. Fuse Block. T. A. Edison, Menlo Park, N. J.
438,306. Telephone. T. A. Edison, Menlo Park, N. J.
438,307. Manufacture of Incandescent-electric Lamps. T. A. Edison, Menlo Park, N. J.
438,308. System of Electrical Distribution. T. A. Edison.
438,309. Method of Insulating Electrical Conductors. T. A. Edison.
438,310. Lamp Base. T. A. Edison.
438,311. Composition of Matter for Making Cells or Retaining Vessels. O. A. Enholm, New York, N. Y., assignor to the Enholm Electrical Company, New York.
438,344. Circuit Interrupter. N. Chaize and J. Chaize, St. Etienne, France.
438,407. Apparatus for Forming or Shaping Sheet Metal Electrically. M. W. Dewey, Syracuse, N. Y.
438,530. Telegraph Key. C. H. Crockett and L. C. Dedrick, Schenectady, N. Y.
438,532. Insulating Appliance for Electric Batteries. S. C. C. Currie, Philadelphia, Pa.

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EVERY SATURDAY

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Engineering and Machinery Exhibition in London.

[From the London correspondent of the Western Electrician.]

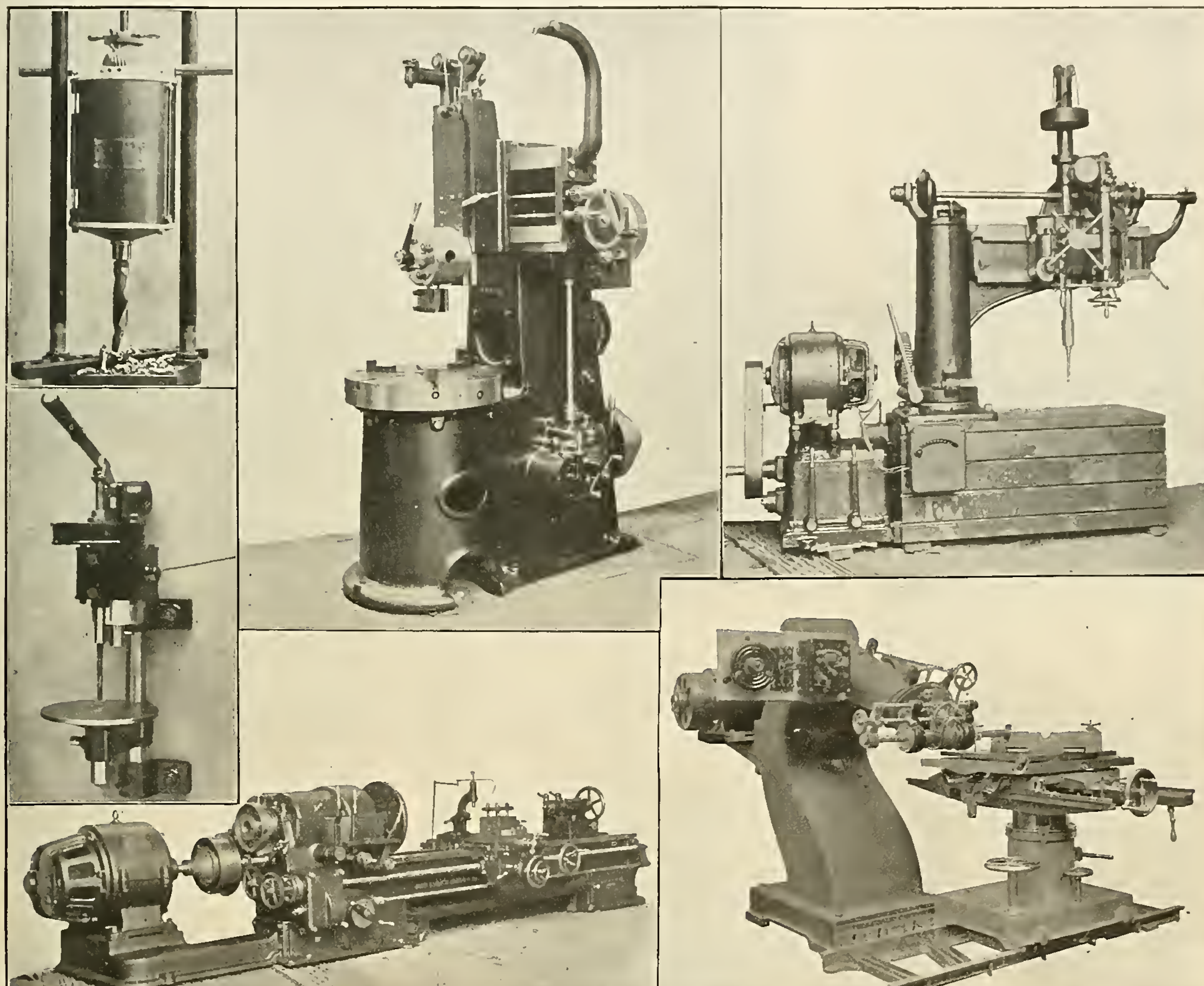
London, October 3.—On September 19th Sir Alexander Kennedy, F. R. S., opened the second engineering and machinery exhibition at Olympia, which is to remain open for a month. The first show was held in the autumn of last year, also at Olympia, where, as now, the electrical interest was somewhat limited. Nevertheless, there is sufficient to warrant a short notice, in spite of the fact that once again the main interest is centered in a very fine collection of machine tools, a large number of which appertain to the automobile industry. Electricity, as a motive power, is almost universally made use of in connection with the driving of these machines, but there is little new to chronicle from last year in the methods employed. In my description of the exhibition last year I drew attention to, and illustrated, one radical departure in the method of fixing the electric motor to the tool. These machines are again exhibited, but in all other cases the motor is separate and distinct and does not form an integral part of the whole. In practically all cases, however, the tool and the motor are self-contained—a state of things almost inevitable in a building such as Olympia, or indeed, any exhibition building where shafting has to be erected by the exhibitors, although this has been done in some cases, and several machines driven by one motor.

What purely electrical exhibits are to be seen are in the nature of small machines and portable apparatus. The Johnson-Lundell Electric Traction Company shows a new departure in direct-current electric-motor construction, the machines having an entirely laminated magnetic circuit built up of special steel stampings in a cast-iron skeleton frame and arranged in such a way that the magnetic path is absolutely free from any inequalities such as are usually caused from spongy castings, bolts, rivets, etc. These machines are also fitted with the company's patent "duplex" brush, which combines a high and low-resistance carbon acting independently in one holder, yet assuming the form of a single brush upon the commutator.

This carbon-brush unit is sectionally divided and assumes the form of two semi-independent carbons, with sections arranged fore and aft in the direction of armature rotation. These move in independent slideways at opposing angles, and are influenced by a self-balancing spring. They converge at a common point on the commutator and present thereto the same area of contact surface as does the single brush; the angle of pressure to which they are subjected causes each to effect good contact with both the central V-shaped wall of the holder and the periphery of the commutator. These holders are mounted upon a common rocker arm, thereby affording means for adjusting the brushes to the neutral position and for accommodating them to the commutator wear.

Reverting to the motor construction, the patented form of skeleton frame is the mechanical body proper, the enclosing crate for the field laminations, and the basis of the supports. The yoke is built up of laminations, and, the machine being cylindrical, these laminations assume the form of true concentric rings. The pole pieces are also of laminated steel and are bound between two end plates by means of a single rivet, which, passing through the laminations in a direction perpendicular to them, so little obstructs the magnetic path as to become a negligible quantity. The pole heads so constructed are brought into firm and intimate contact with the yoke by means of screws which pass through the yoke casing outside the yoke laminations and are threaded into the pole-head end plates, also outside of its laminations. The core of the armature is of the slotted-drum type. The commutator is built upon an open spider. The machines are made in four classes—constant-speed, shunt-wound; variable-speed, shunt-wound; ordinary series wound; compound wound.

One or two firms show portable electric drilling and the like apparatus. One of the most noticeable is an electrically driven internal grinder, by the



Portable Drill. Vertical Boring and Turning Mill. High-speed Radial Drilling Machine.
Portable Drill (Wolf). Abnormal High-speed Lathe. Wood Skiver.
SOME OF THE ELECTRICALLY DRIVEN MACHINE TOOLS AT THE OLYMPIA ENGINEERING AND MACHINERY EXHIBITION.

Phœnix Dynamo and Motor Company, which is driven at the end of an extended shaft which, in the larger sizes, enables work to be done at distances up to 42 inches away from the motor. A bench grinder mounted on a cabinet base for the storage of tools has the grinder attached to a swiveling table which can be moved vertically through an angle of 45 degrees. The shaft of the motor carries clamps at each end for an emery wheel and grinder disk.

Another tool is a sensitive drill, which can be mounted on a cast-iron tool cabinet for floor use or can be supplied for bolting down directly to the top of a bench or wall bracket. The motor is mounted on a bracket extension of the supporting pillar, and the drill spindle is driven by a friction pulley running on the under side of a friction plate. By the movement of a small lever the pulley can be slid toward or away from the center of the disk, and by this means the speed of the drill is altered over a wide range. The lever drops into notches marked with the size of drill in the chuck, so that the correct drill speed can always be obtained. A lever feed motion is also fitted to the drill spindle, the sleeve carrying this being provided with a ball-bearing to take the thrust of the drill.

Some special types of drilling machines are those of the Light Electric Motor Company of London, an illustration of one of which is given. The motors used in these apparatus have an armature which revolves around a fixed field magnet. A novelty also sbown is the application of these mo-

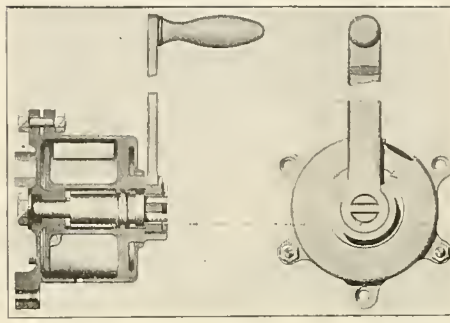
PORTABLE ELECTRIC GRINDER AT OLYMPIA EXHIBITION

tors to hair brushes, the spindle of the fixed field magnet being extended to form the two handles of the brush, the latter being detachable from the motor. The weight of one of these little machines, when complete and ready for use, is only about 6½ pounds. Illustrations are also given of some types of portable machines exhibited by S. Wolf & Co. of London. Nothing new is claimed for these, but the illustrations serve to show what is being done in this way over here.

The illustrations of electrically driven machine tools are good examples of the latest developments in this branch. The most noteworthy machines again are the products of John Stirk & Sons of Halifax. As will be seen from the picture of the electrically driven high-speed radial drilling machine, all the wheels are entirely encased. Although the motor is attached, and does not actually form part of the machine in its original design, the method of attachment is such that the completed machine is a very self-contained affair and is as neat as any of the chain or belt-driven machine tools to be seen at the exhibition. In this case the machine is driven by a belt running at constant speed, and through a gear box giving nine changes of speed operated by two handles. The spindle thus has 18 changes of speed, ranging in geometrical progression from 600 down to 20 revolutions per minute. Under test conditions the machine has been driven by a 30-horsepower motor and has sent a 1-inch drill through mild steel 3½ inches thick at the rate of 8 inches per minute, and through cast iron 3 inches thick at the rate of 12 inches per minute.

Two other machines illustrated are of somewhat more interesting design. The electrically driven 30-inch vertical boring and turning mill has the armature of its motor built into the body of the machine, the motor being of the variable-speed type, while the 12 inch abnormal high-speed lathe is driven by a 35-horsepower motor, which is direct attached on an extension of the bedplate of the lathe. The wood skiver shown is also a good example of an electrically driven wood-working machine, and was shown by Messrs. Wadkin of Leicester.

The Prescot electric welder, which is exhibited by the British Insulated and Helsby Cables, is shown in one of the pictures. The electrical resistance in the secondary circuit of a transformer being practically all located at the two end surfaces, all the heat is developed at those surfaces,

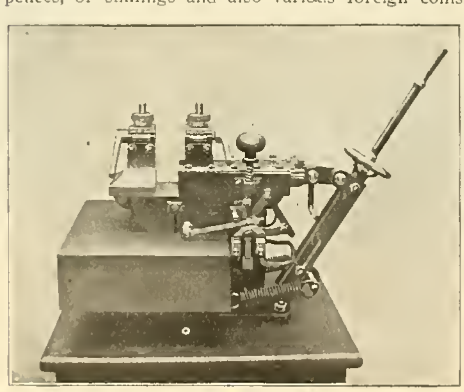


ARC-LAMP WINCH SHOWN AT OLYMPIA EXHIBITION.

i. e., where the weld is required to be made, and the resulting increase in temperature, by further increasing the electrical resistance at this point, adds to the desired effect. A device is provided for regulating the pressure between the two ends of the rods, since this pressure must be made to suit the size of the rods and the plasticity of the metal at its correct welding temperature. A special feature of the transformer is that the main casting of the welder is made use of to form the secondary coil.

Another illustration shows a new self-sustaining arc-lamp winch, the distinguishing feature of which is that it is direct-driven, i. e., each turn of the handle gives one complete revolution of the drum. The load is at all times self-sustaining, either when lowering or raising, as immediately the handle is released the drum becomes locked. This effect is produced without the use of ratchets or pawls. The winch was exhibited by Bernard Metz of London.

Reference should also be made to the Mordey-Fricker electrolytic prepayment electricity meters. In these meters there is a copper voltameter through which the whole current to be measured is passed. The anode is a thin wide copper ribbon fed into the electrolyte by a sprocket, roller actuated by a coin-operated handle. A definite feed is given for each coin. When the immersed portion thus prepaid is consumed by electrolysis the circuit is opened at the surface of the liquid. There is no other switch, accuracy being relied upon from the fact that a given number of ampere-hours always causes a given weight of copper to be eaten away. The meters are made to take pennies, sixpences, or shillings and also various foreign coins.



ELECTRIC WELDER SHOWN AT OLYMPIA EXHIBITION.

There is also shown for the first time a new form of the Mordey-Fricker clock-type meter, intended specially for small users of alternating current, but also applicable for direct current. In this instrument, which is designed for cottages and for any small installation where low first cost is essential, the clock train has been redesigned to serve the purpose of the counting mechanism.

Included in the loan section is a considerable amount of apparatus from the General Postoffice, which includes a Cooke and Wheatstone four-needle instrument (1838), Highton's single-needle instrument (1848), double-needle instrument used at Buckingham Palace (1851), and numerous other instruments and specimens which show the whole development of telegraphy down to the present day.

American Electrochemical Society.

The twelfth general meeting of the American Electrochemical Society was held in New York city on October 17th, 18th and 19th, and was the most successful fall meeting of the society that has ever been held. The attendance on the first evening was nearly 250, of which over 100 were members. The total registration on Saturday was over 330, of whom more than 140 were members. This shows the decided revival in interest which has taken place recently. For the next meeting in the spring of 1908 over 20 papers are already promised.

The meetings of Thursday and Friday were held at the Chemists' Club, 108 West Fifty-fifth Street, and the meeting on Saturday was at Earl Hall, Columbia University. There was by far too little time available for the presentation of all the papers, and the discussions on some of the most interesting and valuable papers had to be omitted.

Excursions to Edison's Laboratories at Orange, N. J., where Mr. and Mrs. T. A. Edison met the members and guests personally; to the United States Metals Refining Company at Chrome, N. J.; to the Electrical Testing Laboratories, and to the new Pennsylvania railroad power plant at Long Island City were all well attended. The subscription dinner at the Liederkranz Hall and the smoker given by the Chemists' Club were the special social features of the convention.

The lecture by Dr. George F. Kunz on "The Diamond and Moissanite," and the contributions by Dr. Potter on "Monox," by L. H. Duschak and G. H. Hulett on "The Silver Coulometer," and by A. S. Cashman on the "Corrosion of Iron" were exceptionally interesting and valuable.

Thursday Evening Session.

The session on Thursday evening was opened by President C. F. Burgess, professor of chemical engineering at the University of Wisconsin. There were two lectures scheduled for the evening, one by Dr. Geo. F. Kunz, gem expert for Tiffany & Co., and one by E. G. Acheson on "Deflocculated Graphite." Dr. Kunz's lecture treated the subjects of "Diamond and Moissanite—Natural, Artificial and Meteoric," in a very interesting and concise form, and the lecture was supplemented by photographic views of the South African Diamond Mines and by diagrams of gems and gem-cutting tools. Dr. Kunz stated that the diamond is the only chemical element which is a precious stone. Its transparency, great refractive power and extreme hardness are its valuable properties. Without exception, even among the recently discovered electric furnace products, it is the hardest substance known.

Diamonds vary considerably in their hardness, especially when not perfectly transparent. Their cleavage properties are remarkably great, so that in breaking up larger diamonds into smaller ones the greatest of care has to be taken to obtain a product of the greatest value. Their extreme hardness makes them indispensable in wire drawing and gem cutting, as well as for such coarser work as stone cutting. Only the poorer quality of diamonds, known as bort, is used for the purposes of cutting or polishing. Diamond dust, or crushed diamonds, is used by spreading it on discs of metal or by feeding it with a moving steel wire over the articles to be cut. Diamonds possess in varying degrees the power of absorbing light and emitting it again when in the dark. They also become "phosphorescent" by X-rays and ultra-violet light.

Moissan's experiments upon the artificial production of diamonds were reviewed, he having obtained a total of 100 milligrams from 300 tests. Obviously his ingenious methods of dropping into water a white hot ball of iron saturated with carbon were not a commercial success.

Moissanite, a new term for natural carbide of silicon, was named after Moissan, who discovered the mineral in some meteorites belonging to the Museum of Natural History in New York. Artificial moissanite, or carbide of silicon, was discovered independently by Acheson, Moissan and Cowles, but Acheson first published and realized the great value of the product for practical work.

Dr. Kunz stated that carborundum had no peer except the diamond in hardness, a point which has been in doubt. The existence of diamonds in meteorites and the various theories of the formation of natural diamonds were discussed. As yet no conclusive explanation has been made.

The lecture by E. G. Acheson was very similar to that given before the American Institute of Electrical Engineers and the American Chemical Society earlier in the year, and covered the remarkable results obtained with his new form of colloidal or "defloculated" graphite as a lubricant. This is made by merely shaking up a very finely pulverized soft form of artificial graphite, called "unctious graphite," with water or oil and a little gallotannic acid. A few drops of ammonia are also necessary with ordinary water to counteract the effects of dissolved salts and gases. The lecture was illustrated by experiments showing the action of the gallotannic acid and ammonia in causing this "deflocculation."

Friday Morning's Session.

The first paper was by Messrs. A. E. Greene and F. S. McGregor "On the Electrothermic Reduction of Iron Ores." The authors gave the results of some experimental work done at the Massachusetts

Institute of Technology with a 30-kilowatt electric furnace. The proper design of the furnace, the measurement of the temperature of the charge, the effects of varying the mixtures and operating temperatures, and energy efficiency measurements were discussed. The furnace was of the single suspended electrode type similar to that used at the Soo experiments for the Canadian government, the inside lining being of carborundum brick. The ores used were a Pacific Coast ilmenite ore free from sulphur and phosphorus and containing 52.5 per cent. iron, and some titaniferous ores from Essex county, New York. Pocahontas coke crushed to pass a one-fourth inch mesh sieve was used for the reducing agent, and a pure burnt lime for the flux. The frequency of the circuit was 133 cycles. No series resistance or "ballast" was used. The power factor was 92 per cent.

Among others, Major Morehead and Dr. J. W. Richards discussed points brought up in the paper. Mr. Morehead stated that it was possible to obtain titanium in alloys to any desired extent. Car wheel makers, however, do not desire any alloy containing more than 4 per cent. titanium, because it is so difficult to make the richer alloys combine with molten cast-iron.

Dr. Richards thought that the graphite electrodes used in the experiments carried off too much heat by conduction from the interior of the furnace, and that amorphous carbon electrodes which have a much lower heat conductivity would have given higher energy efficiency results.

Dr. Richards then gave an abstract of the report on the experiments made at Sault Ste. Marie, Ontario, under Canadian government auspices, in the smelting of Canadian iron ores by the electro-thermic process. In these experiments Canadian magnetites rich in magnesia and magnetites, rich in titanium were successfully smelted with small fuel and electrical energy consumption, producing satisfactory cast-iron of any desired quality. Dr. Richards thought that by far too much coke was used. He had made calculations on the carbon required for the various mixtures, and in nearly all cases the amount of carbon actually present was far in excess of the requirements for reduction. Analyses which he made of many of the slags from these experiments showed in nearly all cases a large quantity of free carbon.

Another point of great interest is that of the total amount of heat required for the reduction; one-third was supplied by the combustion of carbon to carbon monoxide and two-thirds by the electric energy. He suggested the use of calcium silicides or calcium carbide to remove sulphur instead of using large quantities of lime.

The paper by Dr. H. N. Potter on the subject of silicon monoxide showed that a great deal of work had been done in trying to show whether or not the compound silicon monoxide exists.

After oxygen, silicon is the most abundant element in the earth's crust. Up to the present time the only way in which silicon has ever been proven to exist in combination with oxygen alone is as the dioxide—SiO_2.

From a peculiar product which has been produced in electric furnaces, and recently in large quantities, by Dr. Potter, there is some evidence of a second oxide, the monoxide of silicon, SiO. Dr. Potter discussed his observations on its formation and analysis and concluded that although he could not prove absolutely by chemical analyses that it existed, its heat of combustion, its specific heat and its new physical properties were sufficient evidence to make him believe that it does exist at high temperatures and may exist at low temperatures. The material is formed at a temperature of between 1,700° and 1,800° C. by a supposed interaction between silicon and silicon dioxide, $Si + SiO_2 = 2SiO$. It may also be produced by any electric furnace reaction where silicon and silicon dioxide are present.

A. B. Albro, who is working with Dr. Potter, gave a method of "Analysis of Silicon Compounds" which cannot here be taken up in detail.

W. R. Mott had a paper on a new method of determining free silicon by chemically displacing silver or copper from its solution.

O. P. Watts' paper on the "Metals in Order of Their Boiling Points" was adversely criticised by Dr. Richards, because so many of the boiling points had been estimated from their vapor tension when in alloys.

Gustav Gin of Paris, France, forwarded a treatise on the "Electrometallurgy of Zinc," in which he utilizes the induction or transformer electric furnace to heat an annular bath of molten iron to a temperature more than 1,300° C., and then allows the zinc ores to be reduced by this molten iron. The cost of producing zinc is calculated and found to be considerably less than by the old distillation process. No results based on actual runs are given.

A paper on "A New Application of Chlorine in Metallurgy" was read by C. E. Baker of Cleveland. The application consists of a dry treatment of metallic sulphide ores by dry chlorine gas, a chemical replacement of the sulphur by chlorine taking place. This is done in a ball mill, so that the production of protecting coatings of chlorides is prevented as well as clodding or balling of the mass. The materials may or may not require much additional heating to cause the chemical substitution. The chlorides are leached out and recovered from solution by ordinary metallurgical processes. The process apparently has much promise of being valuable in some cases where ores and chlorine are available.

F. A. J. Fitzgerald presented some notes on the heat conductivity of carbon. The range of temperatures covered was small and the results quite variable. Roughly, graphite rods were found to conduct 18 times as well as pressed amorphous carbons.

SATURDAY MORNING SESSION.

Prof. S. A. Tucker of Columbia University presented some notes on granular carbon resistors, but as others have noted before, great variability is always found.

Studies on the silver coulometer formed the basis of a highly interesting and valuable contribution to scientific methods and results presented by Messrs L. H. Duschak and G. A. Halett, of Princeton University. The electrochemical equivalent of silver was gone into in detail and shown to be a quantity which, on account of the many difficulties encountered, cannot be accurately reproduced. Consequently, the silver coulometer is not a device available for standardizing purposes where the highest degree of accuracy is required. The greatest of care should be taken to remove all moisture and gases such as oxygen, nitrogen and hydrogen.

A mathematical paper on the induction furnace, by Gustav Gin, was briefly abstracted by E. F. Roeber. Dr. Roeber stated that the induction furnace is merely a transformer with a large leakage factor and that the design of these furnaces should be such as to reduce that leakage as much as possible.

Other brief papers were given by E. E. Free, of the United States Department of Agriculture, on the "Electrolytic Determination of Minute Quantities of Copper," and by H. W. Gillett on a method of separating copper and silver by varying the cell voltage.

The name "Monox" has been given by Dr. H. N. Potter, of the Westinghouse research department, to his new commercial electric furnace product. It consists of a mixture of very finely divided silicon (probably in the amorphous state), silicon monoxide and silicon dioxide, with traces of silicon carbide and metals. The particles are as fine as the finest lampblack. The true density of the particles is 2.24, but the material is so fluffy that the product weighs but 2½ pounds to a cubic foot. When freshly prepared it burns readily with emission of little light but much heat. When old it burns with great difficulty in air but readily in oxygen. It decomposes water when fresh. It dissolves in caustic alkalies with liberation of hydrogen, and is also attacked by aqueous solution of hydrofluoric acid. Anhydrous hydrofluoric acid attacks it also. When treated with this acid it is difficult to get a sample containing over 90 per cent. silicon (the oxides being attacked by the acid). Sodium peroxide and most other oxidizing agents attack it with violence.

Monox absorbs water readily and remains suspended for long periods. It occludes gases readily. It is charged electrostatically on the slightest frictional provocation, the charge being strongly negative.

Monox has a wide range of uses, primarily as a paint pigment. Being inert it is of great value as a rust retarder. As an ink filler it is said to give excellent results. For filtering gases, for special cases of lubrication and for ceramic glazes, it gives promise of becoming a standard product.

Monox is made in a vacuum furnace from carbon and silica, or carborundum and silica.

$$SiO_2 + C = SiO + CO$$

$$C + SiC + SiO_2 = 2SiO + 2CO$$

The monoxide is formed as a vapor which is condensed by sudden expansion in a large chamber over the furnace, removed through flues and caught in a bag. The vacuum is produced by a rotary vacuum pump. Water-cooled expansion and sealing joints have been designed so that rubber gaskets may be used. No details of dimensions of the furnace were given in the abstract.

A. S. Cushman of the United States Department of Agriculture gave a highly interesting presentation of an electrolytic theory of the corrosion of iron, which, in brief, is that inasmuch as commercial irons and steels are known to be non-homogeneous materials, there are potential differences set up between the non-homogenous portions when a mass of iron or steel is in the presence of any electrolyte. These differences of potential cause local or eddy currents to be set up and thus, according to the laws of electrolysis, decomposition of the electrolyte and, concomitantly, corrosion of the iron occurs.

The theory is beautifully illustrated by means of a solution which W. H. Walker and A. S. Cushman jointly worked out. This consists of an electrolyte which causes corrosion of iron readily, and which contains phenolphthalein and ferricyanide of potassium. The solution indicates immediately the place where iron goes into solution and where the electric currents enter the metal again. The ferricyanide turns blue where iron goes into solution, and the phenolphthalein turns red where the current passes from the solution into the metal.

These results and the theory point to various methods of preventing corrosion. This is, first, to produce homogeneous metal if possible, and where this is not possible to stop corrosion by other means, such as making it "passive." Passive iron is obtained under certain conditions by treating the surface with oxidizing agents, after which it resists corrosion temporarily. When the surface is so prepared, a protective paint can be applied which contains a small quantity of this passifying agent.

Bichromate of sodium will cause iron to become passive, and Dr. Cushman cited that remarkably good results have been obtained in a certain galvanizing plant by immersing the iron in a bichromate solution between the pickling and galvanizing stages.

Manganese was cited as one of the elements which causes non-homogeneous metals, and by its almost complete removal great improvements were made in the quality of sheet steel.

Other papers which could not be presented for lack of time were by the following-named: Dr. Herman Schlundt, "Electroscopic Determination of Radium in Some Tufa at Hot Springs, Ark.;" Dr. H. E. Patten, "Electrolytic Reduction of Nitric Acid;" Dr. Henry S. Carhardt and F. J. Mellencamp, "A Further Contribution to the Study of Concentration Cells;" Dr. Louis Kahlenberg, "On the Nature of Electrolytic Conductors;" P. B. Sadtler, "Physio-chemical Notes on the Alkali Aluminates;" J. W. Turrentine, "Action of Ammonium Persulphates on Metals;" O. W. Brown and R. R. Sayers, "The Treatment of Storage Battery Elements Before Putting Them Out of Commission;" M. G. Floyd, "Note on the Use of the Capillary Electrometer for Alternating Voltage."

FINE EXAMPLE OF OUTLINE LIGHTING IN CINCINNATI. (SEE PAGE 326.)

A Motor-generator Set with Flywheel for Mine Hoist.

By H. H. Clark.

The following is a brief description of a unique and interesting electrical hoisting equipment recently built by the General Electric Company for the Kendall Gold Mining Company of Kendall, Mont. The requirements which this outfit had to meet were similar to those encountered in most mine-hoist installations.

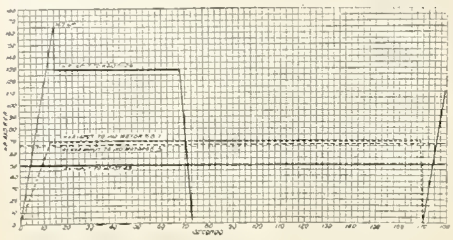


FIG. 1. HORSEPOWER INPUT TO MINE HOIST WITH UNBALANCED OPERATION

This hoisting equipment was designed to raise 2,000 pounds of ore from a 1,000-foot level every 103 seconds when operating two drums, and every 170 seconds when a single drum only was in operation.

The mine shaft has two compartments, and extends vertically to a depth of 1,000 feet. Two cylindrical drums are used, which are provided with the usual clutches for individual and combined running, each drum operating a compartment in which the weight of the rope is always balanced by an individual tail rope, whether the other compartment is working or not. This rope is one inch in diameter, and weighs 1.6 pounds per foot, the hoisting speed being 1,000 feet per minute. Each compartment is supplied with one skip weighing 1,400 pounds, and having a capacity of 2,000 pounds of ore.

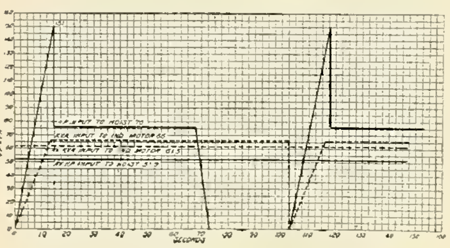


FIG. 2. HORSEPOWER INPUT TO MINE HOIST WITH BALANCED OPERATION.

Figs. 1 and 2 show the theoretical curves of horsepower input to the hoist, both when running one compartment (unbalanced operation) and two compartments (balanced operation). From these curves the unusual demand which occurs during the period of acceleration is made very apparent.

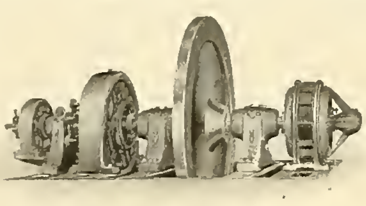


FIG. 3. MOTOR-GENERATOR SET WITH FLYWHEEL.

The capacity of the generating station being somewhat limited, the large rush of current incident to starting and accelerating the hoist tends to produce undesirable voltage fluctuations in the system, and the equipment here described was designed to eliminate this trouble and improve the regulation of the line.

To this end an outfit was supplied which permits of the most perfect speed control, allowing the load to be accelerated as rapidly or as gradually as desired. The equipment was also supplied with a means of equalizing the demand upon the power system, so that instead of being intermittent in character it is practically constant.

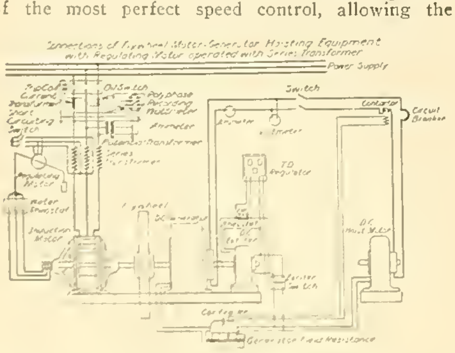


FIG. 4. DIAGRAM OF CONNECTIONS OF FLYWHEEL MOTOR-GENERATOR HOISTING EQUIPMENT.

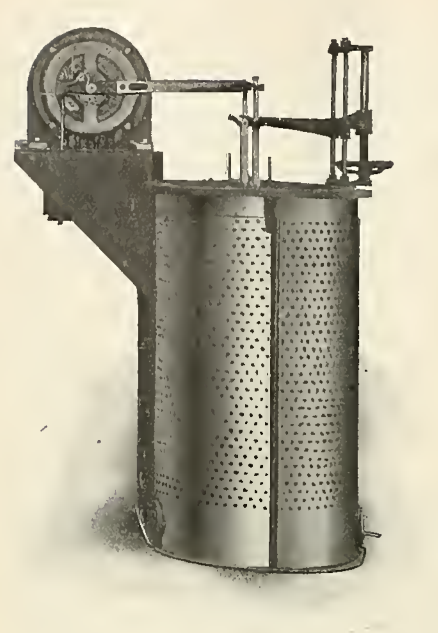


FIG. 5. REGULATING MOTOR AND WATER RHEOSTAT.

The system of control has the further great advantage of electrically braking the load in a manner which not only gives complete control over the retardation of the moving parts of the hoist, but also returns a considerable portion of their kinetic energy to the flywheel.

The hoist equipment comprises a shunt-wound direct-current motor, arranged to be geared to the hoisting drums, the motor receiving its power from a motor-generator set driven from the main power system. This set, as is very clearly shown in Fig. 3, consists of an induction motor, and a direct-current generator, with a flywheel swung between them, and a direct-current exciter overhung at one end of the set. The function of this latter machine is to excite the field of the generator and that of the direct-current hoist motor. The speed and direction of rotation of the latter machine is controlled by varying the field strength of the direct-current generator by means of a rheostatic controller, which is conveniently located for the hoist operator.

In this set the induction motor is a three-phase 60-cycle form-M variable-speed machine, while the direct-current generator is provided with commutating poles, and is designed for operating with a very weak field at all loads.

Fig. 4 shows the diagram of connections of the complete equipment.

The flywheel is a steel casting, machined all over and perfectly balanced; it weighs about 12,000 pounds and operates at a peripheral speed of about 18,000 feet per minute. The wheel is used to store energy when the hoist is not in operation, and is called upon to give up this energy when the demand on the line is at a maximum.

In order to obtain this effect on the part of the flywheel of alternately storing and surrendering energy, the induction motor is arranged for variable-speed operation, changes in speed being automatically controlled by the variation of the main-line current, which is led through a small three-phase regulating motor operating a water rheostat in series with the secondary winding of the motor.

The torque which is produced by the full-load value of the main-line current in the windings of the regulating motor is exactly balanced by the weight of the moving parts of the water rheostat, so that there is no change in the resistance that is in series with the rotor winding of the motor-generator set so long as the motor is taking full-load current. If, however, it should demand more or less, there is an immediate movement of the water rheostat, tending to accelerate or retard the speed of the motor-generator set to such a point that the induction motor once more takes full load, and the movement of the water rheostat is stopped.

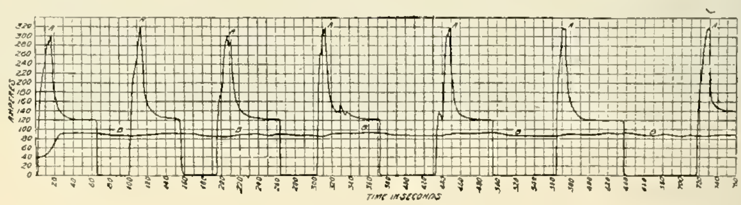
Fig. 5 gives a good idea of the regulating motor and the water rheostat which it operates.

The voltage of the exciter is maintained at a constant value during the speed variation of the motor-generator set by means of a Tirrill regulator.

Referring once more to Figs. 1 and 2, attention is called to the curve which shows the kilovolt-ampere input to the induction motor when a flywheel generator set is used. In these curves the undesirable starting peak has entirely disappeared; it was to secure this result that this equipment was designed.

Fig. 6 shows the curves of current input to the hoist motor and induction motor that were obtained from actual test, carried on at the works of the General Electric Company under conditions of load approximating, as nearly as possible, those which the set would be required to meet after installation at the mine. This figure shows very clearly indeed how well the automatic devices perform the duty required of them, keeping the demand on the line practically constant, while the hoisting motor was called upon for several times its full-load capacity.

This equipment has now been installed for several months, and is operating to the complete satisfaction of the purchasers.—From the General Electric Review.



A Is Current Input of Hoist Motor. B Is Current Input of Induction Motor of Motor-Generator Set.
FIG. 6. CURVES OF CURRENT INPUT TO MOTORS.

Transatlantic Wireless Communication.

According to the daily newspapers, October 17th was marked by the beginning of regular transatlantic communication by means of wireless telegraphy. After years of experimental work the Marconi stations at Clifden, in Ireland, and at Glace Bay, Nova Scotia, were ready for commercial service. The first message sent from Canada was addressed to the London Standard by Sir Wilfred Laurier. It was as follows:

"Standard, London, Eng.: Welcome new bond between Britain and Canada, one more triumph for empire and science. Wilfred Laurier."

The first message from Ireland was sent to the New York Times by Lord Avebury, formerly Sir John Lubbock. It ran thus:

"I trust that the introduction of the wireless will more closely unite the people of the United States and Great Britain, who seem to form one nation, though under two governments, and whose interests are really identical. Avebury."

A large number of similar messages were sent and these with a considerable number of press dispatches made a total of about 10,000 words for the first day's work. Mr. Marconi was repeatedly congratulated on the triumph of his system. He stated that he does not regard the new service as a competitor with the cable lines at present. He intends to continue investigations to enlarge the capacity and otherwise perfect the system.

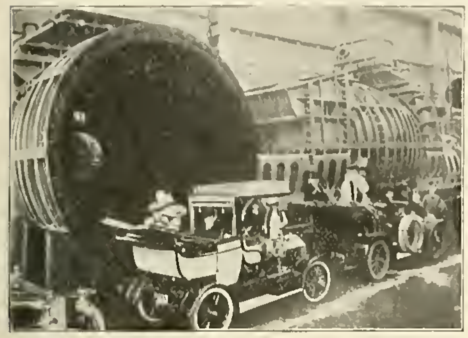
For the present the stations will be open only from 8 a. m. to 8 p. m., and the traffic will be confined almost entirely to press dispatches. The rates for the service are much below the cable rates. Although some messages were sent nearly five years ago between the stations at Glace Bay and Poldhu, in Cornwall, this, it is declared, marks the beginning of a regular wireless service on a commercial scale with perfected apparatus.

A Fine Example of Outline Lighting.

In the illustration on page 325 is shown an interesting example of outline lighting in the city of Cincinnati. The building which is thus made so conspicuous at night is the department store of the Mabley & Carew Company. In outlining the structure 5,500 four-candlepower incandescent electric lamps are used, while the sign requires about 500 more. The outlining lamps are spaced about 10 inches apart at the bottom of the building, but higher up they are placed farther apart, to give the observer on the street level the impression that the spacing is uniform. The installation is on flat-rate contract with the Union Gas and Electric Company of Cincinnati, and the lights burn from dusk until midnight every night. The work was designed and executed by the Union Gas and Electric Company. The wiring is all done in iron pipe, and the daylight appearance is also attractive.

Steam Turbines of 70,000 Horsepower for Mauretania.

In view of the record-breaking performance of her sister ship the Lusitania, the steam-turbine equipment of the recently launched Mauretania is of unusual interest. This equipment is of no less than 70,000 horsepower in capacity. The accompanying pictures show portions of the Mauretania's gigantic steam turbines while they were in the shops of the Wallsend Slipway and Engineering



A PORTION OF THE MAURETANIA'S STEAM-TURBINE EQUIPMENT.

Company, Newcastle-on-Tyne, England. The pictures were obtained by Mr. W. H. Whiteside, president of the Allis-Chalmers Company, Milwaukee, and the turbines shown are of the same general type as those built by that company for service on land. When the photographs were taken the turbines were under inspection by a party of British Admiralty Lords and their friends.

Electric Current in a New Transformation Role.

A correspondent of the Western Electrician sends the following account of a peculiar incident:

"Geo. W. Eberhardt, superintendent of the municipal electric-light plant of Lawrenceburg, Ind., has brought suit against the Cincinnati, Lawrenceburg and Aurora Traction Company to recover $100 damages on a peculiar complaint. According to Mr. Eberhardt's story, he is the possessor of a cow whose color was black until a broken trolley wire of the defendant company fell upon her back, knocking her to the ground as if shot. The animal, however, arose to her feet again and was driven home, where she continued to tremble for three days, at which time it was discovered that a peculiar transformation was taking place. The animal, once coal black, is now turned to white. Two theories are advanced; one is that the change of color is due to fright, the other to the electric shock. The cow has given no milk since being shocked, although she is in good health otherwise. The damages claimed is for the loss of the milk."

Commonwealth-Edison Consolidation.

An opinion from the office of the corporation counsel, given at the request of the committee on gas, oil and electric light of the Chicago City Council, finds that the recent consolidation of the Chicago Edison Company and the Commonwealth Electric Company is entirely legal. As a necessary

A PORTION OF THE MAURETANIA'S STEAM-TURBINE EQUIPMENT.

result, it is contended, the Commonwealth Edison Company must pay compensation of three per cent. on gross business of both companies, as the company will operate under the Commonwealth franchise. Heretofore the Edison business paid no compensation, as its franchise had no such clause.

Directors of the Commonwealth Edison Company have declared the regular quarterly dividend of 1¼ per cent. on the capital stock, payable November 1st to stockholders of that date, and payable thereafter to persons subsequently becoming stockholders of record through the exchange of their Chicago Edison stock for certificates of the Commonwealth Edison Company. The directors also declared a dividend at the rate of eight per cent. per annum of the period from September 10 to November 1, 1907, upon the amount of first installment paid in on account of the Chicago Edison Company stock subscriptions, which shall be represented by subscription receipts outstanding November 1, 1907.

Single-phase 15-cycle High-speed Electric Locomotive.

In the accompanying illustration is shown the Westinghouse single-phase 15-cycle high-speed locomotive, built for demonstration purposes and exhibited at the Atlantic City convention of the American Street and Interurban Railway Association last week. The unit is one-half of an articulated type locomotive designed to handle a 400-ton passenger train. Each of the two units comprising the locomotive is complete in itself. The motors are of the well-known Westinghouse gearless type. The motors and transformers are cooled by forced ventilation.

The principal data of the complete locomotive are as follows:

Weight, total	140 tons
Weight on each of the four drivers	50,000 lbs.
Weight on each of the two-pony trucks	40,000 lbs.
Weight on each motor	19,500 lbs.
Diameter of drivers	72 in.
Diameter of pilot wheels	36 in.
Wheel base, total (half locomotive)	20 ft. 7 in.
Wheel base, rigid	7 ft. 6 in.
Wheel base, pony truck	6 ft. 2 in.
Length over bumpers (half locomotive)	31 ft.
Height of locomotive	13 ft. 4 in.
Width of locomotive	10 ft.
Number of motors per locomotive	4
H. P. of each motor (one-hour rating)	500
H. P. of each motor (maximum)	800
H. P. of each motor (cont. cap.)	375
H. P. of each locomotive (maximum)	3,200
Tractive effort of loco. (max.)	40,000 lbs.
Tractive effort of loco. (at 1 hr. rating)	14,700 lbs.
Tractive effort of loco. (at cont. cap.)	9,200 lbs.
Speed, miles per hr. (at 1 hr. rating)	51
Speed, miles per hr. (at con. rating)	61
Voltage on trolley	11,000
Voltage on each motor	275

SINGLE-PHASE ELECTRIC LOCOMOTIVE ON EXHIBITION AT ATLANTIC CITY.

Tantalum.

An advance chapter from "Mineral Resources of the United States Calendar Year 1906," by Frank L. Hess, geologist for the United States Geological Survey, gives some interesting facts about the metal tantalum.

The principal ores of tantalum are tantalite and columbite (a combination of iron, tantalum and columbium), which occur in pegmatites, or coarse granites. In the United States tantalum ore may be found probably in the greatest quantity in the Black Hills of South Dakota. In 1906 one mass weighing 600 pounds was discovered. A small lot was shipped to Germany from Canyon, Colo., during the year, and small shipments have also been made from Mitchell County, N. C.

This metal has some remarkable properties. It is not attacked by hydrochloric, nitric or sulphuric acids, aqua regia, or alkaline solutions. It can be drawn into fine wire having a tensile strength greater than soft steel. A red-hot lump of tantalum may be at once hammered into a plate which, on repeated rehammering, becomes as hard as diamond. A diamond drill running continuously for three days at 5,000 revolutions a minute failed to penetrate such a plate, although it was but one millimeter thick, while the drill was much worn.

A British patent has been obtained for making writing pens from tantalum, whose hardness, elasticity and resistance to corrosion would seem to fit it well for such use. The principal use for tantalum, however, is for making the new incandescent lamp filaments, which are meeting considerable success.

A Comedy of Errors in Milwaukee.

Comptroller Paul Bechtner of Milwaukee, Wis., is threatened with mandamus proceedings by one of the aldermen to compel him to countersign certain council measures looking to the establishment of a municipal lighting plant. Mr. Bechtner characterizes the municipal lighting proceedings as a comedy of errors, and he intends to see to it that all proceedings are absolutely legal and business-like before he gives his consent to measures involving an expenditure of more than a million dollars. In 1904 the people of the city authorized the expenditure of $500,000 for a city-owned lighting plant, but the present plans, it is said, would reach $1,000,000. Furthermore the comptroller says the people have changed their minds and do not want a city plant since the new state law has made the lighting rates of the company lower than what it would cost the city to produce the light.

Railway Signal Association.

The annual convention of the Railway Signal Association this year was held in Milwaukee, the sessions extending over three days. Addresses, reports and papers along the lines of railway signaling service were heard. The annual banquet at the Hotel Pfister combined social and scientific features and was attended by 274 members and guests of the organization. The first speaker was President J. A. Peabody, signal engineer of the Chicago and Northwestern Railway. He was followed by A. H. Rudd, signal engineer of the Pennsylvania Railroad. Other speakers and their subjects were: W. A. Gardner, "The Relation of Signaling to Railway Operations;" E. Morse, "Relation of the People to the Railroads;" C. A. Dunham, "Duties of the Signal Engineer;" E. W. McKenna, "The Duty of the Railroads Toward Safe Transportation of Persons and Freight."

After selecting Washington, D. C., as the meeting place for next year's convention, the following officers were elected: President, A. H. Rudd, signal engineer of the Pennsylvania Railroad, Philadelphia; senior vice-president, L. R. Clausen, Chicago, Milwaukee and St. Paul Railway, Milwaukee; junior vice-president, H. S. Balliet, Grand Central Station, New York; secretary and treasurer, C. C. Rosenberg, Lehigh Valley Railroad, Bethlehem, Pa.

Nashville Voters Reject Municipal Ownership.

A dispatch from Nashville, Tenn., dated October 16th, says: "In a regular municipal election the Nashville public has voted down municipal ownership of its electric-lighting system. Although this feature was the leading issue in the platform of the successful candidate for mayor, who carried every ward and received more than three times the vote of his opponent, the vote stood 1,353 against municipal ownership and 860 for it. The measure was designed to not only substitute the service of a municipal plant, for which $400,000 of bonds were to be issued, for that of the Nashville Railway and Light company, but to establish competition in commercial lighting."

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CORRESPONDENCE relating to electricity or any of its practical applications is cordially invited, and the co-operation of all electrical thinkers and workers earnestly desired. Clear, concise, well written articles are especially welcome; and communications, views, news items, local newspaper clippings, or any information likely to interest electricians, will be thankfully received and cheerfully acknowledged.

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DEPARTMENTS.

DATES AHEAD.

International Independent Telephone Association (annual meeting), Coliseum, Chicago, January 21, 22 and 23,

As FULL of valuable, practical material as an egg is full of meat is the report of the committee on maintenance and inspection of electric-railway equipment, presented to the American Street and Interurban Railway Engineering Association at Atlantic City last week, and a portion of which is presented in this issue of the Western Electrician. We congratulate the committee, of which Mr. John Lindall of Boston is chairman, with Messrs. W. D. Wright, E. T. Munger and L. L. Smith as fellow members, on an accomplishment of real usefulness, the result of hard and honest work.

THERE SHOULD BE a clearing-house for the various electrical societies, state and national, so that an arrangement could be made to avoid conflicts of dates. Suppose the American Institute of Electrical Engineers, National Electric Light Association, Illuminating Engineering Society and Edison Association should hold their annual conventions during the same week. The number of electrical men who would wish earnestly to be in two or three places at once would be large. The coincidence imagined is not likely to happen, but only last week the street-railway conventions and the general meeting of the American Electrochemical Society were held on overlapping days. Occasionally two important state conventions are held in the same week, to the inconvenience of those who might attend both. With a suitable interchange of views there is no doubt that a sequence of conventions could be arranged easily.

STANDARDIZATION of electrical equipment, particularly of electric-railway equipment, received a decided impetus by the adoption of a carefully prepared report on this subject by the American Street and Interurban Railway Association at its convention of last week. The report was first adopted by the subsidiary Engineering Association, and then confirmed by the parent body. Standards were recommended for car axles, journals, journal bearings, journal boxes, brake shoes, brake-shoe heads and keys, wheel treads and wheel flanges. Various sizes are provided and alternative designs are submitted. But, as one of the delegates remarked, two styles of brake shoes, for instance, are better than twenty. The report is a tangible evidence of a concerted desire for improvement, and is one of the best pieces of work ever done by the association. It now remains for the companies gradually to take steps to carry it into effect. As one gentleman remarked, "We can come here and talk till we are black in the face, but if the report is pigeonholed, nothing will come of it all!" An entering wedge is at hand for the general standardization of electric-railway equipment, and the operating companies should avail themselves of the opportunity.

IN HIS annual address at Atlantic City last week President John I. Beggs of the American Street and Interurban Railway Association took a depressing and perhaps rather extreme view of the relations of public-service corporations and the communities which they serve. In part, this is what he said:

"It is to be earnestly regretted that we cannot report more favorable conditions existing between many of the companies and the communities in which they operate. This is largely owing to the continued unreasonable, vindictive and demagogic attitude of many of the public officials and politicians in the various localities where our companies operate, the only stock in trade possessed by many of these officials and politicians being their unprincipled attack upon public-service corporations, most of them following the examples set in higher places, but with less ability, the result being that we are passing through the most trying period that the managers and investors in these properties have ever experienced. While I believe that this wave of unreasoning prejudice, denunciation and unwise legislation is at its crest, if it has not already commenced to recede, nevertheless it is a period when the greatest ability, courage, perseverance and patience are required successfully to withstand the abuse and attacks from all sides that are heaped upon those charged with the trying, exacting and perplexing responsibilities incident to operating public utilities at any time, but particularly in times such as we are now passing through."

Until this condition of affairs is remedied, said Mr. Beggs, it will be almost impossible to obtain additional capital to make extensions. This condition is likely to continue "until the several states provide for the creation and appointment of commissions with power intelligently and impartially to investigate and regulate the conditions of operation and the charges to be made by public-service corporations, and remove them from the exploitation of local politicians, whose principal business is generally to play to the galleries by attacking everything done by a public-utility corporation, whether right or wrong."

Regulation by state commissions is, then, the remedy to be hoped for, always provided, of course, that the regulation is broad-minded and reasonable, or of that "live-and-let-live" kind of which some people with a longing for justice and fair dealing speak in old-fashioned phrase. In this conclusion Mr. Beggs is at one, we believe, with most thoughtful students of the problem. But it is to be remembered that there are two sides to the question; the people are the ultimate masters of the situation, of course. It is to be hoped that their servants in public office are not everywhere so unworthy as the type of politicians which Mr. Beggs denounces in such vigorous language.

TRANSATLANTIC "WIRELESS" is an assured fact, if we are to believe the daily newspapers, and their good faith in making the announcement can hardly be doubted. So far only press messages have been transmitted, we believe, and it will be remembered that once before a transatlantic wireless press service was heralded by a great London daily, but after a few dispatches had been received and printed there was a complete slump. Perhaps the present undertaking will be more successful, and will be permanent. It is quite likely, for it is the result of experiments now continued for a number of years.

The question in relation to long-distance radiotelegraphy is not so much whether it can be made to work as whether it will work continuously and reliably under all sorts of conditions and with reasonable speed. It remains to be seen whether the present service is to prove a permanent, useful addition to the world's means of communication. We hope so, for it will be a great achievement. But "wireless," with its brilliant record, has also furnished some disappointments, and it is curious, if it is commercially practicable, why it is not in daily use over narrow arms of the sea, such, for instance, as those separating England and France or Florida and Cuba.

ATLANTIC CITY may be the meeting place of the American Street and Interurban Railway Association for five years to come if an offer of the Hotel Men's Association of that city is accepted. The Atlantic City people point out that one of the amusement piers is to be remodeled, and if the association will agree to use it for the next five years this pier will be rebuilt as a very large, convenient and up-to-date exhibition structure, with about all facilities for making exhibits, even of heavy machinery, that can be imagined. Presumably the same proposition has been laid before other societies making large exhibits, such as the Master Car Builders. In many ways it is a tempting offer. Atlantic City is a seaside resort, with a fine beach and an attractive climate. It has ample and very excellent hotel accommodations. People who go to Atlantic City are generally glad to repeat the visit. It is not too far north or too far south; the one serious objection is that it is too far east; geographically, it is at the edge of a very large country. Once in a while the western people like to join the throng on the Board Walk in Atlantic City, but to ask them to spend the money and time to go year after year for five years is asking a good deal. This is the drawback to the proposal now under consideration, and we hope the executive committee of the American Street and Interurban Railway Association will give it careful consideration.

STREET-RAILWAY CONVENTIONS AT ATLANTIC CITY.

With an attendance of over 3,000 the annual convention of the American Street and Interurban Railway Association and of its affiliated organizations of accountants, engineers and claim agents, held in Atlantic City last week, was a great success. The exhibition on the Steel Pier was the best the association, or its allied body, the Manufacturers' Association, has ever held, and that is saying a great deal. An important report on the standardization of axles, journal boxes, brake shoes, car wheels and other devices was adopted. It was decided to form a new auxiliary association to have to do with transportation, traffic, general operation and the like. Calvin G. Goodrich of Minneapolis was elected president of the parent association. Reports of the proceedings follow in some detail.

American Street and Interurban Railway Association.

The 1907 convention of the American Street and Interurban Railway Association was held on the Steel Pier, Atlantic City, N. J., on October 16th, 17th and 18th. The first session was held on Wednesday morning, October 16th, with President John I. Beggs of Milwaukee in the chair. Mayor Stoy of Atlantic City welcomed the association, and then Mr. Beggs delivered the president's address.

President Beggs' Address (in Part).

During the year the secretary and treasurer has more than maintained the record made during the preceding year, in the amount and value of the work turned out of his office, and it is with great pleasure that I bear testimony to his untiring energy and efficiency. From the statistics gathered together in the secretary's office he has been enabled, during the year, to render valuable service to a number of companies holding membership in our association. That these services have been of great value and highly appreciated is evidenced by the fact that one of the companies to whom this service was rendered sent to the secretary and treasurer a check for a substantial amount in recognition of his work. This check the secretary and treasurer voluntarily and properly returned to the company, which prompts me to suggest that in cases where the companies feel that the service they have obtained from the office of the association is of great value to them, that it would not be amiss for them to make a contribution direct to the association, to be used in enlarging the scope of its work.

I believe that additional effectiveness could be given to the office of the secretary and treasurer at a minimum of cost if the working position of the secretaryship of the several affiliated associations—I mean particularly the accounting, the engineering and the claim agents—were placed in the office of the secretary and treasurer of the American association, and that the position of secretary of those three associations should be an honorary position. This would enable a statistician and additional clerical force to be employed in the permanent office of the association, this work being done by one of the assistants of Professor Swenson, and the honorary position held like the other executive offices of this association.

It is gratifying to be able to report that, notwithstanding the increase in the dues, all of the larger companies who are called upon for the larger amount of dues have continued their membership in the association, and that the total membership at the close of our fiscal year, September 30, 1907, was 227, as compared with 200 at the beginning of our fiscal year, October 1, 1906, and that notwithstanding the expenses of the association increased during the year to the extent of $2,991.75, the balance to the credit of the association at the beginning of the ensuing fiscal year, October 1, 1907, is $6,137.95, as against $6,976.90 12 months previous. The associate membership in 1906 was 113; in 1907 it is 148, a gain of 35.

In order that you may better comprehend the solicitude that your officers feel respecting the necessity of administering the financial affairs of this association with care, I might state that the receipts of the association for the last fiscal year were $24,724.77 and that the expenses, kept down as they were, amounted to $25,563.72. This association should have annual dues coming in to an amount of from $30,000 to $35,000 per annum in order to enable it to perform the work in the manner it should be done to the greatest advantage of the association, which means its individual members; and it is in line with making this amount of money go as far as possible that I suggest this consolidation of the salaried officers of the various affiliated associations.

Passing from the business affairs of the association to that of the companies holding membership therein, it is to be earnestly regretted that we cannot report more favorable conditions existing between many of the companies and the communities in which they operate, largely owing to the continued unreasonable, vindictive and demagogic attitude of many of the public officials and politicians in the various localities where our companies operate, the only stock in trade possessed by many of these officials and politicians being their unprincipled attack upon public service corporations, most of them following the examples set in higher places, but with less ability, the result being that we are passing through the most trying period that the managers and investors in these properties have ever experienced. While I believe that this wave of unreasoning prejudice, denunciation and unwise legislation is at its crest, if it has not already commenced to recede, nevertheless it is a period when the greatest ability, courage, perseverance and patience are required successfully to withstand the abuse and attacks from all sides that are heaped upon those charged with the trying, exacting and perplexing responsibilities incident to operating public utilities at any time, but particularly in times such as we are now passing through.

No consideration appears to be given to the fact that while every element entering into the operation and maintenance of electric railways and other public utilities has greatly increased in cost, we not only cannot increase the charges for the service rendered, but in many cases unjustifiable and unreasonable demands are made for reductions in charges for the service rendered, notwithstanding the amount possible to be earned upon the capital invested does not exceed, and in many instances does not equal, the amount that could be realized on investments in mortgages or other classes of property not subject to the risks incident to investment in public utilities; and this has become so marked that I venture the prediction that, until a very radical change is worked in the minds of the general public, it will be almost impossible to obtain additional capital to make the extensions and additions necessary to give to the cities and towns the transportation and other public utilities the facilities their increasing growth and the demand for better equipment and service constantly renders necessary. This condition is, in my opinion, likely to continue until the several states provide for the creation and appointment of commissions with power intelligently and impartially to investigate and regulate the conditions of operation and the charges to be made by public-service corporations, and remove them from the exploitation of local politicians, whose principal business is generally to play to the galleries, by attacking everything done by a public-utility corporation, whether right or wrong.

STEEL PIER AT ATLANTIC CITY.—HEADQUARTERS OF CONVENTIONS

The magnitude of the business of the street, suburban and interurban electric railways of the country may be judged by the fact that at the close of the year 1906 the total capital liabilities of these companies in the United States amounted to $3,765,317,875, being an increase of practically $400,000,000 during the year 1906. The total mileage of these roads at the close of 1906 was about 36,932, an increase of 3,782 miles during the year.

It gives me great pleasure and satisfaction to bear testimony to the good work done by our affiliated associations, which will be evident to anyone attending their meetings or reading their proceedings.

A matter of great importance, and one which I do not think has been given that degree of attention which it merits, by a large number of our companies or this association, is that of depreciation and amortization, and I feel that it is high time that the companies recognized the vital importance of this question and took means to set aside funds to provide for the continual wear that is going on and for which no provision is being made.

I commend to your consideration the advisability of revising to some extent the schedule of dues as provided for in the constitution adopted two years ago. Some of the larger companies feel that the amount they are called upon to pay is out of proportion to the value they receive as compared to the advantages of the association to the smaller companies.

I suggest that there should be some official recognition given to the gentlemen who have performed the work of presidents, for no one has any idea of the amount of work there is to be done until he has passed through it. I have therefore suggested that the past presidents should be constituted honorary members of the executive committee, but without a vote therein, in order that the association may continue to avail itself of their position as representative men in this business.

General Business.

The report of Secretary and Treasurer B. V. Swenson was presented and approved.

The report of the executive committee was then presented. It consisted of the minutes of the various meetings of the committee held during the year. It also was approved.

The possibility of holding the convention every year at Atlantic City for at least the next five years, in consideration of the erection of a new pier for the convention and exhibition by local interests, was broached, but no action was taken at this session.

Brief addresses were made by the presidents of the affiliated organizations. C. L. S. Tingley, second vice-president of the American Railways Company, Philadelphia, spoke for the Accountants. He referred to the importance of discussing depreciation. H. H. Adams, superintendent of shops of the United Railways and Electric Company of Baltimore, followed as the president of the Engineering Association. Mr. Adams dwelt on the importance of the work of the standardization committee of his association. He said the report had been adopted, but if it was to be pigeonholed the work of the committee would be of no avail. H. C. Bradley, claim agent of the Chicago Union Traction Company, addressed the convention on behalf of the Claim Agents, and James H. McGraw of New York spoke as president of the Manufacturers' Association. Mr. McGraw said the Atlantic City exhibition was the best in the history of his association. There was 75,000 square feet covered with the displays of 210 exhibitors.

President Beggs announced that the membership of the parent association, including new members just admitted, stood at 243.

An invitation to hold the next convention at Asbury Park was received.

In order to carry into effect President Beggs' recommendation, C. D. Wyman offered the following amendment to the by-laws: "The entire charge and management of the affairs of the association shall be in the hands of the executive committee, which shall consist of the president, the vice-presidents and one member appointed by each affiliated association and all the past-presidents of the American Street and Interurban Railway Association and its predecessor, the American Street Railway Association, these past-presidents to be honorary members of the executive committee, but without power to vote at meetings of the committee. The executive committee shall make arrangements for carrying out the objects of the association." This amended by-law was adopted.

From the committee on subjects, Richard McCulloch recommended that the new committee on subjects be appointed at the present convention. This new committee should lay out the programme for 1908 at once, so that the work of selecting authors for the papers, which is the principal work of the committee, may be entered upon without delay.

John W. Corning presented the report of the committee on car wiring. He showed how the committee had been able to obtain modifications in the underwriters' requirements for car wiring. Questions in relation to car heaters and bonding in car houses are still pending. On the relation of the underwriters and the electrical interests President Beggs said:

"We recognize, those of us who are charged with the administration of these large properties, not only in the street-railway business, but in that of electric lighting as well, that our interests and those of the underwriters are absolutely mutual. There have been many exacting regulations formulated by the underwriters in past years simply because those who understood better the hazards and the method of preventing fires in our properties were not sufficiently frank with the underwriters. There should be no difference if the underwriters can show to those charged with the care of these properties that a certain method or way of wiring or protecting them is better. Why, we are the direct beneficiaries, not the fire companies alone, because we cannot afford to have a fire."

Standardization.

On the subject of standardization of equipment, H. C. Page of Springfield sent in a report endorsing the report on the same subject adopted by the Engineering Association, as shown in the report in this issue of the Western Electrician on page 332. President Beggs also endorsed the report, saying, among other things:

"If we can have one standard, we will say, of axles, it would facilitate obtaining the supplies throughout the country. It would then become a standard axle just as the A. S. C. E. rail. Those of us who are using standard rails on interurban lines know just what we are going to get when we order certain things. As it is now, nearly every company has some peculiar belling or diameter, or some peculiar curve on axles and wheels and brake-shoes that makes it necessary every time an order comes in for the manufacturer to put in rolls or turn on lathes axles of different diameters, and that all tends to cost more money. The standardization of these axles will tend to lower the prices and facilitate the manufacture. I am speaking now to practical men spending large amounts of money for this apparatus. I think it is highly important, and therefore we can each of us afford to sacrifice some minute details to get down to a standard."

On motion of A. E. Lang the Engineering Association's report on standardization was adopted as the standard for the guidance of members of the parent association.

Papers of Wednesday.

The first paper presented was on "The Technically Trained Man and the Electric-railway Profession," by Prof. H. H. Norris of Cornell University, Ithaca, N. Y. Mr. Norris was present, and read his paper, in which much interest was taken. Those taking part in the discussion were W. Caryl Ely of Buffalo, H. W. Blake of New York, Professor Richey of Worcester Polytechnic Institute, C. S. Sergeant of Boston, C. D. Wyman of Seattle, W. H. Evans of Buffalo, J. W. Corning of Boston and C. L. S. Tingley of Philadelphia. Future reference to this paper and discussion will be made in the Western Electrician.

Ralph Sweetland of the New England Insurance Exchange of Boston then read his paper on "The National Fire Protection Association." He described the work of that organization. Mr. Staats discussed the paper briefly.

"The Influence of the Design of Railway Structures on Economy of Operation" was the title of a paper by H. T. Campion and William McClellan of New York, which was read by title at the suggestion of Mr. McClellan. Adjournment for the day followed.

Opening Business of Thursday.

President Beggs appointed the nominating committee the first thing on Thursday. It consisted of all the past-presidents attending the convention, of whom W. Caryl Ely of Buffalo, C. S. Sergeant of Boston and A. E. Lang of Toledo were named.

E. G. Connette of Worcester, Mass., reported from the committee on standard rules of operation. Many companies have adopted the standard rules of the association, but others have not. The future work of the committee lies in the direction of conferring with the Central Electric Railway Association and important groups of operating companies to the end that one uniform book of rules may be adopted for the whole country, if possible. The committee made a report of progress.

Freight Handling on Electric Railways.

Two papers on electric freight service were read at Thursday's session, both by Iowa men. The first was by P. P. Crafts, general manager of the Iowa and Illinois Railway Company, Clinton, Iowa, on "Light Freight Handling by Electric Lines," and the other was by H. H. Polk, president of the Interurban Railway Company of Des Moines, whose subject was "Freight Service on Electric Railroads." There was a good discussion, in which C. L. Allen of Utica, N. Y., C. D. Emmons of Fort Wayne, Ind., E. F. Peck of Schenectady, J. H. Pardee of New York, George W. Parker of Detroit, G. B. Hippee of Des Moines, W. S. Dimmock of Tacoma, Richard McCulloch of St. Louis and others participated. On motion of Mr. Haggerty the Accountants' association was requested to take up the matter of accounting in freight matters in connection with the classification of freight and interstate business.

Thursday's Papers.

The paper entitled "A Department of Publicity," by J. Harvey White of the Boston Elevated, was read by H. W. Blake, in the absence of the author. A. W. Warnock, general passenger agent of the Twin City Rapid Transit Company of Minneapolis, followed with a paper on "Advertising from the Standpoint of the Street-railway Company." Mr. Harrington presented the report of the committee on the promotion of traffic, and it was considered in connection with the publicity papers.

H. S. Cooper, manager of the Galveston Electric Company, had prepared a paper, "Problems of the Small Electric Road." He was not present, but F. C. Randall, the assistant manager of the same company, read the paper in his place, and shortly thereafter adjournment was taken until Friday morning.

Insurance.

Friday's session was the concluding one of the convention. After routine opening business the report of the committee on insurance was presented by Chairman H. J. Davies of Cleveland. Mr. Davies gave returns from over 70 reports from electric-railway companies, showing premiums paid of over $3,000,000 and payments to insured of $1,360,000. Thus, while rates have been reduced, there is still considerable profit in the fire-insurance business, but of course much of the premium money goes as commissions to agents. The following extract shows the trend of the report:

"Your committee is of the opinion that, while this association should acknowledge obligation to the stock insurance companies for their present lively interest in the traction-insurance business, and for the efforts they are making to so improve street-railway properties as to enable them to reduce rates, the street-railway companies of the country should so construct, equip and protect their properties as to invite competition in insurance, and should be prepared to carry all of their own insurance whenever rates are too high, and prepared at once and at all times to carry at least enough of their own insurance to make the rates. To this end we recommend most earnestly your support of the insurance companies that have been organized by about thirty of the traction companies. This association ought to have the means of knowing, through its own bureau or through a bureau maintained by an insurance company or insurance companies organized and conducted in the interest solely of street-railway companies, and not for profit, the exact cost of insurance, and the best methods of construction and protection, so as to be able to give intelligent consideration to the rates charged or asked by the old-line companies, or by other companies, and, if they appear exorbitant, to be able to present reasons why they should be lower."

President Beggs and Mr. Staats discussed the report at some length.

E. J. Cook of Rochester presented the report of the committee on rules for the construction of modern car houses, which was considered in connection with the subject of insurance. The report was adopted.

Municipal Ownership.

C. D. Wyman of Seattle presented the report on municipal ownership, which the Western Electrician hopes to present in a future issue. In relation to the attitude of the labor leaders toward municipal ownership, Gen. G. H. Harries of Washington said: "Having given some thought to this matter, mainly in connection with the Civic Federation investigation, I know that there are in a few places labor leaders who are strongly socialistic, and who, thoughtlessly—because all their leaders, like the leaders of any other class, are not necessarily thoughtful men—have favored municipal ownership; but the big, strong men of the labor movement realize that municipal ownership, if it ever should be an accomplished fact, will mean death to unionism, and they oppose it. There has not been much said on the platform, but under the surface, in the inner workings of the strong labor organizations, there is opposition to municipal ownership, because if this thing should be carried out there would not be any unions of trainmen, as there are no unions of policemen, or firemen, or of any other municipal organization. That I think to be the general condition within the heart of the labor movement. I have talked that matter over with men who are undoubtedly the mainspring of labor, and I believe that to be their position."

Future Place of Meeting.

A. T. Bell, president of the Atlantic City Hotel Men's Association, was given the floor to ask that Atlantic City be the annual meeting place of the association for at least the next five years. In return the local people will agree to erect an ideal permanent exhibit hall on a pier extending over the ocean for perhaps two-thirds of a mile. Here there will be steam-railroad tracks, overhead traveling crane, storage for crates and boxes, live-steam pipes, electric circuits, exhibit tracks and all other facilities. This exhibition pier (on the site of the old Young's Ocean Pier) will cost from $1,500,000 to $2,000,000. In any event the pier will be improved. If the big associations favor the scheme, the exhibition hall will be built; but in any case the decision must be reached soon. This important matter was referred to the executive committee of the American association to act with the executive committee of the Manufacturers' Association.

Heavy Electric Traction.

Calvert Townley of New Haven presented the report of the committee on heavy electric traction. It is given herewith in full.

The scope of your committee's work, as suggested in the committee's own report of last year, included mainly the consideration of such questions pertaining to heavy electric traction as might from time to time be referred to it by the association. Fortunately, such references have not seemed necessary to your officers, during the last year, and therefore your committee is not called upon to report its consequent findings.

The progress of electrification has been considerable, and the service required from electrified lines widely varied. Owing to this latter fact, and to the rapidly developing state of the art, it is as yet rather early to attempt to establish new standards, and your committee is not prepared to recommend such.

The more important electric-railroad projects begun or materially advanced during the last year have all been bulletined and many of them described in the technical press. A review of same would be out of place here, but it may be of interest to summarize these in a brief list, which is therefore below appended.

Continuous-current 500 to 600-volt Installations.

New York Central and Hudson River Railroad, New York city.—This noteworthy installation, which has been in progress for some years, and which comprises 35 100-ton locomotives, and 131 multiple-unit cars, has been practically completed and is in successful operation.

Detroit River Tunnel Company, Detroit, Mich.—Six 100-ton locomotives.

United Railways, Portland, Ore.—One 35-ton locomotive.

Boston Elevated Railway Company, Boston, Mass.—This company, which has operated heavy elevated service for a number of years, has under construction 308 160-horsepower motors for use as double equipments.

Metropolitan West Side Railway Company, Chicago, Ill.—Two hundred and twenty-eight 160-horsepower motors have been added to the previous equipment of this company's motive power for use with multiple-unit control as double equipments.

Philadelphia and Western Railroad, Philadelphia, Pa.—One hundred cars, each equipped with four 125-horsepower motors.

Brooklyn Rapid Transit Company, Brooklyn, N. Y.—This company has added to its rolling stock 100 elevated cars, each equipped with two 200-horsepower motors operated with multiple-unit control.

West Jersey and Seashore Railroad (Pennsylvania Railroad), Camden, N. J.—Eighty cars, each equipped with two 200-horsepower motors.

Philadelphia Rapid Transit Company, Philadelphia, Pa.—This company has added to its equipment 170 125-horsepower motors for use in two-motor equipments.

The Hudson Companies, New York, N. Y.—Fifty cars, each equipped with two 170-horsepower motors.

Buffalo, Lockport and Rochester Railway, Rochester, N. Y.—Nineteen cars, equipped with four 75-horsepower motors each.

Texas Traction Company.—Fifteen cars, each equipped with four 75-horsepower motors.

West Shore Railroad Company (Oneida Railway Company), Utica, N. Y.—Fifteen cars, each equipped with four 75-horsepower motors.

Pittsburg, Harmony, Butler and Newcastle Railway Company.—Twelve cars, each equipped with four 75-horsepower motors. This equipment is noteworthy, as contemplating the use of 1,200 volts on the trolley, two 600-volt motors being connected in series.

Buffalo and Lake Erie Traction Company, Buffalo, N. Y.—Eight cars, each equipped with four 100-horsepower motors.

Single-phase Alternating-current Installations.

New York, New Haven and Hartford Railway Company, New York city.—This installation, which has been in progress for the last two years, has been practically completed and is in successful operation. It comprises 35 90-ton locomotives, operating both from 11,000-volt single-phase trolley and a 650-volt continuous current supplied from the third rail.

Spokane and Inland Railway, Spokane, Wash.—This installation comprises 14 locomotives, six equipped each with four 100-horsepower motors and eight equipped each with four 175-horsepower motors; also 21 passenger cars, each equipped with four 100-horsepower motors. This road is operating partly from 6,600-volt trolley and partly from a continuous current. Length of track, 146 miles.

Sarnia Tunnel.—Five 62-ton locomotives; trolley voltage, 3,300 volts.

Illinois Traction System, Springfield, Ill.—One 50-ton locomotive and 11 cars, each equipped with four 75-horsepower motors; trolley voltage, 3,300.

Erie Railroad, Western New York.—Six cars, each equipped with four 100-horsepower motors; trolley voltage, 11,000. Length of track, 34 miles.

Washington, Baltimore and Annapolis Railway Company, Baltimore, Md.—This equipment comprises 21 cars, each equipped with four 125-horsepower motors; also four cars, each equipped with two 125-horsepower motors; trolley voltage, 6,600.

Richmond and Chesapeake Bay Railway Company, Richmond, Va.—Four cars, each equipped with four 125-horsepower motors; trolley voltage, 6,600.

Polyphase Installation.

Great Northern Railroad, Cascade Tunnel, Washington.—This equipment will comprise four locomotives, each of 100 tons, to be operated on a 3,000-volt three-phase alternating current. This installation will doubtless be watched with great interest and will give an opportunity of demonstrating the fact regarding the advantages for and objections to polyphase currents for heavy railroad use.

Continuous-current 1,200-volt Installotions.

Southern Pacific Company, Oakland, Cal.—This equipment will comprise 44 cars, each to be operated with 125-horsepower motors, to be operated continuously two in series on 1,200 volts. There will also be 40 trail-car equipments.

Indianapolis and Louisville Railway.—Ten cars, each to be equipped with four 75-horsepower motors, connected two in series for 1,200-volt operation. Much interest has been attracted to the investigations of the Pennsylvania Railroad, which is preparing to equip its new New York City Terminal and the tunnels connecting Manhattan Island with New Jersey and with Long Island with electricity. For the purposes of demonstrating the various possibilities, the company has arranged to test both large continuous-current and large alternating-current locomotives, that comprising the greatest novelty being a 152-ton, 15-cycle, single-phase, alternating-current locomotive for operation from 11,000-volt trolley.

COMPENSATION FOR CARRYING MAIL.

Gen. G. H. Harries of Washington reported that an effort was made by the chairman of the committee (Mr. Rogers of Binghamton, N. Y.) and Secretary Swenson to interest the Postoffice Department and the House committee on postoffices and post roads in the matter of increased compensation for carrying the mails on electric cars. The committee had already, as most of you are aware, succeeded in procuring legislation to increase the maximum compensation for carrying pouch mail from three cents to four cents. At the same time Congress has placed a very serious restriction in the law, by providing that on electric railroads, outside of cities exceeding a distance of 20 miles in length, the compensation received by such roads shall not exceed the rates paid to the steam roads. That is an unfair discrimination, and will cause many railway managements more or less distress because the price paid must necessarily be less than the actual cost of rendering the service. The new committee should be instructed to make an effort at this next session of Congress to secure the maximum of six cents for the pouch service, and not less than 25 cents a car-mile on the postal-car service. The 20-mile limitation should be extended to 50 miles.

FRIDAY'S PAPERS.

"The Use of the T Rail in Cities" was the title of a paper read by C. Gordon Reel, vice-president, Kingston Consolidated Railway Company, Kingston, N. Y. Mr. Reel advocated the T rail strongly and said that the Twin City Rapid Transit Company of Minneapolis and St. Paul, the Milwaukee company and the Montreal system are all using the T rail, in addition to his own road in Kingston. P. P. Crafts, F. W. Coen of Cleveland, P. E. Mitchell and others discussed the paper.

The paper on "Public Policies of the Past and Future," by C. Loomis Allen, vice-president Utica and Mohawk Railway Company, Utica, N. Y., was read by title in the absence of the author.

Theodore Stebbins of New York read his paper on "Interurban Fares." There was no discussion. William J. Clark of New York followed with his paper on "Municipal Ownership in Great Britain and the United States." He paid a tribute to the labor leaders in relation to this question. "No class of men worked more thoroughly and earnestly on our investigation than our labor leaders, and I believe, gentlemen, that the most valuable contribution to the literature on this great subject is that which will soon appear by Prof. John R. Common and J. W. Sullivan, both eminent labor leaders. There is actually more solid meat, more truth, told in their report, more facts that go to the point, than are concentrated in any other source. I might also say that at this committee the only man I knew to change his mind thoroughly, as the result of all this investigation, was one of the labor leaders."

From the public relations committee W. Caryl Ely reported. Mr. Ely said that the burden of the report related to the proper attitude of the association toward the movement to regulate or control public utilities through public-service commissions.

ELECTION OF OFFICERS AND CONCLUDING BUSINESS.

These officers were elected on report of the nominating committee, made by Mr. Ely:

President—Calvin G. Goodrich, Minneapolis.

First vice-president—James F. Shaw, Boston.

Second vice-president—Arthur W. Brady, Anderson, Ind.

Third vice-president—Thomas N. McCarter, president the Public Service Railway Company, Newark, N. J.

Executive committee—The president, vice-presidents, and Frank R. Henry of St. Louis, president of the Accountants' Association; Frederick G. Simmons of Milwaukee, president of the Engineering Association; H. R. Goshorn of Philadelphia, president of the Claim Agents' Association.

The usual resolutions of thanks to the Manufacturers' Association, to the Atlantic City people, to authors of papers and others were adopted. The resolutions were gracefully worded and were signed by C. D. Wyman of Seattle, C. S. Sergeant of Boston and H. J. Davies of Cleveland.

ANOTHER AUXILIARY ASSOCIATION TO BE FORMED.

This self-explanatory resolution, offered by Mr. Ely, was adopted:

Whereas, Experience has demonstrated the desirability and usefulness of our existing affiliated organizations; and

Whereas, It has appeared from discussion that another organization of similar character should be organized, to which should be committed lines of work pertaining to transportation, traffic and general operation; now, therefore, be it

Resolved, That the executive committee be and hereby is requested to take such steps as it may deem desirable to encourage the formation of such an organization.

Shortly after adopting this resolution the association finally adjourned.

The Engineering Association.

The fifth annual meeting of the American Street and Interurban Railway Engineering Association was held in Atlantic City on October 14, 15 and 16, 1907. President H. H. Adams of Baltimore called the first session to order on Monday afternoon, October 14th. He introduced as the first speaker President Beggs of the parent association, who addressed the association at some length. Among other things Mr. Beggs mentioned the fact that the Milwaukee Electric Railway and Light Company is seriously considering the adoption of four motors of practically 100 horsepower each for each of its standard city cars. This would have been thought very heavy equipment for the most important interurban line a few years ago. The speaker had a good deal to say of the importance of standardization. The standardization of equipment, he said, means reducing costs, and so is important financially. The shops can be run better, for instance, when there are one or two standard types of brake-shoe rather than twenty. The standard car axle in Milwaukee is 5½ inches in diameter. Then, again, standardization will keep the smallest practicable proportion of the equipment in the shops for repairs. In the speaker's judgment, not more than five per cent. of the equipment should be in the shops at any one time, leaving 95 per cent. free to carry passengers at all times.

In the course of his remarks Mr. Beggs said: "If we are not able to get the intelligent, the untiring interest and enthusiasm of the men who are at the head of our shops and roadways, it is almost impossible for us to make a success of the administration of these properties; and yet there is so much at stake in these days. On every street corner, in every saloon, in every legislative body, and in every council chamber there are people who are conjuring up imaginary ills that they are supposed to suffer because of the manner in which these public utilities are being operated. Consequently, there is all the more reason why these utilities should be operated in such manner as not to leave even the shadow of a suspicion of a lack of intelligent administration." Mr. Beggs then recounted with justifiable pride how when his Milwaukee company's books were examined by certified accountants in a reduced-fare agitation these experts commended in the highest terms the manner in which the books had been kept. He added: "If your books are demanded some day, so do your work that you will not need to hesitate to put them on the table and let all see the cards."

C. L. S. Tingley of Philadelphia, president of the Accountants' association, gave a few words of greeting, and Past-President E. W. Olds of Milwaukee also spoke briefly. The next order of business was the president's annual address:

PRESIDENT ADAMS' ADDRESS (ABRIDGED).

The work of the standardization committee has demonstrated the necessity of going further into committee work, as the subject is so broad it is necessary to subdivide and appoint committees to handle various parts of the equipment. These should be appointed to take care of wheels, axles, brake-shoes and heads, motors and various other important items.

I desire to call your particular attention to the report of the standardization committee, but, before going into details, let me say, that, owing to pressure of business, Mr. Wallerstedt had to relinquish his duties as chairman, and it was with great regret that I accepted his resignation; Mr. Wallerstedt, however, kindly consented to remain a member of the committee. This association is greatly indebted to him for his work in the past as chairman of the committee, for, under his guidance, a great deal of the foundation of this report was prepared. Mr. W. H. Evans was appointed chairman to fill the vacancy on July 3, 1907. The report, as submitted by the standardization committee, represents the most important one that has been presented in the history of the association. It shows that certain steps have been taken toward uniform practice in gearing for motors, the committee having met with a cordial response from the motor designers, and further steps in the question of uniform design in certain of the motor parts is only a question of time. It is exceedingly desirable that definite action be taken on the report at this meeting, in order that a start may be made in the direction in which we have been looking for a long time.

The importance of the adoption of these recommendations, from a commercial standpoint alone, is very great. For example, the brake-shoes and heads that are recommended will reduce to a minimum the number of patterns required, and the stock to be carried will be decreased accordingly, as the manufacturer will be able to supply standard shoes upon short notice. Also, in good practice today, brake-shoes are scrapped at between 40 and 50 per cent of their original weight. With the narrow tread shoe recommended, the scrap will run from 30 to 40 per cent. Prices will also be affected, as, by reducing the number of parts to be carried, the manufacturer will thus be able to give the consumer the benefit of lower figures.

In the name of the association, I desire to thank the individual members of this committee for the noble work they have done in connection with the report, and the association is particularly indebted to Mr. W. H. Evans, the chairman, for his untiring efforts in this direction. The valuable assistance and co-operation given this committee by the representatives of the manufacturers cannot be overestimated, and their efforts are fully appreciated by this association.

The report of the committee on maintenance and inspection of electric equipments covers a large subject in a very able manner, and the data presented are exceedingly valuable. The report shows the necessity of further investigation along these lines, and several standing committees should be appointed to deal with the same for the future.

At the conclusion of the president's address the secretary read the report of the treasurer, which showed the following financial transactions during the year: Receipts, $1,412.66; expenses, $1,376.08; balance, $36.58.

CONTROL APPARATUS.

By request F. E. Case of Schenectady, one of the engineers of the General Electric Company, described recent improvements in control apparatus for railway equipments. He said that for some time his company has felt that the standard forms of K type series-parallel controllers were not entirely satisfactory for service-operating conditions. While these controllers successfully handle the ordinary arcing and currents, if a motor or other part of the equipment becomes damaged so as to take an excessive amount of current through the controller, the capacity for disrupting arcs is exceeded and short-circuits sometimes occur. The use of higher operating voltages has also imposed a greater duty upon the platform type of controller. The company has, therefore, designed a new line of cylinder controllers with improved magnetic blowouts, which can be safely used where the voltage peaks may reach 750. The present line of controllers comprises three sizes, as follows: The K-34 controller, which is suitable for use with either two 150-horsepower or four 75-horsepower motors rated at 500 volts; the K-35 controller, for use with either two 100-horsepower or four 60-horsepower motors and less; the K-36 controller, for use with two motors only of a capacity of 60 horsepower each or less. The main operating handle in all sizes of these controllers is directly connected to the operating cylinder without the intervention of gearing. The reverse switch and handle are located at the left of the controllers, in order to permit a better arrangement of the new style of magnetic blowout, differing from the previous K types of controller in this respect.

A number of improvements have also been made in type M controls. In order to economize in space a new form of contactor in several sizes has been designed which is narrower than the present contactors, and is also simpler in construction. This produces a heavier contact pressure than previous contactors of the same capacity without requiring any more operative current. New contactor boxes have been designed for the new contactors, in which the control-circuit fuses are placed at one end, thereby simplifying the control-circuit wiring. The length of the contactor box suitable for use with four 60-horsepower motors is about 54 inches over all and for four 25-horsepower motors is about 72 inches.

A radically new design of contactor for alternating-current operation has been developed. This contactor has a very efficient magnet for operating it, and a pressure as great as that in the direct-current contactors is obtained. As a matter of fact, this contactor is just as simple in construction as the latter and operates with perfect freedom from the disagreeable humming incident to most alternating-current magnets. The same type of magnet is used for operating the reverser, oil switch and other devices requiring to be operated by means of magnets.

Mr. Case concluded: "There have been many opinions expressed regarding the proper design for a trolley base, and we have attempted to incorporate in a new base, known as the US-13, the desirable features recommended by our railway friends and to eliminate those points which various types of trolleys in service have proved to be objectionable. The following is a brief specification: Vertical roller bearing, comprising 31 steel rollers one-fourth inch in diameter by 5⅜ inches long; four tension springs adjusted with one screw; capacious oil well; resilient spring stop; height, five inches; weight, approximately 100 pounds; maximum pressure at 45 degrees with 14-foot pole and high-speed fork and wheel, 35 pounds, the pressure increasing slightly at a lesser height and decreasing at a greater; minimum pressure at 45 degrees with 12-foot pole and small wheel, 18 pounds. It is believed that this trolley base is one which can be universally used for both high speed and city service with excellent results."

In the ensuing discussion the following points were made:

J. W. Corning: I would speak of something in connection with controllers that came under our observation in the Boston Elevated Railway Company, and that is the adjustment of the steps on the accelerating rheostat. It was brought to our attention by one of our officials that there were cases of uneven acceleration on a number of our cars, which he had noticed from personal observation while on the cars, and it was thought an investigation of the matter might prove advantageous. We went into the matter with one of the recording ammeters made by the General Electric Company and found in some instances some very bad setting of the resistance connections. I might give an illustration of it. We were operating some 25 old box cars with two G-58 motors and K-10 controller, and it was found that on the last step in parallel, just before going into full multiple, there was a peak of about 325 amperes in accelerating on a grade of about five per cent. The average current in multiple on that controller was a great deal larger than the average current in series, per motor. By a readjustment of the resistances we were enabled to bring the peak down to about 185 or 190 amperes. We had had a great deal of trouble on that line with flashing of motors, blowing fuses, and short-circuits in the controller. Since the readjustment of the resistances that trouble has been practically wiped out.

It was found by talking with the motormen that they were afraid to carry the controller to the last notch, because they often blew fuses when they did it, and the blowing of a fuse by a motorman was considered a very bad sign; he was called down by the division superintendent and had to explain why it happened, so that most of the motormen remained on the next to the last notch of the rheostat a long while before advancing to the last point. That resulted in numerous cases of burning out of rheostats. By changing these resistance connections, and getting an average current in series and parallel per motor of the same value, we have been enabled practically to eliminate the motor flashing and also the fuse blowing and controller trouble. We have gone over all of our equipment and worked up a standard set of connections for all the motors. With the newer type of equipment which we have, multiple-unit control, the companies are furnishing connections to go by, but in all of the old equipments it would seem that the different car-house foremen have made connections that best suited their judgment.

William Roberts: So far as the operation of cars is concerned, and the use of controllers generally, with the better class of workmanship, the better standard of the operation of our cars, the superintendent of motive power may say that there are no really bad controllers. In reference to the paper read by Mr. Case, with special reference to his remarks about the 28 controller, I will say that we have an equipment of not four 40-horsepower, but four 65-horsepower motors, 93 Westinghouse, that have not been in the car barns for a year and 10 months for repairs. They are operated on a baggage car 52 feet long, and we have to operate that car over 13 per cent. grades, carrying loads that are simply limited by the size of the car.

N. W. Storer, Pittsburg: In regard to the developments in the last year in the Westinghouse company, I would simply say we have carried on our development in the same line as was shown last year. We still have the electro-pneumatic type of multiple-unit control, and we are using the same contactors for both alternating current and direct current. For the direct-current work we use the battery for the valve magnets, and the same battery and valve magnet apply equally well for the alternating current; the only difference between the contactors is in the blowout, which is modified slightly for the alternating current. We find the greatest advantage comes to us in the heavy pressures we are enabled to get on our contactors by use of the compressed air, and that, combined with an effective blowout, makes a very good operating switch. We installed a considerable number of equipments for the smaller size motors, quadrupled 40 and 60-horsepower motors in the last year, and are getting very good results therefrom. We look for a great increase in this particular development. We are great believers in the multiple-unit equipment for not only heavy work, but for street-car service as well, and look to see it put in operation in city streets more and more. I believe that train control in cities will do more to increase the capacity of the line than any other one thing. It is certain, for instance, that operating a three-car train in a city street will give a great deal more capacity than where single cars are operated. The three cars will occupy the street very little longer than a single car, and the delays at crossing will be practically one-third what they are with one car. I believe this will come into practice more and more. The main thing in introducing it is to get the men properly acquainted with the apparatus. After that there will be very little trouble with it.

Maintenance and Inspection of Electrical Equipment.

L. L. Smith presented the report of the committee on this subject, which is presented in part in this issue of the Western Electrician. The report was discussed by C. B. Fairchild, William Roberts, E. W. Olds, Mr. Harper of Washington, D. C., W. H. Evans, F. G. Simmons. The committee was extended a vote of thanks, and adjournment until Tuesday was taken.

Track Construction and Maintenance.

The first business of Tuesday morning's session was the report of the committee on way matters. F. G. Simmons, chairman of that committee, explained that the report was embodied in the various sub-committee reports and reports of investigations carried on during the year, which were listed in the programme. The way committee was instructed to send out a circular letter and investigate the matter of rail corrugations. Such a letter was sent out, and a tabulation of the replies has been printed.

George L. Wilson, engineer of the Twin City Rapid Transit Company of Minneapolis and St. Paul, read his paper on "Care of Electric-railway Tracks." Mr. Wilson considered first interurban track, then passed to city track and concluded with some observations on oil sprinkling and snow removal. E. O. Ackerman, Columbus Railway and Light Company, Columbus, Ohio, opened the discussion, and he was followed by C. H. Clark, who believed in machinery rather than brawn and muscle for track work. F. G. Simmons said a good word for the T rail. A. M. Schreiber said the track department was far behind the times in the use of machinery, although there is the objection that machines on city tracks may obstruct traffic and scare horses. W. Boardman Reed of New York described a plan of snow removal paid for at so much per inch of snowfall as determined by the reports of the Weather Bureau. E. N. T. Ryder spoke of tile drainage of track ballast. M. J. French favored an open trench for drainage rather than tiles. W. J. W. Griffin told of the system of keeping labor costs on interurban track work near Rochester, N. Y. Mr. Wilson gave a resumé of the discussion.

Rail Corrugation.

Mr. Simmons presented the report of the subcommittee on rail corrugation. Reports from street-railway companies, while considerably at variance, seem to indicate that the length of rail affected is from three feet to several hundred feet; that the length of time the rail is in service before corrugation appears varies from four months to 13 years; that the length of corrugations is from 1 to 15 inches; that the depth of corrugation varies from an inappreciable amount up to three-sixteenths of an inch; that deep girder rails are most liable to rail corrugation, and that the corrugations occur mostly upon track which is not laid upon a thoroughly rigid base. The Philadelphia Rapid Transit Company appears to have had the greatest experience in dealing with this phenomenon. Mr. Wilson, C. E. Voynow, Mr. Reed, Mr. Simmons, Mr. Olds and I. E. Matthews discussed the report. The investigation of the causes of and possible remedies for rail corrugation will be continued.

Concrete Ties and Rail Matters.

In relation to concrete ties the committee reported progress in its investigation. It will be necessary to undertake a number of experiments, and no definite conclusions are now available.

Mr. Clark presented the report of the committee on rails and rail matters. The committee recommends as the best practice, and as standard for city construction paved streets, the use of a seven-inch T rail known as the Lorain section No. 95,400 and the Pennsylvania Steel Company's section No. 272. Mr. Simmons said that from fifty to one hundred, or possibly more, types of rails are now in use in various cities. No action was taken on the committee's report.

Committee on Nominations.

At the conclusion of this session President Adams announced the committee on nominations as consisting of C. H. Clark, Buffalo, chairman; George L. Wilson, Minneapolis; Charles Hewitt, Philadelphia; George J. Smith, Kansas City: W. D. Wright, Providence, R. I.

Standardization.

The important report of the committee on standardization came up on Tuesday afternoon. W. H. Evans, chairman of the committee, presented the report. The report, with a portion omitted, is as follows:

Your committee appointed to investigate the subject of standardization as applied to electric-traction equipment reports that it has proceeded upon the lines laid down for this committee in the year 1906, and has investigated the same topics, namely:

(a) Standard axles, journals, journal bearings and journal boxes.

(b) Standard brake-shoes, brake-shoe heads and keys.

(c) Standard section of tread and flange of wheel.

(d) Standard rails.

Considerable work on all of the above subjects was done by the committee during the year 1906, both previous and subsequent to the convention at Columbus, and all the information given in the data sheets was compiled in tabular form for consideration by the committee.

It was subsequently decided desirable to have the subject of rails considered by the way committee. All the information received on this subject was turned over to that committee by direction of the president, and that committee will submit a separate report. This committee has considered the subject of rails and special work only as affecting the recommendation of a standard wheel tread and flange.

In order thoroughly to study the conditions affecting the above subjects the committee held meetings in New York on May 20th and 21st, in Cleveland on July 26th and 27th, and again in New York on September 12 and 13, 1907. At each of these meetings representatives of the various manufacturers of all the equipment under consideration were present, and materially assisted the committee in arriving at the recommendations which are embodied in this report.

A consideration of this subject disclosed that it would be very difficult to adopt standards which would accommodate to any general extent the equipments already in service. After a thorough discussion by the representatives of all the interests involved this committee decided to recommend arbitrary dimensions which conform to what is believed to be the very best recommended practice, at the same time meeting as nearly as possible the requirements of the existing conditions. The dimensions proposed very nearly approach the standards adopted by many of the large electric-railway properties of the country.

In this connection the committee has profited very materially by the experience of similar organizations which have developed the axle problem since the beginning of operation of railroads in this country, and this was found to be not only valuable in taking advantage of what experience had taught but also desirable from a commercial standpoint.

We, therefore, recommend the axles shown in Fig. 1 and designated as EA, EB, EB1, EC, EC1 and ED. A general summary of the axle and gear data is given in Table 1, below.

The distinguishing feature, in fact the only variation in dimensions as between the axles indicated as EB and EB1 and also in the case of EC and EC1, is the diameter of the motor fit, as it was originally thought best to recommend an axle 5½ and 6½ for those two sizes; but after further consideration it was considered desirable to specify a particular axle which would have a five-inch motor fit and also a six-inch motor fit, so that we really have adopted but four standard axles with that particular variation.

Axle EA has a journal of 3.75 by 7 inches. It is designed to carry a load of 15,000 pounds per axle and for the accommodation of motors not to exceed 45 horsepower capacity.

Axle EB has a journal 4.25 by 8 inches and is designed to carry a load of 19,000 pounds per axle and for motors not to exceed 65 horsepower capacity.

Axle EB1 has the same general dimensions as axle EB, except that it is 5.5 inches in diameter at the motor fit. It is designed to carry 22,000 pounds per axle and for motors not exceeding 100 horsepower capacity.

Axle EC has a journal 5 by 9 inches. It is designed to carry a load of 27,000 pounds per axle and is intended to accommodate motors not to exceed 150 horsepower capacity.

Axle EC1 is of the same general dimensions as axle EC, excepting that the diameter at the motor fit is 6.5 inches. It is designed to carry 31,000 pounds per axle and to accommodate motors not exceeding 200 horsepower capacity.

Table I.—Summary of Axle and Gear Data.

Type.	Journals, Inches.	Motor Fit, Inches.	Gear Fit, Inches.	Wheel Fit, Inches.	Distance Between Hubs.	Centers of Journals.	Maximum Capacity.	Horse-power.	Length of Gear Seat.	Gear Pitch.	Gear Face, Inches.	Diam'ter of Gear Hub and Motor Bearing Flange	Finished Width Gear Hubs. Wheel Side.	Finished Width Gear Hubs. Motor Side.
EA	3¾ by 7	4½	5⅛	5 7-16	48	75	15,000	45	6⅛	3	5	8	1	1
EB	4¼ by 8	5	6	5 15-16	48	75	19,000	45—60	6¼	3	5	8	1	⅛
EB1	4¼ by 8	5½	6	5 15-16	48	75	22,000	65—100	6¼	3	5	8	1	⅛
EC	5 by 9	6	7	6 15-16	50	76	27,000	100—150	6⅛	2½	5¼	9½	⅛	¾
EC1	5 by 9	6½	7	6 15-16	50	76	31,000	150—200	6¼	2½	5¼	9½	⅛	¾
ED	5½ by 10	7	8	7 15-16	50	77	38,000	200—250	6⅛	2½	5¼	10½	⅛	¾

Axle ED has a journal of 5.5 by 10 inches and a carrying capacity of 38,000 pounds per axle. It is designed to accommodate motors not to exceed 250 horsepower capacity.

Axles EA, EB and EB1 are to accommodate motors that do not require more than 48 inches between the wheel hubs, and axles EC and EC1 and ED are to accommodate motors that do not require more than 50 inches between the wheel hubs.

Particular attention is directed to the dimensions given on these axles, all of which were worked out with a great deal of care by the committee and were adopted only after a very careful consideration of each and the relation of each to all the others. This applies with particular emphasis to the diameter and length of wheel fit, diameter and length of gear fit, the gear keys and the diameter of the motor fits. The discussion in connection with these subjects developed that the dimensions recommended by the committee are the most desirable and very acceptable to the manufacturers of the different parts of the equipment. Their original adoption will result in eliminating a great variety of dimensions of these parts. This lack of uniformity in the past has worked a particular hardship not only on the manufacturers but also upon the companies operating the equipment.

toward the general adoption of wheels having this tread.

Your committee recognizes the fact that local conditions on many of the systems forming our association are such that it will be difficult for a number of years to operate a wheel of the dimensions represented by wheel A. To meet these conditions your committee recommends wheel B (Fig. 2) with a tread of 2.5 inches wide and a flange 0.75 inch high, this flange to have the same general dimensions as wheel A, with the exception of the height above the tread line.

In mounting and gauging wheels it is understood that the gauge line is at a point on the flange 0.25 inch above the wheel tread, and your committee recommends that the wheels be gauged 0.25 inch narrower than the gauge of the track, the track gauge being measured between points 0.25 inch below the tops of the rails.

The investigation conducted by this committee during the last two years indicates the need on the part of the association in the future for a standing committee or standing committees to take charge of the changes and progress in electric-traction equipment. The extent of the field suggests the desirability of dividing the subject among various committees as has been found necessary in the

Schreiber mentioned one design that has never been tried, and that is to make a car barn with one-third of the cars covered, with protection for offices and men's quarters, and then for the other two-thirds to be a sort of a cheap umbrella type of protection. "The details of this," said he, "I am not just ready to describe, but I am confident that it could be done."

LIGHTNING PROTECTION.

The Question Box was presented by Secretary Mower, and in connection therewith an interesting discussion arose on the subject of lightning protection.

A. W. Corning: I would like to ask if any of the members have had experience with lightning arresters composed of a high-resistance rod, a rod of graphite or similar material, which is on the market at the present time.

If there is no answer to that question I would like to ask what the practice is on some of the roads as to the disposition of lightning arresters along the line, whether there is any generally adopted plan of placing them at certain intervals?

Mr. Simmons: Our road endeavors to place lightning arresters at least every half mile on all our interurban lines.

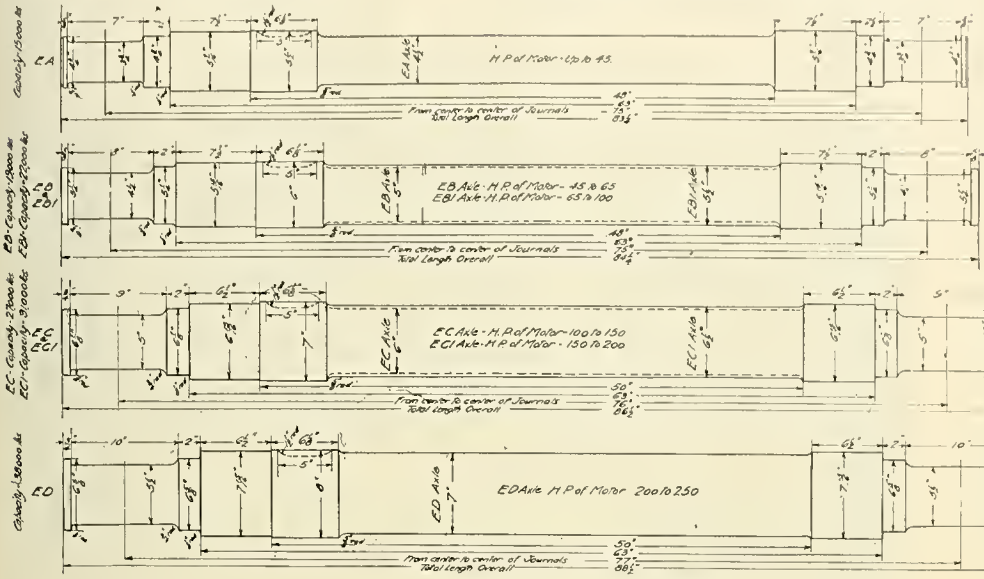


FIG. 1. PROPOSED STANDARD MOTOR AXLES.

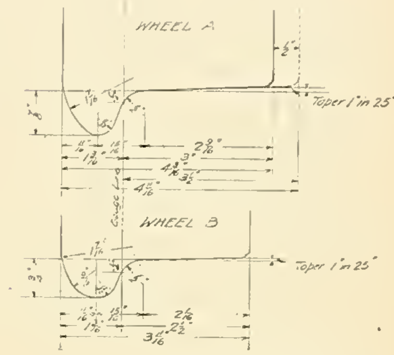


FIG. 2. PROPOSED WHEEL SECTIONS.

Special attention is directed to the length of gear seat and the key way as well as to the diameter of the gear hub and the width of gear face, as it was found that by adopting these dimensions the motor builders would be able to arrive at a uniform gear practice.

It is further recommended that for motors not to exceed 100 horsepower a three-pitch gear with five-inch face be adopted as standard, and that motors exceeding 100 horsepower should have a 2.5-inch pitch gear with a 5.25-inch face.

For journals and journal-bearing keys we recommend the use of the four sizes known as the Master Car Builders' standards. These are the result of years of experience in equipments of similar character and generally familiar, and are specified in reports of the proceedings of that association.

[A portion of the report relating to journal boxes, brake-shoes, brake-shoe heads and keys is here omitted.]

The investigation by this committee of the various types of wheels in service on electric-traction properties throughout the country shows that there is a very wide variation of wheel sections in use, especially as regards flanges and treads. An inspection of the data sheets demonstrated that it was almost impossible to select one wheel which would meet all the varying conditions. These sheets also showed conclusively that wheels of a considerably narrower tread than the increased weight of the equipment requires are being operated. Your committee, therefore, recommends as standard for street and interurban railways as far as it can be applied a wheel tread and flange contour which conforms to that shown in Fig. 2 and indicated as wheel A, this wheel to have a tread three inches wide and a flange seven-eighths inch high and 1 3-16 inches thick at the throat. It is the opinion of the committee that this wheel tread and flange can be applied with comparatively little difficulty to a great majority of the roads forming our association.

A number of roads are using wheels with a tread 3.5 inches wide for combined city and interurban work, and there is a decided tendency in this direction. This wide tread assists in carrying the load across special work without running on the flange, and avoids the necessity for flange bearing on the special work. We, therefore, also recommend wheel A with the tread increased to 3.5 inches for interurban work, and also for city work where it can be used. In the judgment of your committee it is especially desirable to work

case of similar work carried on by other associations.

In making these recommendations your committee has been greatly assisted by representatives of the manufacturers of the various parts of the equipment concerned, and it is pleasing for us to report that these recommendations appear to meet with their general approval. In fact they will gladly co-operate in the adoption of these standards, as many of the various manufacturers represented in our conferences have long felt the necessity for the adoption of standards for electric-traction equipment. It is possibly well to state that these recommendations are the result of a very thorough and general discussion on the part of all the interests involved, both the manufacturing and various departments of the electric railways. Your committee takes this occasion to acknowledge the very valuable assistance and enthusiastic support of all those who co-operated in the work leading up to these recommendations.

The recommendations of this committee are the result of the labor of two years and we urge that definite action be taken in this matter at your convention this year.

Following the reading of this report there was an extended discussion, but at its conclusion the report was unanimously adopted and recommended for adoption by the American or parent association—the "bosses of us all," as one member expressed it.

Those taking part in the discussion were N. W. Storer of Pittsburg, E. D. Priest of Schenectady, E. W. Olds of Milwaukee, M. Ayers, John R. Dickie, C. S. Sergeant, E. G. Connette, A. H. Weston, C. E. Voynow, F. G. Simmons, C. L. Allen, Mr. Owens, J. E. Welsh and William Roberts. On motion of F. H. Lincoln, seconded by J. N. Smith, the report was, without change, accepted, adopted and recommended for the approval of the American Association. A rising vote of thanks was extended to the committee.

CAR HOUSES.

Martin Schreiber presented the report of the committee on "Open versus Closed Terminals for Car Houses." Mr. Olds is chairman of the committee. The question of open or closed terminals was shown to be decided by local conditions, as climate, finance, operating methods and the like. Mr.

P. E. Mitchell: We place lightning arresters in deep railroad cuts and on high spots that we have found most subject to lightning.

William Roberts: It is our practice to cluster lightning arresters on high spots and to cluster them very thickly around the power house. On every pole around one power house at Cuyahoga Falls that is particularly susceptible to lightning I have placed 24 lightning arresters. I am not here to advertise any particular make of lightning arrester, but we have used very extensively during this last summer quite a number of a new type of lightning arrester. Last year we lost 38 armatures on our high-speed cars between Akron and Cleveland. This year we have only lost three, and I believe that that favorable result has been largely owing to the fact of adopting this new type of lightning arresters and grouping them around the power house.

Only once this year have we been seriously troubled with lightning, and the storm was so heavy on that occasion and the lightning so concentrated around the city that I rushed to the power house and shut down the whole station. We had seven shocks—three on the direct-current end and four on the alternating-current end. One came in on the 22,000 transmission line and burned about four feet out of one of the three-phase wires. That happened just as I was making my way down from the office. I will never forget the sight that presented itself to me from the glass doors of the switchboard room. I thought it was just one small hell—(laughter)—just a blaze of fire. I couldn't see anything. When I got in, the first thing I heard was, "The big transformers are gone." I said, "Not on your life. Throw everything out." I said, "Make yourself busy now and get that wire spliced up. We want to go in a few minutes." I just held her down. I went down to the direct-current board, stood a few moments, turned to one of the switchboard attendants and I said, "We will take chances in starting up the 1,000-kilowatt direct-current engine." Of course, we had all the engines turning, but not in operation on the electrical end. Just as I said that I put my hand up and I said, "Just a moment." Just then we got three shocks in on the direct-current side. Two of them came in over these lightning arresters, and that took care of every shock. I walked along to the alternating-current board on the high-tension side and I stood just under the glass tube, and we got a static discharge there;

and if the dynamic had followed it we would not have had any power house.

I just waited a few moments, went out to the north end of the building, looked out and came back again, and I said, "Just get her moving, boys, but don't get anything in." About five minutes after that we had another shock that I believe would have put us out of business altogether, but presently the storm seemed to move further toward the east, and we started up. We were shut down 25 minutes, the first time we have had to shut down for quite a long time. I think it was a very good thing to do, for unquestionably in my mind we would have had some serious trouble in the power house. As it was, the trouble was simply confined to the destruction of this wire and the burning away of about four feet of copper on the No. 2 wire on the high-transmission line.

In all the literature I have read on the subject I have never found any definite statement made of the best place to locate lightning arresters. The fact that our trouble has been decreased from a loss, as I have said, of a large number of armatures, I think it was 36, although I am not quite sure, and that this year we have lost only two, and possibly three, I attribute entirely to the fact of the placing of the lightning arresters around the power house, and also to this fact that on one of our long-distance lines we have a station storage battery and on the other a line battery. They are the best lightning arresters in the world.

I would advise any gentleman who is up against this proposition to find out where your trouble starts, and that is a very easy matter to determine, and group your lightning arresters. Do not be afraid of spending money on lightning arresters, and put them all around the power house.

P. E. Mitchell: We adopted some years ago the keeping of a map and noting every time we have a lightning storm about where the lightning strikes cars or line. We find that certain spots are more liable to it than others, and we put lightning arresters there, and in that way have cut down losses greatly. We have very few losses at present.

Gas Engines and Steam Turbines.

On Wednesday morning there was a joint meeting of the American Association and all the allied associations. The concluding session of the Engineering association was held on Wednesday afternoon. The first item on the programme was the paper entitled "A Year's Experience with Gas Engines," by Paul Winsor, chief engineer of motive power and rolling stock, Boston Elevated Railway Company. Mr. Winsor could not attend the meeting, and Charles Hewitt of Philadelphia read the paper. This short but valuable paper is given elsewhere in this issue.

St. John Chilton, engineer of Allis-Chalmers Company, Milwaukee, read his paper on "Some Practical Points in Steam-turbine Construction, with Particular Reference to the Parsons Type," and was followed by August H. Kruesi of Schenectady, whose paper was entitled "Curtis Turbines in Railway Service." Considerable discussion ensued, relating to steam pressures and boiler tubes, oil or water for step bearings, steam or electrically driven auxiliaries, and the like. Among those taking part were William Roberts, P. E. Mitchell, Charles Hewitt, F. E. Henshaw, C. F. Baker, Dudley W. Farrand, president of the National Electric Light Association, Mr. Kreusi and others.

J. R. Bibbins, engineer of the Westinghouse Machine Company of East Pittsburg, abstracted his paper on "Recent Developments in Steam-turbine Power-station Work." He gave also some results of the test of the 7,500-kilowatt Westinghouse-Parsons turbine in the New York Edison Waterside Station No. 2, recently summarized in the Western Electrician.

The Western Electrician hopes in a future issue to print some of the material presented in the steam-turbine papers and discussion.

Concluding Business.

On motion of Mr. Evans it was resolved that all papers and printed matter to be presented to the next convention be printed and in the mail at least thirty days before the meeting of the convention. It was felt that some of the papers were inadequately discussed because advance copies were not distributed.

Officers were elected as follows:

President—F. G. Simmons, superintendent of construction and maintenance of way, Milwaukee Electric Railway and Light Company, Milwaukee, Wis.

First vice-president—Paul Winsor, chief engineer of motive power and rolling stock, Boston Elevated Railway Company, Boston, Mass.

Second vice-president—F. H. Lincoln, assistant general manager, Philadelphia Rapid Transit Company, Philadelphia, Pa.

Third vice-president—W. H. Evans, master mechanic, International Railway Company, Buffalo, N. Y.

Secretary and treasurer—J. W. Corning, electrical engineer, Boston Elevated Railway Company, Boston, Mass.

Executive committee—Officers and W. J. Harvie, electrical engineer, Utica and Mohawk Valley Railway Company, Utica, N. Y.; William Roberts, superintendent of motive power, Northern Ohio Traction and Light Company, Akron, Ohio; E. O. Ackerman, engineer, maintenance of way, Columbus Railway and Light Company, Columbus, Ohio; John J. Murphy, electrical engineer, Chicago Union Traction Company, Chicago, Ill.

Mr. Adams thanked the association for its support and introduced President Simmons, who made a few remarks, speaking of the ability and energy of the retiring president, Mr. Adams, and of the excellent work of the retiring secretary, Mr. Mower. Vice-president Evans also spoke briefly, referring to Mr. Adams' work in terms of hearty praise. A pleasant incident then occurred in the presentation to Mr. Adams of a handsome clock. Messrs. Olds, Roberts and Baker made congratulatory speeches, and Mr. Adams fittingly responded. The new secretary, Mr. Corning, was introduced, and the association stood adjourned.

Accountants' Association.

President C. L. S. Tingley of Philadelphia called to order the eleventh annual meeting of the American Street and Interurban Railway Accountants' Association soon after 10 o'clock on Tuesday morning, October 15th. Subsequent sessions were held on Tuesday and succeeding days. Mr. Tingley delivered the annual presidential address and was followed by an address by John I. Beggs, president of the American association.

The report of the secretary and treasurer showed a total membership in the Accountants' association of 246, with a cash balance of $338.67. Following this report Messrs. C. F. Balch, W. J. Myer and H. M. Edwards addressed the association, these men representing, respectively, the Interstate Commerce Commission, the Public Service Commission of New York and the National Electric Light Association.

A paper on "Park Accounting" was read by Frank J. Pryor, Jr., of the American Railways Company of Philadelphia, and it was freely discussed. Pursuant to the suggestion of Mr. Edwards, the president, on motion of F. E. Smith, appointed a committee to meet with the committee of the National Electric Light Association and the Gas Institute to adopt a standard form of reports applicable to all concerned. Similarly a committee was appointed to act with the New York state commission.

Amendments to the by-laws were referred to the incoming executive committee. William M. Steuart, chief statistician for manufactures of the Bureau of the Census, addressed the association relative to next year's census. Data furnished by the companies will be absolutely confidential and will be for statistical purposes only. In collecting financial statistics the form of accounting promulgated by the Accountants' association will be used.

The paper on "Mechanical Devices for Office Use" was read by the author, F. E. Smith, auditor for the receiver of the Chicago Union Traction Company. The report of the committee on "Standard Classification of Accounts and Form of Reports" brought out a long discussion. The tentative classification of operating-expense accounts submitted by the committee was approved with certain amendments and referred back to the committee for final revision.

The paper by J. H. Neal of the Boston Elevated Railway, entitled "Where Maintenance Ends and Depreciation Begins," was read by W. F. Ham. The paper outlined seven plans for arriving at the proper amount which should be laid aside each year for depreciation. The paper was thoroughly discussed by W. F. Ham, F. R. Henry, W. B. Brockway, W. G. McDole, President Tingley and W. H. Forse, Jr.

The following-named officers were elected: President, F. R. Henry, United Railways Company, St. Louis; first vice-president, R. N. Wallis, Fitchburg and Leominster Street Railway, Fitchburg, Mass.; second vice-president, W. H. Forse, Jr., Indiana Union Traction Company, Anderson; third vice-president, S. C. Rogers, Mahoning and Shenango Railway and Light Company, Newcastle, Pa.; secretary and treasurer, E. M. White, Birmingham Railway, Light and Power Company, Birmingham, Ala.; executive committee, the officers and C. L. S. Tingley, Philadelphia; A. L. Linn, Rochester, N. Y.; A. R. Patterson, Savannah, Ga.; H. E. Wells, Davenport, Iowa.

Claim Agents' Association.

The meeting of the Claim Agents' Association was called to order at the St. Charles Hotel on Monday afternoon, Acting President Henry C. Bradley of Chicago presiding. The annual presidential address was delivered by Mr. Bradley. A report of the work of the secretary and treasurer was made by B. B. Davis.

President John I. Beggs of the American association was introduced and made an address. He advised the claim departments to keep as many cases as possible out of court, and every policy should be based on the principle of right. One of the properties which Mr. Beggs administers has not had a case in court which has finally been sustained by the higher courts in a period of three years. All the persons employed in the claim department should come from the ranks of the brightest and most intelligent of the motormen and conductors.

ALLIS-CHALMERS EXHIBIT AT ATLANTIC CITY STREET-RAILWAY CONVENTIONS.

At Tuesday morning's session the following papers were read and discussed: "The Policy of the Claim Department to the Injured Employe," R. H. Schoenen, Lehigh Valley Transit Company, Allentown, Pa.; "The Claim Agent of Today and His Work," H. K. Bennett, Fitchburg and Leominster Street Railway Company, Fitchburg, Mass.; "How I Manage Bad Cases," Harry P. Vories, Pueblo and Suburban Traction and Light Company, Pueblo, Colo., read by Dr. Lemon.

The question of the Claim Agents' Association becoming a member of the Alliance Against Accident Fraud was introduced by Russell A. Sears of the Boston Elevated Railway, and after discussion was referred to the executive committee.

At the afternoon session the paper of Ellis C. Carpenter of the Indiana Union Traction Company, Anderson, Ind., was discussed. The subject was "The Selecting and Training of Investigators and Adjusters for the Claim Department." The Question Box was then opened and the contents considered.

The election of officers resulted in the adoption of the report of the nominating committee, as follows: President, H. R. Goshorn, Philadelphia Rapid Transit Company; first vice-president, A. J. Farrell, International Railway, Buffalo, N. Y.; second vice-president, W. F. Weh, Cleveland Electric Railway Company, Cleveland, Ohio; third vice-president, J. S. Harrison, Jacksonville Electric Company, Jacksonville, Fla.; secretary, B. B. Davis, Columbus Railway and Light Company, Columbus, Ohio (re-elected).

The last session was called to order by Third Vice-president Weh, and the reading and discussion of papers was taken up. "The Claim Department and What Should Be Done to Make It Effective" was the subject of a paer by C. B. Hardin of the United Railway Company of St. Louis. F. W.

Johnson of the Philadelphia Rapid Transit Company read a paper on "Instructions to Employes in the Work of Preventing Accidents."

A pleasing address was delivered by the new president, H. R. Goshorn, and he then announced the appointment of several committees, the executive committee being Peter C. Nickel, New York City Railway; C. B. Hardin, United Railways of St. Louis; E. C. Carpenter, Indiana Union Traction Company, and E. G. Roberts, Knoxville Railway and Light Company.

Convention Notes and Exhibits.

The Buckeye Electric Company of Cleveland came to the convention in the person of Assistant Manager Milton Hartman.

E. G. Chamberlain and W. E. Mitchell talked of all sorts of poles on behalf of the Southern Exchange Company, New York.

James Todd, Dr. W. Riddle and P. F. Norvell appeared for the Pittsburg Insulating Company, which showed insulated cloths and papers.

New York Manager Frank Donohoe of the American Electrical Works, accompanied by Mrs. Donohoe, was among those who enjoyed the reception and ball at the Marlborough-Blenheim on Tuesday night.

Secretary Albert L. Tucker and Mr. John Benham were on hand to look after the interesting exhibit of the International Register Company of Chicago.

The Heany Fireproof Wire Company of York, Pa., represented by H. L. Owen and T. A. Shock, presented asbestos-covered wire, asbestos tape, cloth and twine.

The Locke Insulator Manufacturing Company of Victor, N. Y., had on exhibition a steel transmission tower on which were mounted its new 100,000-volt insulators, underhung type. W. T. Goddard, A. S. Watts and John S. Lapp were there to "show things."

W. R. Adams of the American Sewer Pipe Company of Pittsburg, Pa., made no attempt at an exhibit other than to show interesting samples of vitrified-clay conduits in single and all multiple ducts, for electrical underground wiring. Mr. Adams was accompanied by Messrs. Kondolf and McCome.

Of course, Manager T. E. Hughes of the Philadelphia office of the Standard Underground Cable Company dropped down from Philadelphia. Mr. Hughes was accompanied by Samuel S. Warner. This was Mr. Warner's first street-railway convention on behalf of the Standard Underground Cable Company.

The Franklin Electric Company of Hartford, Conn., presented the Franklin street-railway lamp. The vibrating machine, shaking both an ordinary lamp and a special railway lamp of the Franklin company, was a fine demonstration and proved conclusively the value of the small glass column employed in the Franklin railway lamp. The company was represented by P. S. Klees, G. O. Curtis, C. N. Thorpe and C. Leonard.

Advertising Manager Charles D. Young, who, it will now be remembered, is also one of the directors of his company, did most excellent work in advertising the Ohio Brass Company at Atlantic City. This company's exhibits included automatic radial car couplers, pneumatic track sanders, genuine bell-metal motor bearings, rail bonds, third-rail insulators, and overhead material of all kinds, including catenary. The company was represented by C. K. King, A. L. Wilkinson, Nathan Shute, P. A. Hinds, C. H. Tomlinson and a number of other gentlemen.

All sorts of cord for electric railway and lighting service constituted the display of the Samson Cordage Works, Boston, Mass. Specialties shown were waterproof trolley cords, bell and register cord in colors, mahogany wire center armature cord, solid braided rope. F. J. Coakley and R. G. Whiting did the honors.

H. A. Jones of the Philadelphia office of the Stromberg-Carlson Telephone Manufacturing Company showed the street railway men several splendid examples of modern railway telephonic equipment. Mr. Jones was able to demonstrate most conclusively the value of a telephone in railroad work.

Under Mr. Charles P. Fry the Weston Electrical Instrument Company, Newark, N. J., exhibited Weston voltmeters and ammeters, both alternating and direct current; display of portable wattmeters, bridges, Weston standard cells, multimeters and instruments of precision for laboratory testing. A special feature was a new line of alternating-current instruments, volt and ammeters for switchboard and portable use. Dr. Edward Weston came over, and Caxton Brown and F. A. Gilbert were also in attendance.

Irreproachable Willard S. Sisson took care to represent the D. & W. Fuse Company of Providence, R. I. A large sample board of D. & W. fuses and cut-outs for lighting and power circuits was shown, as also were railway cut-out boxes, service switches and transformer cut-outs and Deltabeston magnet wire.

President H. B. Crouse was on hand at Atlantic City in person looking after the interests of the Crouse-Hinds Company of Syracuse, N. Y. He was assisted by A. F. Hills, F. M. Hawkins, Frank Buchanan and D. C. Gidley. The company made a handsome exhibit of Imperial arc headlights, Syracuse changeable and stationary incandescent headlights, condulets (the modern line of conduit outlet boxes and fittings), and harpoon guy anchors.

The indefatigable "Lansingh" of Holophane fame, of course, arrived to look after the exhibition of the Holophane Company of New York city. Mr. Lansingh showed an interesting comparative test, most convincing as to the superior merits of Holophane reflectors. He also presented Holophane scientific and prismatic reflectors for car lighting, reflectors for general car lighting and reflectors for individual lamps over seats for reading illumination.

One of the most interesting exhibits was that presented by the Crocker-Wheeler Company, Ampere, N. J. No machinery to speak of was shown, but interesting large photographs of generating installations, photographs of the California Gas and Electric Corporation's 4,000-kilowatt generators, were there for inspection. The company was represented by Julian Roe, S. Russell, Jr., R. N. C. Barnes, L. S. Horner, R. J. Randolph, Jr., and Rodman Gilder.

The Union Electric Company of Pittsburg, Pa., presented a general line of railway and lighting supplies and was represented by George W. Provost, Thomas M. Cluley and R. M. Kerschener. Manager E. J. Kulas of the Brilliant Electric Company of Cleveland was also on hand constantly and exhibited in conjunction with this company the various types of the Brilliant high-efficiency lamps. Mr. Kulas has recently moved into a large new factory, giving him a greatly increased output. He loses no opportunity to bring the Brilliant lamp constantly before buyers.

The Chicago Pneumatic Tool Company presented Duntley electric drills and grinders for direct and alternating current, including 550 volts, direct current; Duntley electric hoist for direct current; pneumatic chipping and riveting hammers, pneumatic drills; portable pneumatic cleaning outfit. The company was represented by J. W. Duntley, W. O. Duntley, Thos. Aldcorn, George Barden, C. B. Coates, Howard Small, B. H. Tripp and Paul Severin.

To say that the Joseph Dixon Crucible Company of Jersey City was there meant that among a vast number of other specialties there were shown Dixon's silica graphite paint, American graphite pencils, plumbago crucibles and retorts, Ticonderoga flake graphite lubricants, graphite gear grease, pipe-joint compound, graphite motor brushes and other graphite products for street railways and manufacturers. J. A. Condit, L. H. Snyder, C. H. Spotts and J. J. Tucker were on hand.

The following-named gentlemen were in attendance at the comprehensive and artistic booth of the American Steel and Wire Company of Chicago: F. A. Keys, L. A. Dietrich, J. M. Holloway, C. R. Sturdevant, J. D. Sutherland, C. S. Marshall, G. A. Cragin, W. A. Greenberg. Rail bonds and bonding tools, American railway fencing, electrical wires and cables, trolley wire, galvanized strands, trolley springs and concrete reinforcement and other American Steel and Wire specialties were exhibited.

The Electric Storage Battery Company of Philadelphia exhibited various types of Chloride accumulators, plates and an R83 element in a lead-lined tank, having a capacity of 4,920 amperes, this being one of the types recently installed for the New York Central Railroad. This company also showed railroad-signal and Exide sparking and vehicle batteries. Those in attendance were: Charles Blizard, G. H. Atkin, Albert Taylor, H. B. Gay, Edward L. Reynolds, R. C. Hall and Hugh Lesly.

No convention is complete without the Dearborn Drug and Chemical Works of Chicago. This company has recently gone into a new and very large factory, and the present occasion was a fine opportunity through which to impress upon a rapidly growing business the remarkable success of its methods. The representatives of the company were Robert F. Carr, William B. McVicker, Grant Spear, G. F. Duemler and H. G. McConnaughy. The treatment for boiler-feed water was described and samples were shown of high-grade lubricants, hydraulic elevator compounds, multiple and triple-effect compounds.

The National Brake and Electric Company, Milwaukee, Wis., showed various types of air compressors ranging in capacity from 11 to 50 cubic feet. Also a 25-foot alternating-current and direct-current compressor; two portable compressing outfits, one having a capacity of 11 feet and the other of 50 cubic feet. Schedules MSH and TSH, embodying a new type of emergency and quick-release valve, with all apparatus included in an installation for a motor and trailer car. R. P. Tell, A. I. Wailes, J. T. Cunningham, G. C. Anthon, W. H. Goble, C. N. Leet, W. R. Crawford, B. S. Aikman, W. M. Bisel, W. J. Richards, G. J. Johnstone and J. R. Petley constituted the company's staff in attendance.

The H. W. Johns-Manville Company of New York, with branches in all large cities, was well represented with an attractive exhibit and a number of its representatives. Among the materials exhibited were Victor combination meters, overhead line material, "Noark" fuse devices of 250, 600 and 10,000-volt capacity. Transite asbestos fireproof lumber, etc. The exhibit of supplies included molded mica weatherproof sockets, arc-lamp hangers, high-tension insulators, rail bonds, etc. Samples of asbestos wood, showing the various applications, were also on exhibit. Among a large number of representatives were J. W. Perry, New York; H. M. Voorhis, Philadelphia; H. M. Frantz, Chicago; R. R. Braggins, Cleveland, and M. H. Crosswell, Milwaukee.

President C. H. Weeks of the Buckeye Engine Company of Salem, Ohio, again made what might be characterized as his "annual hit" at artistic advertising. It is said that "a thing of beauty is a joy forever," and it would seem that a knowledge of this fact has enabled Mr. Weeks for years to do one of the best bits of advertising that has been accomplished anywhere in the electric-railway or lighting business. When an institution sets out to pin a rose or other flower on every delegate and lady that visits an exposition and repeats the process daily during almost an entire week, it is safe to say that that institution will live in pleasant remembrance in the minds of those so decorated. Mr. Weeks has carried out this plan for a number of years, and the delicacy of this method of advertising has been warmly appreciated. In addition to the flowers distributed the Buckeye Engine Company had on exhibition photographs of different

GENERAL ELECTRIC COMPANY'S BOOTH AT ATLANTIC CITY STREET-RAILWAY CONVENTIONS.

types of Buckeye steam engines, horizontal and vertical, simple and compound; a small steam-engine model, and wash drawings of Buckeye four-cycle tandem gas engines. Assisting Mr. Weeks were Paul Bigelow, C. E. Machold and A. H. Ridell.

The Gould Storage Battery Company of New York exhibited a 49-plate "type N" cell in lead-lined tank, a 19-plate "type S" cell in lead-lined tank, a 21-plate "type O" cell in glass tank, a 19-plate "type O" cell in 21-plate lead-lined tank. There were also couple type cells, photographs of railway installations and an exhibit of plates. A type S positive plate, in service five years at Easton, Pa., cut out for test after five years of hard work, was shown. The battery was flooded twice by extraordinary high water of the Le-

VIEWS OF WESTERN ELECTRIC COMPANY'S BOOTH AT ATLANTIC CITY STREET-RAILWAY CONVENTIONS.

high River. In spite of hard service and the flood the plate is still good for considerable service (probably two years), and has its initial capacity. The company was represented by H. N. Powers, C. H. Bradley, Jr., W. K. Kise and Dr. W. E. Winship.

Dossert & Co., Inc., manufacturers of "Dossert joints" and solderless connectors and terminals for electric wires and cables, made an excellent exhibit. The Dossert joint is a mechanical device designed to splice wires securely and to make a perfect electrical connection without the use of solder. After field experience and laboratory tests covering a period of over two years, the National Board of Fire Underwriters at the meeting in New York in March, 1907, unanimously adopted an amendment to the rules allowing the use of an approved mechanical joint without solder. Two months later the Dossert joints were placed on the list of approved fittings, and it is the only approved mechanical joint. H. B. Logan, president, and E. A. Dossert, sales manager, for Dossert & Co., were in attendance. The home office is in New York city.

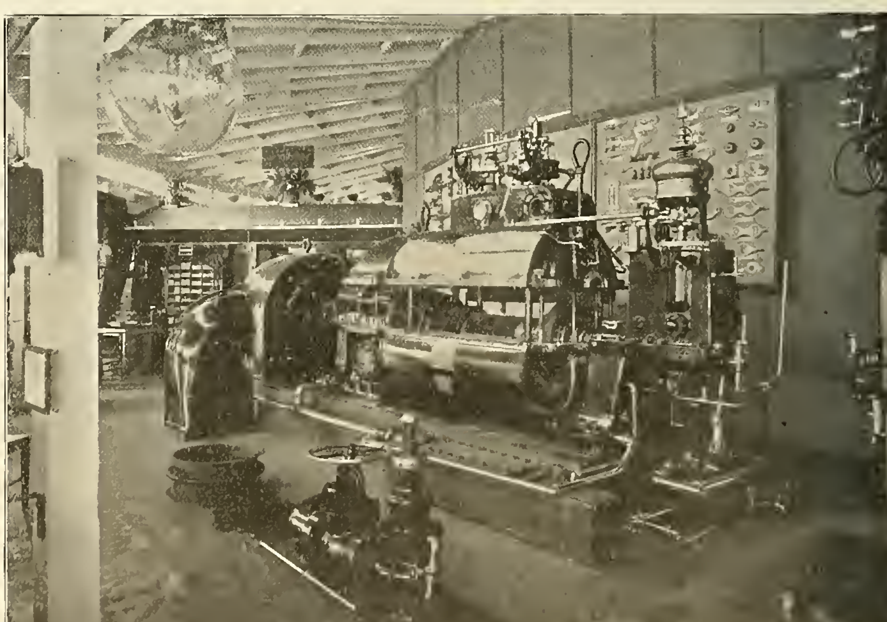
The Western Electric Company of Chicago, New York and Berlin, of course, made an attractive display of the great variety of its electrical products. The company was represented by John Young, C. A. S. Howlett, R. H. Harper, F. D. Killion, A. E. Meixell, D. C. Guest, R. L. Lunt, F. C. Jaeger, H. J. Shreve, R. Roth, James R. Stuard, G. F. Livezy, A. L. Hallstrom, H. E. Scott, P. R. Ziegler and W. Harkness. Among the specialties laid out for inspection were samples of electrose line insulation, Shelby trolley poles, Kalamazoo wheels and harps, Deltabeston wire, Amazon and Dryfield tapes, linen tapes and cotton sleeving, bronze and malleable-iron ears, wood strain insulators, commutators, controller parts, axle bearings, insulating paper, insulating cloth, varnishes, registers, register fittings, mica, trolley catchers, trolley rope, foot gongs, pole brackets, bells, incandescent lamps, car wire, etc. The pictures herewith give but an inadequate idea of the company's booth.

The most striking thing in the exhibit of the Westinghouse Electric and Manufacturing Company was the large single-phase electric locomotive which is one-half of a complete unit. It showed the sort of locomotive used on the New York, New Haven and Hartford road for pulling trains into New York city. In addition to the complete equipment there were individual parts arranged for minute inspection. There were several of the single-phase motors, for instance. It was noticed that the commutator, brushes and brush-holders are of especially ample and rugged construction. The control equipment was also exhibited apart from the locomotive, showing the method by which the voltage is reduced on the car to the pressure suitable for the motors, as well as the method of varying the voltage applied to the motors so that every notch is a running notch, no resistance being required. The catenary line construction used on the single phase roads was also shown. The pantograph trolley was set up on the floor connected to a compressed-air supply so that it could be raised or lowered exactly as in the complete equipment, by the air supply. One portion of the exhibit contained the complete unit switch control used in the control of electric trains operated either by alternating or direct current. This was set up and connected for operation so that the various actions and operations which occur as the motorman moves the controller may be fully observed. The various movements are directed from a very compact master controller which governs the action of the various magnets. In addition to the above there are several standard direct-current railway motors. More interesting than this are the two interpole railway motors which make use of the auxiliary poles to improve the commutation. Interpole motors have been used with satisfaction for variable-speed service, but are new in the field of railway work. They have, however, been tried sufficiently to prove that their use materially improves the commutation, and hence increases the life of both commutator and brushes, so that much is expected of them in the future. In conjunction with the Westinghouse Machine Company a steam turbine generator set was displayed on the first floor for inspection. This was a unit capable of delivering 500 kilowatts at normal rating, and represents a compact and reliable machine for the development of power by steam. There was a large delegation of Westinghouse men. Among them were J. R. Bibbins, C. P. Billings, L. M. Cargo, H. A. Coles, C. S. Cook, H. P. Davis, J. N. Dubarry, Geo. C. Ewing, Wallace Franklin, G. B. Griffin, L. W. Hershey, W. M. McFarland, J. C. McQuiston, L. N. Reed, F. L. Shepard, N. W. Storer, Carl M. Vail, Edwin Yanger, J. A. Brett.

Of course, that old-timer and carbon expert, Manager J. S. Speer of the Speer Carbon Company, secured for his institution one of the best located booths and made one of the most interesting and instructive displays on the steel pier. Mr. Speer, who was accompanied by his "right bower," Mr. G. P. Fryling of the company's St. Mary's office, was much sought after by those desirous of learning more of the technique of the dynamo and motor brush. Mr. Speer's book on the carbon brush has served to establish him as one of the authorities in the electric-lighting and power business. For years he has made a specialty of this one branch of a highly technical business, and naturally the knowledge he has acquired is now eagerly sought. Mr. Speer also did a clever bit of advertising out of the regular run not only by his booklet, "A Few Facts," but by engaging the sand sculptor to carve the name of the Speer brush and its merits in the sand, where all who ran (along the Board Walk) might see.

No street-railway convention would be quite natural without a comprehensive exhibit from the National Carbon Company of Cleveland, Ohio. Under the management and design of Sales Manager N. C. Cotabish there was presented at Atlantic City a display well worthy of the name "National." On hand to carry out Mr. Cotabish's exhibition work were A. E. Carrier, F. D. Kathe, O. T. Weaver, A. C. Henry and Frank C. Park. It is impossible to enumerate all the specialties, but among them were shown carbon brushes in all styles, dry batteries, arc-light carbons, headlight carbons and flashlights. A clever advertising novelty was given away. It was a square or cubical matchbox formed to represent a copper or gold-plated carbon brush. This novelty made a decided hit, as it was of great use to every smoker, filled, as it was, with matches.

The General Electric Company, as usual, was prominently represented both by men and by exhibits. Among the former were: J. G. Barry, manager of the railway department; W. J. Clark, manager of the traction department; W. B. Potter, engineer of the railway and traction department; E. D. Priest, F. E. Case, A. H. Armstrong, engineering department; C. C. Peirce, Boston; J. J. Mahoney, S. W. Trawick, New York; R. E. Moore, Philadelphia; H. L. Monroe, Chicago; G. D. Rosenthal, St. Louis; E. H. Ginn, Atlanta; H. C. Houck, Cincinnati; H. N. Ransom, W. G. Carey, Schenectady, and F. H. Gale, in charge of advertising. The exhibit occupied one of the largest spaces on the pier and its location gave ample opportunity for an arrangement of machinery so that it was easily inspected by visitors. The Curtis steam turbine was illustrated by a 1,000-kilowatt 12,000-volt 60-cycle machine dismantled so that every part was displayed, and it furnished a valuable demonstration of the simplicity and rugged construction of this design. For the first time at any convention a commutating-pole motor was shown in operation and undergoing test to demonstrate the remarkable commutation features of this design. This was done by means of a booster set which furnishes voltage up to 950 volts. Full load on the commutating-pole motor was provided by a GE-90 railway motor direct coupled to it and operated as the generator with water-box load. By means of the variable voltage supplied the commutating pole motor, ample demonstration is given of its sparkless operation under such unusual conditions. A collection of contactors and similar devices used in railway equipment was exhibited and the new K-35A controller which is designed for four 50-horsepower motors at 500 volts or four 60-horsepower motors at 600 volts. Various other devices of interest to electric-railway engineers were installed, such as multiple-gap lightning arrester for 10,000-volt alternating-current circuit and a direct-current lightning arrester type M form D-2 for 600 volts. Power-circuit arc lamps for railway use were shown, and a feature of the exhibit was two direct-current arc lamps of the company's recent design mounted at the front entrance. The company's reception headquarters on the pier were arranged inside with illumination by new tungsten lamps with Holophane reflectors. A complete exhibit of bonds and line material was displayed as well as



PART OF WESTINGHOUSE EXHIBIT AT ATLANTIC CITY STREET-RAILWAY CONVENTIONS.

the company's latest design of catenary line material.

Under the skillful management of W. S. Heger, assistant to President Whiteside, and J. H. Denton, manager of the air-brake department, the Allis-Chalmers Company of Milwaukee made a most interesting and attractive exhibit. The display was devoted, in so far as apparatus was concerned, almost entirely to the air-brake and turbine. There were, however, other representations, photographs, etc., of Corliss engines, gas engines, hydraulic turbines, condensers, generators, rotary converters, motors and power and electrical machinery of every kind. One of the most interesting features of this exhibit was found in the new type J emergency valve for use with straight air-brake equipments. The principal advantage of the straight air-brake system, as is well known, lies in its simplicity and in the fact that the brakes may be applied and released gradually; but it formerly had one serious defect, for when two or more cars are run in a single train having this equipment, if the train should break apart the brakes would not be applied automatically. Moreover, in the ordinary straight air system the control of the train is in the hands of the motorman alone, whereas, with the automatic system the brakes can be applied by the conductor in case of emergency from any one of the cars in the train. The Allis-Chalmers Company's straight-air emergency valve was designed to overcome these two points of deficiency in the straight air-brake system, so that it is now possible by using the emergency valve to equip with straight air trains of two to four cars, which will have all of the advantages of the simplicity and positive action of that system and at the same time possess the automatic safety features to be applied in case of a break in couplings or hose connections. This, it will be readily seen, puts the control of the brakes in the hands of the conductor as well as in those of the motorman. Another object of especial interest was the new type OB pneumatic governor. The reliable operation of an air-brake equipment depends largely upon the governor. The Allis-Chalmers Company directed its engineers to design a governor which would overcome the objectionable features experienced heretofore. How well they succeeded may be shown in a reference to the first trial which this apparatus sustained outside of the company's own works. Prior to the placing of a large order it was given an exhaustive test by the engineering department of the Manhattan Elevated Railway, New York city, in a series of 284,000 continuous operations, breaking a current of 35 to 40 amperes, at 600 volts, without any attention whatever during the period of the test, which would be equivalent to about two and one-half years' service under ordinary conditions. The illustration on page 334 shows the Allis-Chalmers booth and air-brake apparatus. With Messrs. Heger and Denton were the following-named men prominent on the Allis-Chalmers staff: F. C. Randall, manager New York office; W. W. Power, manager Philadelphia office; W. G. Clayton, engineer air-brake department; St. John Chilton, engineer steam-turbine department; J. F. Dixon, selling force, New York office; H. W. Rowley, selling force, New York office; A. E. Peck, selling force, New York office; J. B. Nicholson, selling force, Philadelphia office.

Two Steam Turbines Built and Installed in Record Time.

What is probably a record for the furnishing and installing of steam turbines was made by Allis-Chalmers Company in connection with two 1,000-kilowatt steam turbines and accessories which that company built for the South Works of the Illinois Steel Company at South Chicago, Ill. The contract was signed on May 13, 1907; shipment commenced from the factory on May 25th and finished on May 31st; the erection of both units was completed July 16th and the commercial load was put on the machines July 22d. Since that time they have operated almost continuously, carrying loads up to 1,500 kilowatts each—that is, loads 50 per cent. above their rated capacity. At one stretch the turbines ran over three weeks, day and night, without being stopped.

The turbines are installed in a temporary wooden building, and as no crane or the usual facilities were available during the erection this record is considered remarkable. Since starting the turbines have given no trouble, and the manufacturer's engineers left them in charge of the Illinois Steel Company's operators within a few days after the load was first carried.

The installation consists of two units, each comprising a 1,000-kilowatt steam turbine coupled to a 1,000-kilowatt 25-cycle three-phase 2,300-volt Allis-Chalmers turbo-alternator, together with necessary surface-condensing apparatus, pipe connections and switchboard. The speed of the turbines is 1,500 revolutions per minute; each is provided with a direct-connected exciter.

The Allis-Chalmers steam turbine is of the horizontal, full annular flow, reaction type, and is provided with a number of special features, such as improved methods of holding and protecting the blades, improved balance pistons, etc., all of which tend to make this machine both efficient and reliable.

ELEMENTS OF ELECTRICAL ENGINEERING.

By Geo R. Metcalfe.

XXXIX.—Electric Railways.

Brakes.

Efficient brakes are one of the most important features of a trolley-car equipment, and their importance has increased very materially with the high speeds at which electric cars are frequently run. Almost all electric cars are equipped with hand brakes, but in many cases these are used purely for emergency purposes or in case the power brakes for any reason fail to act. Some form of power brake is almost invariably installed in addition to hand brakes, so that each car, as a rule, contains two kinds of brakes, either of which may be used independently of the other. As both air brakes and electric brakes are operated with slight physical exertion on the part of the motorman, these brakes are invariably used for general service, and the hand brakes are used only in emergencies.

The different styles of brakes in general use today may be divided into several different classes as follows:

First—Hand brakes, in which the power required for pressing the brake shoes against the wheels is furnished through the action of the motorman in winding a chain about the brake staff, or by operating a long leader to which the brake chains are attached.

Second—Air brakes of either the straight or automatic type, which are operated by turning a valve handle.

Third—Electrical brakes, of which there are several kinds, and which are operated by the movement of the controller handle.

Fourth—Track brakes, in which shoes carried on the sides of the truck are pressed against the top of the track rails until the friction between the shoes and the rails stops the car.

Fifth—Friction, or disk, brakes in which the momentum of the car is utilized to apply the brakes to the wheels.

Of these five classes of brakes, the first and second together, or the first and third together, are in very general use, while the fourth and fifth classes are more rarely used.

Hand brakes are almost universally used on trolley cars, and the brake rigging is arranged in a wide variety of ways by different manufacturers. A detailed description of the various brake riggings would involve an amount of detail beyond the scope of this series of articles, and therefore only a few of the more important points will be considered.

In general, the brake-shoes are hung either outside or between the truck wheels, the center of the brake-shoe coming about on a line with the car axles. The two brake-shoes are directly opposite each other, and each one is securely fastened to a bar extending across the car truck, which is flexibly supported so as to allow the brakes to be moved against or away from the wheels.

On single-truck cars the brakes are generally hung outside the wheels, and the two cross bars carrying the brakes are connected by various systems of levers and toggles so arranged that when the chain which connects them to the vertical brake staff is wound up about the staff the brakes are forced against the wheels with a heavy pressure which soon brings the car to rest. On double-truck cars the arrangement of the brakes is somewhat more complicated, as the brake rigging must be arranged to accommodate itself to the swiveling of the trucks. On swivel trucks the best practice is to hang the brakes between the two pairs of wheels of the truck instead of on the outside of the wheels. By placing the brakes between the wheels there is less tendency to cause the truck to tilt when the brakes are applied suddenly, and this arrangement therefore makes an easier riding car.

The brake-shoes should normally hang from one-eighth to three-sixteenths of an inch from the wheels, and the shoes are fastened to the cross-beams, so that the distance between the shoe and the bed of the wheel can be easily adjusted. This distance should be equal on all the brake-shoes, as it is important that they all be brought to bear upon the wheels at the same time, in order to have them produce the maximum braking capacity. It is also very important that all of the shoes bear against the wheels with an equal pressure, as otherwise some of the wheels would stop revolving before the others and would therefore slide upon the track, thus producing flat spots, which cause a constant pounding on the rail, and which make riding very uncomfortable.

To equalize the pressure between the different shoes and the wheels the connection between the different brakes is made flexible, so that whatever pressure is applied to the brakes naturally divides itself evenly between them.

Brakes should never be applied with such force as to lock the wheels, so that they slide or skid along the rails, as the retarding effort is greatly reduced as soon as the wheels begin to slide; moreover, this sliding causes flat spots on the wheels. If the wheels are locked and they commence to slide on a down grade, the brakes should be loosened up until the wheels begin to turn, when sand should be applied to the track. When the wheels are locked and skidding, the retarding force is only about one-third of what it was before the wheels commenced to slide.

Brake-shoes are generally made of soft cast-iron, with insets of steel, carborundum or some harder material, although in some cases the entire brake-shoe is made of very hard iron. The wear of brake-shoes is not of much consequence on small cars equipped with hand brakes only, but on large high-speed cars equipped with power brakes, brake-shoe wear becomes rather a serious item. The eight brake-shoes on a double-truck car sometimes last but a comparatively few days, and the expense of brake-shoe renewals, under severe circumstances, may reach in the neighborhood of $200 a year.

Air brakes for use on electric cars may be of what is known as the straight or of the automatic type, depending upon the number of the cars which are to be coupled together in trains. The straight air-brake system is the simplest, and is almost always used where not more than two or three cars are run as a train. Where trains consist of a larger number of cars the automatic air brake is necessary.

In the straight air-brake system the pressure from the air reservoir is opened to a cylinder which contains a piston working against a spring. When this piston is moved by the pressure of the compressed air, it acts directly upon the levers which operate the brakes. The compressed-air supply is furnished by means of a small air compressor, usually driven by an electric motor, and the motor is operated by means of a switch, which is controlled by a pressure regulator. This regulator is set to maintain a constant pressure of about 60 pounds per square inch in the air reservoir, and as soon as this pressure is reduced by the use of the brake, the drop in pressure causes the motor to be started, and it operates until the pressure again reaches 60 pounds, when it is automatically cut out again. The supply of air to the cylinders is therefore maintained practically constant as long as current is supplied to the car, and this supply being regulated by the pressure in the reservoir, is maintained without any attention whatever from the motorman. It is also possible to operate the air compressor mechanically by means of an eccentric on the car, but this method is seldom used.

The application of air to the brakes is made by means of the motorman's valve, which is a small valve having a handle which may be set in three positions. To apply the brakes the valve is turned so as to let the air pressure from the reservoir into the brake cylinder. This moves the piston in the cylinder, which pulls the brake levers and applies the brakes. To release the brakes the valve handle is turned in the opposite direction to which it was placed for applying the brake, and this permits air to escape from the brake pipe and also closes the passage of air from the reservoir to the brake pipe.

Between the positions of "application" and "release" is what is called the "lap" position of the valve handle. When on the "lap" position all the valve ports are closed, and this is the only position in which the handle can be removed from the valve when the motorman wants to change from one end of the car to the other. By moving the handle from the lap to the application position and immediately returning it to the lap position a small amount of air will be admitted to the brake cylinder, which will apply the brakes with a slight pressure.

The force with which the brakes are applied depends upon the distance the valve has turned in the application direction, and the length of time

Note.—This series of articles, intended to survey, briefly, the whole field of applied electricity for light, power and heat, was begun in the Western Electrician of February 2, 1907.

it had left there, and whatever the condition of the air pressure is in the brake cylinder it remains the same while the valve is on the lap position.

If it is necessary to make an emergency stop, the valve handle should be thrown to the application position to its extreme throw. This permits the full pressure of the reservoir to be applied to the brake cylinder, so that the brakes are applied with the maximum force. It is necessary, however, to use care in making an emergency stop in this way, as if the track is slippery the wheels are apt to become locked and allow the car to skid.

To release the brakes the valve is turned in the release direction, and this allows the air to escape from the brake cylinder, whose piston is moved back to its normal position by the spring against which it works. When it is not intended to apply the brakes the valve handle should always be left in the release position.

Where trail cars are used the air for the operation of the brakes on the rear cars is supplied through a flexible-hose connection between the cars. It is apparent that if this hose connection should be broken, the brakes would be useless. Moreover, if the train consisted of a number of cars, it is also apparent that quite an appreciable time would elapse before the reservoir pressure could fill the pipes and operate on the cylinders of the rear cars. This would cause an uneven application of the brakes, and would prevent prompt and efficient braking, as the brakes on the front car would begin to operate some time before those on the rear of the car would be applied.

It is for this reason, as well as for additional safety, that the automatic air brake is used where cars are operated in a long train. The automatic air brake is the style of brake in general use on the steam roads, and as it has a rather limited application in electric-railway work, and, moreover, is very complicated, it will not be described in detail here. In this system the reservoir pressure is kept constant in a pipe extending from one end of the train to the other, called the train pipe. Any reduction of the air pressure in the train pipe causes the brakes to be applied. It is apparent, therefore, that if the train should break in two, or any air hose should be broken, the pressure in the train pipe would be released, and the brakes on all of the cars would be automatically applied.

Another form of air brake in use to a limited extent is the storage air brake. In this system the air is not compressed upon the car by means of a small air compressor, but a main reservoir is devised, which is charged with compressed air at a pressure of about 300 pounds. This high-pressure reservoir is filled from a storage tank located at some point along the route of the car in which a supply of air at about 300 pounds pressure is constantly carried.

The high-pressure tanks on the cars contain sufficient air to make perhaps four or five hundred stops, which will frequently be sufficient for several round trips of a car over a city route of average length. An auxiliary reservoir is also carried on the car, which is connected to the high-pressure reservoir by means of a reducing valve, so that the pressure in the auxiliary reservoir is reduced to 50 or 60 pounds for use in the brake cylinders. The air from the auxiliary reservoir to the brake cylinder is controlled by the motorman's valve, and the system is essentially similar to the straight air-brake system which has been previously described, except that the motor-driven air compressor is replaced by the high-pressure air-storage tank.

The reason for using the storage tank rather than motor-driven air compressors is the saving of weight and the extra simplicity of the system. It is also asserted that the storage system decreases the cost of maintenance, as it avoids the use of the small compressor sets on each of the cars.

[*To be continued.*]

Baltimore-Washington Electric Railway.

Much interest is manifested in the new electric railway to connect Washington, D. C., and Baltimore, a distance of 30 miles. The line will be opened about November 15th. The cars will come into Baltimore over the tracks of the United Railways, and on account of the difference in gauge a third track rail has been laid close to the inside of one rail of the city tracks to accommodate the new cars. This is the first electric railway between the two cities, connected at present by steam roads only. The electric companies will cut the railroad fare from 50 to 75 per cent., it is understood.

QUESTIONS AND ANSWERS.

Three-phase Power Calculation.

L. W. S., Ada, Ohio: I would like to know the formula or method of obtaining the true watts in a three-phase alternating-current system, having given the volts and amperes of each phase. I have not the angle of lag or the readings of the indicating wattmeter given and would like to know if I can get the watts from the data given above.

Answer.

The true power transmitted in a balanced three-phase system, whether it be star or delta-connected, is equal to the product of $\sqrt{3} \times$ volts between mains $\times$ current in one main $\times$ power factor of the circuit. Without a knowledge of the angle of lag or lead (power factor), accurate results cannot be calculated. If the load is known to be non-inductive, as for incandescent lamps or resistance, the power factor is practically unity. For inductive or capacity loads it must be ascertained by a power-factor indicator or similar device.

Three-phase Distribution.

J. H. L., Alexandria, Va.: I have 10 circuits to distribute on a three-phase system. Can I use a tablet board made up of three-wire to two-wire panelettes?

Answer.

The regular three-wire to two-wire cut-outs or panelettes are unsuitable for this service, as each one of the branch circuits has one side connected to the neutral wire of a direct-current three-wire system. The branch circuits should be so arranged as to keep the load between each set of mains as well balanced as possible, say, in this case, three circuits running from mains 1 and 2, three from mains 2 and 3 and four less heavily loaded circuits from mains 1 and 3. Panel boards for three-phase distribution are not usually kept in stock, but can be made to suit the conditions on comparatively short notice by most manufacturers. A number of wiring contractors make up tablet boards for this service by using three-pole single or double-branch cut-outs.

Invention of the Telephone.

C. A. P., Chicago: I would deem it a great courtesy if you will tell me when the telephone was invented and by whom.

Answer.

In 1854 a Frenchman, Charles Bourseul, predicted the transmission of speech, and thought it could be carried out by using a disk which would alternately make and break a circuit. In 1860 or 1861 a German schoolmaster, Philipp Reis, actually invented an apparatus along these lines, which he called a "telephon," and which transmitted musical sounds quite well, but speech in a doubtful manner. In 1868 Royal E. House of Binghamton, N. Y., invented and patented an "electro-phonetic telegraph," which was capable of operating as a magneto-telephone in the same way as the instruments devised by Bell later. He knew nothing of its capabilities, however.

In 1876 applications for patents were made simultaneously at the United States Patent Office for speaking telephones by Alexander Graham Bell and Elisha Gray. The authorities conceded Bell's claim to priority and granted him the patent. This matter went into the courts later and after long litigation a compromise was effected and both patents sold to one company.

The above facts indicate that the honors should probably be divided principally between Reis, Bell and Gray. Reis was regarded by so good an authority as Prof. S. P. Thompson as the "inventor of the telephone," and Professor Thompson has written a book backing up Reis' claims. However, Bell and Gray were undoubtedly the first to produce telephones that did transmit articulate speech.

North Avenue Carnival Illumination.

The three-fourths mile stretch of North Avenue from Wells Street to Clybourn Avenue, Chicago, has been the scene of a carnival and illumination every evening for the four weeks since October 5th. This attraction has been arranged by the North Avenue Business Men's Association to boost the trade of that street. The special illumination is mainly in the form of festoons of incandescent lamps spanning the street at intervals of about 140 feet, over 1,100 lamps being used for this purpose. A large number of the merchants have had installed by private contract gas "arcs" in front of their premises, about 150 being now in use. On October 9th, 15th and 24th special parades with gayly decorated floats were the attraction. The date of closing is October 26th.

Maintenance and Inspection of Electric-railway Equipment.[1]

Part I.

In considering the nature of the report to be submitted your committee felt that it could best serve the interests of the association by finding out, so far as possible, the present practices in the maintenance and inspection of electrical equipment of the member companies and to point out to some extent the good and bad practices, with such suggestions and recommendations for further improvement as would seem advisable.

To this end, early in the summer, there was prepared and sent out question blanks asking for considerable data, and while some of the information asked for may seem lacking in importance, it has been said to your committee that the mere endeavor to supply the information has brought to the attention of operating men conditions which otherwise would probably have gone unnoticed for some time. Your committee realizes that it is impossible to make recommendations that will fit all conditions, but, if we are to learn to shoot, we must have a mark to shoot at.

The maintenance and inspection of car equipment is such an important item in the reliability of operation of a street-railway system that the period of overhauling and inspection should be very carefully fixed. Too many overhaulings and inspections are not conducive to economy, while, on the other hand, too few mean many failures. There is always some one part of the equipment which requires attention more frequently than any other. A study should be made of this part and endeavor made to improve it until it is no longer the first to need attention; then the periods of overhauling and inspection can be lengthened to meet the new conditions, etc.

Control Equipment.

In reply to the question as to the "frequency of inspection of control," the answers were:

K-Type.

Daily—13	Every 5th day—1	Every 300 miles—1
Every 2d day—1	7th day—8	500 miles—1
3d day—7	14th day—2	

Multiple-unit Type.

Daily—1	Every 500 miles—1
Every 3d day—1	1,000 miles—1
7th day—1	1,200 miles—1

It is evident from the above that, notwithstanding the varying conditions, some are inspecting unnecessarily often, while others are not giving sufficient attention.

Your committee recommends that the control equipment of the K type be given a thorough overhauling for every 60,000 miles of service, as follows:

Controller should be taken apart, thoroughly cleaned, defective parts replaced, wood scraped and shellacked, and other parts of the controller painted with insulating paint. The controller should then be given a breakdown test of not less than 1,500 volts alternating current for five seconds. With controllers in good condition, your committee believes that periodical inspections on a basis of from 300 to 500 miles' service—depending upon the conditions of operation—would be sufficient and the most economical, and desires to call attention to the importance of giving careful attention to the fit of controller and reverse handles on spindles, as a loose-fitting control handle will sometimes make it impossible to make the proper contact on the last point. It also renders the pointer useless as an indicator to the motorman and has a tendency to make him careless in the operation of the controller, as the notches cannot be readily distinguished. A loose-fitting reverse handle will sometimes prevent the reverse being thrown quickly, thus being the means of causing an accident when an endeavor is being made to stop the car with the reverse.

Multiple-unit Control, M Type.

Your committee recommends an overhauling on a 60,000-mile basis, as follows:

All coils removed from the contactor, reverser and circuit-breaker boxes, thoroughly cleaned and painted with an insulating paint. Interior of boxes cleaned and painted; contact strips between coil frames inspected for loose contacts; all working parts thoroughly inspected and worn parts replaced where necessary; wires inside of contact box thoroughly painted and when reassembled given an insulation test of 1,500 volts alternating current. It would then seem to your committee that periodical inspections on a basis of from 600 to 900 miles of service would be satisfactory.

As the experience of some of the operating companies with this type of equipment is rather limited, the following points are suggested as requiring attention at such times:

Examine for broken shunt straps and broken hinge pins.

See that interlocks are properly adjusted and that small arcs do not form between the fingers and disks, thereby burning finger and disk, which

1. This is a report presented to the American Street and Interurban Railway Engineering Association at Atlantic City, October 14, 1907, by a committee consisting of J. Lindall, chairman; W. D. Wright, E. T. Munger and L. L. Smith.

would eventually cause a defective contact at this point and a dead car.

Clean the disk and finger with fine emery cloth.

Keep the arc chutes and plates clear of all copper caused by contactors breaking current.

See that all connections are tight.

See that springs are not broken and are in good order, insuring good contact when closed.

See that plungers do not bind and that contactors break free when the current is thrown off.

Contact plates should not be worn so low that screws holding them are burned.

Blow out contactor box with compressed air.

Note condition of wiring in the box.

Clean the master-control cylinder and use a small amount of vaseline on the fingers.

See that the handle is of proper fit and works perfectly free.

The adjustment of controller should be looked after very carefully, as there are no adjustment screws on the contact fingers.

Note condition of throttle.

Clean throttle disks and fingers and see that adjustment nuts are not loose.

Do not clean throttle plunger unless it shows signs of sluggishness.

Great care must be taken when cleaning plunger.

Clean reverser and note adjustment and condition of plates and fingers and that the reverse throws in properly.

Use no oil or grease on contactor or reverser finger or plates.

A great deal depends on the close adjustment of interlocks.

All bearings on contactors and interlocks must be made loose.

When a contactor box becomes coated inside with a yellow coating, caused by the burning of copper, short-circuits are very likely to occur if this is not cleaned off.

Multiple-unit Electro-pneumatic Type.

Overhauling on a 60,000-mile basis is recommended as follows:

Clean the drum and adjust fingers of master switch; inspect cab switch terminals and see that they are held rigidly and no strands of wire are broken. Repair, clean and carefully adjust line relay, limit switch and battery relay. Limit switch should be adjusted with ammeter. Take apart, clean, scrape and shellac drums of motor cut-out switch and reverser; replace any parts that will not make the mileage, and adjust the finger tension. Strip switch groups of all magnets, switch arms and moving parts; replace worn parts when necessary. Replace worn or burned arc shields; adjust all magnet valves to operate at proper voltage; replace defective shunts; adjust and clean all interlocks and interlock fingers; examine all insulation and make as good as new; examine piston leathers, and see that they are flexible and replace those badly worn. Storage batteries should be cleaned of sediment, and acid strength adjusted. Grid diverters should be cleaned, the insulation renewed where necessary, and all connections tightened. Control jumpers should be tested by passing seven amperes of current through them for three minutes, at the same time giving jumper the same motion that it has when in service. Clean and adjust circuit-breaker; thoroughly blow out all piping and air chambers connected with the control.

On short-period inspection the following is the practice on a road having inspection periods based on a 600-mile service:

Master Switch.—Clean and lubricate every tenth inspection.

Cab Switches.—Inspect terminals each inspection day.

Close jaws of cab switch to fit tight each inspection day.

Line Relay and Limit Switches.—Clean with crocus cloth each tenth inspection.

Inspect connections each inspection day.

Motor Cut-off Switch and Reverser.—Inspect finger tension and oil-drum contactor each second inspection and feel the terminals to see if the wires are O. K.

Inspect interlocks each twelfth inspection.

Oil reverser switch toggle each tenth inspection.

Circuit-breaker and Switch Group.—Clean armature and valves each tenth inspection.

Inspect contacts each inspection day.

Clean arc chutes each inspection day.

Blow out with compressed air all switches and grid diverters each third inspection.

Inspect all grid diverter connections and oil all pistons each inspection day, see that all terminals are tight and inspect wires.

Wipe off insulators.

Inspect shunts and battery connections each inspection day.

Add distilled water to take care of evaporation when necessary.

Test specific gravity each thirtieth inspection day.

Test battery relay and inspect terminals of battery switches each inspection day.

Inspection.

In reply to question as to "Whether inspection is made by day or night?" 20 answered "Day," 7 "Night," and 9 "Both day and night."

We believe that it is well understood that inspection made by night is less reliable and more expensive than that made by day.

Your committee would urge that very careful consideration be given this question by those doing inspection work by night. It has been found on a number of roads where at first thought it seemed impossible to have inspection done during the day that by careful study it was found possible to arrange for the work being done in the daytime, and that this has resulted in an improvement to the service as well as being more economical.

The replies to the question as to "What determines the frequency of inspection, whether brakes, control, commutator work or oiling?" would indicate that on 75 per cent. of the equipment "adjustment of brakes" was the first part of the equipment requiring attention, although several companies report motor brushes and oiling as requiring first attention.

It would seem, therefore, that a satisfactory slack adjuster for brakes is very much needed in order to obtain length of service from this part of the equipment equal to that provided by the later types of electrical equipment.

Car Wiring.

"What is done to maintain car wiring in a safe condition?" "How do you test car wiring, including light, heat, motor wiring?" and "How is light, heat, motor wiring installed—in canvas hose, conduits, cleats, molding or in transite?"

The answers indicate a general tendency toward iron-pipe conduit installation with a periodical test for insulation breakdown. Your committee believes this to be the best practice, but in the rewiring of old equipment it is frequently necessary to modify this and use iron-pipe conduit under the cars where exposed to wheel wash, and cabling or boxing wires in the interior of the car.

Your committee recommends that in all cases where wires are run through metal conduit before reaching the main fuse or circuit-breaker, a wire or ribbon fuse be placed on the roof of the car near the trolley of such capacity as would blow only in case of short-circuit of wires before reaching the main fuse or circuit-breaker.

One company reports the use on a large number of cars of a factory-made cable, which consists of a number of flexible insulated wires made up in cable form, the outside covering, or jacket, being made of fireproof material woven around the wires, taps being led out through the covering.

Trolleys.

Replies to question "How often do you inspect trolley apparatus?" show that 90 per cent. inspect them daily, four every seven days, one every 10 days, two from 300 to 500 miles, and two roads report inspecting trolley wheels every trip.

This would certainly indicate that improvement tending to increase life and reduce the necessary attention is much needed. One company reports that with the use of an automatic trolley lubricator they find it only necessary to inspect trolleys every 60 days. Another road reports that with a similar device the labor required to take care of the trolley wheels is reduced 75 per cent. and the life of the bushing is increased nearly 100 per cent. It, therefore, appears to your committee as being well worth investigating by railroads having trouble in maintaining trolley bushings.

Replies to the question, "How often do you replace trolley bushings?" show that for light cars in city service the bushing usually lasts as long as the wheel, but with heavy equipments and high speed, the trolley bushing is the weakest part of the equipment, the wheel lasting from two to three times as long as the bushing

Your committee would call attention to the importance of having trolley contact springs of sufficient capacity and in good order, so that they will carry the current from the wheel to the harp, and thus prevent burning between bushing and spindle. Two companies report using trolley wheels without bushings.

Safety Devices.

In the matter of safety devices for the protection of wiring and apparatus, your committee recommends the use of a fuse in addition to circuit-breaker on all equipments requiring current-carrying capacity of over 200 amperes. The fuse is to be of slightly greater carrying capacity than the circuit-breaker. We also call attention to the importance of overhead trolley cars being properly equipped with lightning arresters and recommend that the same be periodically inspected and tested to insure their being in proper working order.

Armature and Commutator Repairs.

The growing tendency of operating motors at high temperatures due to increased service requirements has brought to the operating men the question of making repairs with insulating material suitable for withstanding the higher temperatures.

Your committee feels that sufficient attention has not been given by operating men to the question of "motor temperatures." If a motor does not melt the solder or actually get on fire, the average car-barn foreman gives the matter no further consideration, whereas motor temperatures should be followed closely, and where this is found to be higher than the motors were designed for, effort should be made to find the cause and remedy it.

For insulation of armature coils wound with round wire and where the ultimate temperature rise is less than 65° C., cotton-covered and varnished cambric insulation is sufficient.

Where ultimate temperature rise is 65° to 100° C., asbestos covering for the wiring is necessary.

In the use of asbestos material your committee would call attention to the vital importance of impregnation with moisture-repelling varnish.

The asbestos should be considered as a fireproof material and a good spacer rather than a good insulator.

Armature coils, and especially those wound with asbestos-covered wire, must be held rigidly in place in the armature core to exclude all movement or vibration in the slot or at the ends.

By some roads it is considered good practice to impregnate an armature after it is wound by heating the armature and revolving it in an impregnating bath. The advantage of this method is improved insulation and rigidity of windings in the core. The disadvantage is the difficulty of raising a coil should it ever be necessary to patch up an individual coil.

Experiment is suggested with the use of all fireproof insulation of armature coils; that is, asbestos-covered wire; spacing and wrapping with mica and wrapping with asbestos tape. It is suggested that this process may give longer life, even under moderate temperatures, than the cotton-covered, oiled-cambric wrapped coils.

Where the original equipment was bar-wound it is recommended that insulation be mica, partially, if not wholly; where bars are to be replaced it is preferable to replace with bars similar to the original, that is, with insulation of mica. However, should it be necessary to repair at short notice and no mica-insulated bars are at hand, a varnished-cambric insulated bar is recommended, appreciating that the life is not as great as mica and shorter as the working temperature is higher.

Referring to the question, "What test do you give coils for short-circuits?" the reports show about equal use of alternating current and direct current for this test. The committee would recommend the alternating-current transformer test as a very satisfactory one. For testing armature windings, the usual yoke transformer test and bar-to-bar test are recommended. For bar-wound armatures it is further recommended that a test be made by applying full-load current through the brushes in their normal position on the commutator at such a frequency as to give approximately full voltage across the brushes; armatures in all cases to be outside of their frames.

Referring to the question, "What insulation test do you give armature coils?" reports show the use of 3,300 volts alternating current as maximum and 500 volts direct current as minimum. Majority between 1,000 and 2,000 volts alternating current:

Your committee recommends an insulation test between windings and ground as follows:

For roads using trolley:

New armatures—2,500 volts alternating current five seconds.

Old armatures—1,000 volts alternating current five seconds.

For roads using third rail where voltage fluctuations have to be taken into consideration:

New armatures—3,000 volts alternating current five seconds.

Old or partly repaired armatures—1,500 volts alternating current five seconds.

Commutator bar to bar test and between armature coils before windings are connected we recommend:

New armatures—220 volts direct current five seconds.

Old armatures—110 volts direct current five seconds.

As to the question, "Have you any preference for rolled or drawn copper over drop-forged segments?" in 22 reports where preference was stated, 12 favored rolled or drawn copper and 10 drop-forged.

Your committee recommends for commutators hard-drawn copper as possessing greater uniformity in size and hardness over the forged bars and corresponding superiority in life and service.

Your committee wishes to call attention to the importance of material and workmanship in the construction of commutators being such as to insure a solid structure which will not shrink, become loose, or get out of true.

Built-up mica is preferable for commutator segments, but it is very important that the building-up should be even and compact. Assembled commutators should be baked at 230° C. and compressed while hot to insure solidity, clamps being tightened before pressure is released.

The best method of maintaining sizes of armature shafts and bearings has been much discussed. To the question, "How many sizes of shaft journals on one type of armature in use?" the replies have been:

Seven report one size.

Six report two sizes.

Six report three sizes.

Two report four sizes.
Two report five sizes.
One reports 12 sizes.

In regard to allowable difference in diameter between sizes:

Eight report one-sixteenth inch.
Five report one-thirty-second inch.
Four report one-sixty-fourth inch.

After considerable discussion, your committee has come to the conclusion that, owing to the wide variety of conditions, it is impossible to suggest any one set of standards to fit them all, and recommends that each road select such standards as best fitted for its own conditions.

Referring to questions, "Do you sleeve worn shaft journals with steel tubing?" and "Do you apply same hot or cold?" we find that the practice of sleeving worn armature shaft journals with steel tubing is becoming quite general, and is, in the opinion of your committee, without doubt good practice.

With but one exception these sleeves are applied hot. Your committee recommends applying sleeves hot, with an allowance of 0.004 inch for each inch in diameter.

"Do you bore your babbitted armature bearing shells or babbitt to size?" While it is the general practice to bore rather than to babbitt to size, your committee suggests that possible economy and good results may be obtained by babbitting near to size and complete finish by forcing a broach or finishing plug through the shell, giving a hard, smooth surface.

"What grade of steel wire do you use in banding armatures?" Four use bronze wire Nos. 16 and 17, others use tinned steel wire usually No. 17, two report No. 18, and one No. 19 B. & S. gauge.

There appears to be lack of sufficient attention as to the quality of the wire.

Your committee would call attention to the necessity of using a high grade of wire on high-speed motors and would suggest that for motors not exceeding 75 horsepower, band wire should have an ultimate tensile strength of 125,000 pounds per square inch, while for large motors operating at a maximum armature speed of 1,200 revolutions per minute, or upward, the band wire should have an ultimate strength of 175,000 pounds, or a sufficient additional number of turns of wire of lower ultimate strength to be equivalent thereto.

Your committee would suggest, on account of higher motor temperatures, the importance of using solder suitable to these temperatures must not be overlooked, and would recommend on all motor work the use of commercially pure tin solder, owing to its high fusing point and greater reliability.

As a flux, resin dissolved in alcohol is recommended, and the use of any flux containing acid or salts is condemned.

In reply to question, "Do you have evidence of old cores materially increasing armature temperature?" the answers have been 9 in the affirmative and 18 in the negative.

It is the opinion of your committee that this is not a serious matter, and, owing to the difficulty of properly reassembling the laminations, the advantage given by dismantling the core and re-insulating the laminations is doubtful.

Where necessary to reassemble laminations they should be drifted and filed to make the core slots smooth and true.

Field Coils.

In reply to question, "Do you manufacture your own field coils?" replies from 18 roads owning 100 cars and upward showed that 17, to a greater or less extent manufactured their own field coils; one did not.

"Do you use asbestos-covered wire for fields?" "If so, are you satisfied that the results obtained justify the use of asbestos-covered wire at extra cost?" "What experience have you had with field coils wound with cotton-covered wire impregnated by vacuum process with solid compounds?" Some replies indicate the use of wire having a layer of asbestos paper and single covering of cotton, which at one time was quite extensively used. Some reports show the use of all asbestos-covered wire and the companies satisfied with it at increased cost. One road reports ownership and use of vacuum impregnating plant using there what is known as solid compound. Although others report that they have in use fields, vacuum impregnated with solid compound, there are but two adverse reports.

It is evident that considerable is yet to be learned from actual experience as to the comparative value of field coils wound with all asbestos-covered wire and vacuum impregnated with solid compound.

Your committee recommends for fields where temperature rise will not exceed 65° that the wire be cotton-covered and coil impregnated with solid compound and wrapped with varnished cambric, further wrapped with heavy webbing and dipped in varnish.

For fields where temperature rise is 65° to 100° that the wire be asbestos-covered, and coil impregnated with solid compound and wrapped with asbestos tape, the asbestos tape also thoroughly impregnated. The above recommendation for temperatures between 65° and 100° applies to strap-wound fields, as well as those of round wire.

Replying to questions, "What test do you give field coils in shop?" and "What test do you give field coils in use in motor?" reports show that a majority of the larger roads are using coil-testing instruments such as are on the market for following up the conditions of field coils. One elevated road reports the use of full-load alternating current, detecting short-circuited fields by difference in temperature or by drop in voltage.

One interurban road reports bridge measurements of resistance for testing fields for short-circuits or number of turns.

In the absence of better facilities, the use of the ordinary field-testing instruments with induction coil and telephone ear-piece is valuable, but your committee recommends that where alternating current can be obtained it is desirable that some form of transformer test be used.

For an insulation test of fields in motor your committee recommends the same voltage of alternating current as was recommended for the test of armature, as follows:

For roads using trolley:

New fields—2,500 volts alternating current five seconds.

Old or partially repaired—1,000 volts alternating current five seconds.

For roads using third rail, where voltage fluctuations have to be taken into consideration:

New fields—3,000 volts alternating current five seconds.

Old or partially repaired—1,500 volts alternating current five seconds.

[To be concluded.]

A Year's Experience with Gas Engines.[1]

By Paul Winsor.

We have now been operating our gas-engine plants over a year and the following statement of the results may be of interest to some of you:

We have two of these plants, both of them generating direct current and feeding into our overhead system in multiple with our steam-driven power stations. They have been operated most of the time by two eight-hour watches from 7 a. m. to 11 p. m. and shut down from 11 p. m. to 7 a. m. The following figures and statements apply to our Somerville power station. I give no figures for our other plant, as it has not yet been accepted.

The Somerville power station has the following equipment:

One pair of Loomis-Pettibone gas producers, with the usual auxiliaries.

Two 600-brake-horsepower Crossley gas engines, each two-cylinder, four-cycle.

Two 350-kilowatt Crocker-Wheeler generators, direct current.

This plant was started in May, 1906, and since then has given continuous, reliable and satisfactory service. There have been no shutdowns, no accidents and no failures.

The fuel has been soft coal, the same as used in our steam stations, mostly run-of-mine Pocahontas. The economic results are shown in the following table:

	Somerville Power Station, Boston Elevated Railway Company Power. Date, January, 1907, to August, 1907.							Total.	Average.
	Jan.	Feb.	March.	April.	May.	June.	July.		
Kw.-hr. generated	204,080	175,200	192,250	202,870	118,640	35,770	60,170	988,980	....
Total pounds coal, including coke	391,223	364,817	405,050	401,150	234,705	90,991	124,452	2,012,388	....
Pounds coal per kw-hr	1.917	2.081	2.120	1.975	1.979	2.542	2.065	....	2.034
Pounds coal per b. h. p. hour	1.322	1.436	1.426	1.363	1.365	1.755	1.425	....	1.404
Sta. load factor based on 16 hours per day and 7 days per week	58.8%	55.9%	55.3%	60.4%	34.2%	10.6%	17.3%	....	41.6%
Eng. load factor	84.2%	86.0%	87.4%	82.3%	78.3%	73.3%	82.8%	....	83.3%
Gen. load factor	99.3%	101.3%	103.0%	97.1%	92.4%	86.5%	97.7%	....	98.35%

These are the results from actual service and include all the fuel used for power, heating, etc., and the auditor's usual one per cent. to make his books balance.

A year ago I told you that we were operating on 1.45 pounds per kilowatt-hour. Later, before the Proceedings were published, I had to withdraw that figure. Overzealousness on the part of the producer men working for the contractors led them to use coal that had not been weighed, and lack of proper checking on the part of our men failed to catch them at it, and it was not until we took account of coal on hand that we discovered what had been going on.

The following are some of the points that have particularly interested us:

Water.

We have used a great deal of water for scrubbing the gas and for cooling purposes. The average amount has been 281 pounds per kilowatt-hour. When we bought this water, as we did for a few months, our water cost about twice as much as our coal. We have been since November 21, 1906, pumping this from a very dirty brook by means of two-stage centrifugal pumps, electric driven, and filtering through a pressure sand filter. This outfit has been entirely satisfactory and has given us no trouble. The suction lift is 12 feet and the pressure at the pumps 30 pounds.

The discharge of water from the gas scrubbers is very dirty, being full of floating lampblack, and is altogether too black to put back into our dirty brook. A sand filter basin 246⅔ square feet in area and tile under-drained removes all the lampblack, so that we are turning back into the brook cleaner water than we take out.

Ignition.

Our ignition current is from 14-volt motor-generators and a floating storage battery, and we have no trouble with the outfit. The igniters are make-and-break, two to each cylinder. These igniters had originally platinum tips, which cost a great deal and gave considerable trouble. We have been running now four months without any platinum and with less trouble.

Back Fires and Pre-ignitions.

During the first months, back fires and pre-ignitions were much too frequent, occurring almost every day. Lowering the compression on one of the cylinders, changes in the igniters and experience have reduced these troubles, so that we now go two or three weeks without a single one.

Reliability.

This plant has proved absolutely reliable. It can be put into service any time in less than five minutes—much quicker than can our steam plants. It can carry good loads, and do it continuously. Each unit has carried 450 kilowatts (652 brake horsepower) for an hour, with swings to 495 kilowatts (717 brake horsepower).

Efficiency.

For the first seven months of this year this plant used 2.034 pounds coal per kilowatt-hour, while our steam plants averaged 3.477 pounds per kilowatt-hour—a saving of 41.5 per cent. One of our smaller steam plants, containing three 200-kilowatt compound condensing engines, used 4.414 pounds per kilowatt-hour; this gas station used only 46.1 per cent. as much.

Conclusion.

Personally, I believe that a gas-engine plant, making its own producer gas, will operate at least as reliably as a steam plant and will use from 30 to 60 per cent. less fuel, depending somewhat on the size of the gas plant, but principally on the size of the steam plant.

The drawbacks to the gas plant are, in my mind:

First—Cost, approximating $200 per kilowatt when rated so as to have a 33⅓ per cent. overload capacity.

Second—Small size of units—the largest gas engine now built, being only of about 3,000 kilowatts capacity.

1. A paper (abridged) read before the American Street and Interurban Railway Engineering Association at Atlantic City, N. J., October 16, 1907. The author is chief engineer of motive power and rolling stock of the Boston Elevated Railway Company.

Favor Middle-of-the-Street Trolley Poles and Lights.

In the proposed beautifying and boulevarding of Dearborn Street, Chicago, from Polk Street to the Chicago River, the Dearborn Street Property Owners' Association is advocating the removal of the trolley poles from the sidewalk to the middle of the street, and possibly this plan may be carried out. The business men think that the best effect from the boulevard cluster lights could be obtained if placed in the middle of the street, which could easily be done by the middle-of-the-street trolley-pole plan. President Roth of the association says that it is generally conceded that poles and wires are less of an obstruction in the center of the street than over the edge of the sidewalk. Dearborn Street has become one of the favorite routes for automobiles to the North Side, and the Chicago Automobile Club also favors the new plan.

Lightning Conductors in Switzerland.

According to the Elektrotechnik und Maschinenbau, an influential commission in Switzerland has recently drawn up a set of normal dimensions for the sizes of lightning rods attached to buildings. Where copper wire is used the minimum diameter for buildings not exceeding 82 feet in height is six millimeters; for more lofty buildings, seven millimeters. If flat copper strip is used instead of round rod, the sectional area must be one and one-half times that of the round rod. Special methods of attachment to the roofs and walls are specified. For buildings up to 3,229 square feet in ground area there should, as a rule, be two earthed conductors. For buildings exceeding this area there should be an additional earthed conductor for each 1,076 square feet of superficies. The method of providing for the earthing of the conductors is also formulated. They should, if possible, be connected with the water mains. All lightning conductors are to be carefully overhauled every five years.

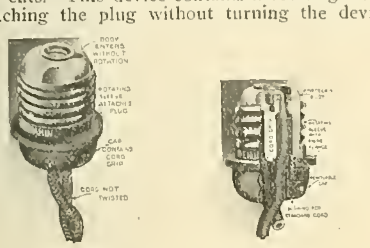
Electric Mail Tubes in Italy.

A law having been passed for the institution of the "electric post" in Naples, Milan and Rome, the Italian minister of posts and telegraphs has nominated a commission to arrange for the opening of bids for the installation of the service. An American consul says:

"The electric post is an invention of a Neapolitan, Baron Piscicelli-Taeggi, who has also patented it in America. The invention renders possible the transmission of mail from one point to another with great speed. It is planned to reserve the electric post for the mail which has greater need of celerity, such as the transportation of special-delivery letters and local telegrams to and from the central office and the substations, as well as late matter which could be sent from the central office to the railroad station ten minutes before train time. The principal tube will be the one which connects the central office with the railroad station. If the service in the cities proves a success it is the ultimate intention to inaugurate a similar service between the principal cities in Italy. It is estimated that in this way the time between Naples and Rome can be reduced from five to two hours."

Benjamin Attachment Plug.

The Benjamin Electric Manufacturing Company of Chicago has just placed on the market its new attachment plug, which is illustrated in the accompanying cuts. This device contains a rotating sleeve for attaching the plug without turning the device,



BENJAMIN ATTACHMENT PLUG.

doing away with the twisting of cord. The cord is securely held by a cap grip. The plug has no detachable parts to become lost or broken, is small, well constructed, neat and unobstrusive in appearance. This is only one of the many excellent lighting specialties made by this company.

GENERAL TELEPHONE NEWS.

The Automatic Telephone Company of Houston, Tex., has begun laying conduits in the streets of the city.

The Poynette Telephone Company has been incorporated at Poynette, Wis., with a capital stock of $10,000.

Bids will be received until December 10th by the deputy postmaster-general, Melbourne, Commonwealth of Australia, for the supply and delivery there of 50 telephones, wall sets.

The new long-distance telephone line between Spokane and St. Joe, Ida., owned by the Interstate Telephone Company, has been opened. The line is 140 miles in length and built with 30-foot poles and heavy wire.

Financial quarters report that the litigation between the Strowger Automatic Telephone Company and the Automatic Electric Company of Chicago is ended. The latter is said to have secured control of nearly 75 per cent. of the Strowger company's stock. Holders of the latter will receive $20 a share in six per cent. 20-year first-mortgage bonds, to be issued by the Automatic Electric Company, covering all its property.

At the regular meeting of the South Norfolk municipality, held at Treherne, Man., a discussion on the installation of a municipal telephone system was held, and the clerk was instructed to write to the provincial Department of Telephones at Winnipeg to make inquiries regarding the same. A large number of ratepayers are strongly in favor of the construction of a municipal or Independent system immediately. R. J. Mills, Treherne, Man., can give information.

The two leading cities of Australia—Melbourne and Sydney—are now connected by telephone. The line is a little over 600 miles in length and is composed of two exceptionally strong and heavy copper wires. The cost of construction was $227,198, and it took four months to complete. The fee for conversations, viz., $1.46 for three minutes, is thought to be too high in business circles, but the postmaster-general, by whose department the line is controlled, has stated that if after three months' trial the line proves payable a series of progressive reductions in the rate will be made.

Indiana Telephone Items.

The Home Telephone and Telegraph Company of New Haven has purchased the poles and wires of the Bell telephone company's system in New Haven. The Bell company will only maintain a toll station in the future.

The Richmond Home Telephone Company has deferred for another week the complete cutting over of the wires to its new automatic system. The officials say that they spent the past week in tests preparatory to such cutting over, but they will train their patrons for another week. The trouble arises over the inability of subscribers to master the use of the new service. The officials say some of their patrons make some very laughable mistakes.

The Southern Electric Company has elected officers with Chas. G. Knoefel as president. This company is allied with the Home Telephone Company of New Albany and makes a specialty of manufacturing a terminal box for the protection of cable service. The box is an invention of Frank Baucond, general manager of the Home Telephone Company of New Albany.

It is reported that the American Automatic Telephone Company will install an automatic plant for the Independent Telephone Company of Indianapolis. This order is said to amount to $155,000, being one of the largest ever received by the American Automatic Company. S.

Southeastern Telephone Developments.

The Southern Bell Telephone Company has secured a site at Greenville, S. C., on which the company will erect a handsome and convenient local exchange building.

Counsel for the Cumberland Telephone Company has applied to the federal court in Alabama to restrain the Louisiana railroad commission from interfering with local and long distance business of the telephone company.

A combination of local telephone companies at Concord, High Point, Lexington and other North Carolina towns is reported, the purpose being to build a long-distance system to connect the different towns named.

Companies operating directly or indirectly in Northern Virginia, District of Columbia, Maryland, Pennsylvania and other states, including the Bell of Philadelphia, the Chesapeake and Potomac in Baltimore and other centers, and the Pennsylvania Telephone Company, have effected a consolidation, it is declared, with $60,000,000 capital and operating over 300,000 telephones. The capital stock will be sufficient to retire the old stock, pay floating indebtedness and provide for improvements. The companies are not competitors and the merger will secure a greater economy. L.

Telephone News from the Northwest.

The Valley Telephone Company of Appleton, Wis., and the Milwaukee Independent Telephone Company have arranged to build a toll line from Appleton and the Fox River Valley to Milwaukee.

The city of Anoka, Minn., has passed an ordinance to regulate telephone charges. The Northwestern Telephone Exchange Company has gone into court to prevent the enforcement of the ordinance and the right of a municipality to regulate rates is brought into question.

A. Reed of Sturgis, S. D., is completing arrangements for a rural telephone line from Vale, S. D., to several towns in the Black Hills.

C. C. Nelson of New Sweden, Minn., for 12 years manager of the Nicollet County Telephone Company, has resigned.

The Hartland Telephone Company has made application to the council of the village of Wells, Minn., for a franchise for a local exchange.

A franchise has been granted at Crosby, N. D., to the Great Northern Telephone Company. R.

Chicago Telephone Ordinance Delayed.

It is understood by the action of the Chicago City Council at its meeting this week that the pending franchise extension ordinance for the Chicago Telephone Company be not taken up until the committee on gas, oil and electric light makes a report on its investigation into the condition of the Illinois Tunnel Company's automatic system in the loop district of Chicago. This company has a franchise for telephone service, but it seems the system has not been extended much since about 5,000 telephones were put in service. The ordinance requires that 20,000 instruments be in service by next year. Some of the aldermen object to two telephone systems, and therefore want to be informed as to whether the Tunnel company intends to install a complete system, in which case they would not favor granting a franchise to another company. The committee is to report at an early meeting of the council, after which the measure for the Chicago Telephone Company is to be taken up by the council in committee of the whole.

CORRESPONDENCE.

Continental Europe.

Paris, October 8.—Up to the present, the only French passenger steamers which carried radio-telegraph outfits were the transatlantic liners belonging to the Compagnie Transatlantique. However, this apparatus is of the Marconi system, and the company accepted the conditions of the Marconi company, which do not allow the vessels to communicate with stations carrying other types of apparatus. On the other hand, the war vessels of the French fleet have been equipped for some time past with apparatus manufactured at Paris and are able to send signals to the different stations located along the Atlantic and Mediterranean coasts and also to inland stations. But it was also very desirable to have passenger steamers fitted with home-built apparatus which would enable them to signal to all the stations. A move in this direction was taken lately by the steamer Ile de France, which started from Marseilles not long since to make the cruise upon the Mediterranean organized by the Revue Générale de Sciences. It is the first steamer outside of the war vessels to be fitted with a French radio-telegraphic outfit. During the cruise the vessel sent a considerable number of private telegrams to the stations on shore, for which the regular rates were paid, and the apparatus worked quite well. When in the harbor of Marseilles, and almost surrounded by high hills, the vessel received messages from the Eiffel Tower station at Paris, of which I have already had occasion to speak. On this vessel the Rochefort system of apparatus is used. The government postal and telegraph department is engaged in erecting a number of stations on the coast for commercial use, and at the same time the system will be largely adopted upon the vessels belonging to different companies. It is to be remarked that the vessels which carry the Marconi system will be free to signal to other stations after July 1st of next year, this date having been fixed at the recent Berlin congress.

A number of new military radio-telegraphic corps are to be organized in the German army, starting from October 1st. These corps will be located at Berlin, Frankfort, Coblentz and Carlsruhe. Each of the new corps of operators will comprise four companies and will figure a total of 1,750 men. Portable outfits of the most recent design are to be used.

During the coming automobile show at Paris there will be held the second congress of industrial alcohol, which will bring out the most recent progress in the way of alcohol motors and also the use of alcohol for lighting and heating. It is desired to promote the use of alcohol in France to replace the imported gasoline, so that the congress will have an unusual interest. The question is a timely one at present, owing to the recent crisis in the vine-growing regions in the south and the agreement which has been made between the southern and northern districts of France by which all the industrial alcohol is to be manufactured in the north. At the same time a fixed rate has been established for industrial or denatured alcohol, which is lower than the former price and also below that of gasoline, and this will naturally promote the use of alcohol for motors and for incandescent burners. The latter are now being manufactured at Paris and give a good light at a very low price. As the last congress upon this subject was held as far back as 1902, there will be a great progress to report, and I expect to mention some of the most interesting points which bear upon power or lighting.

In the town of Valenciennes steps are being taken to substitute the electric system for animal traction. The General Council has adopted the report of the prefect relating to the offer which has been made by the traction company to change over its system, and it is decided that the concession of the company will be extended to this end for a period of 15 years.

A new electric line is to be built in Italy between the towns of Brescia and Caffaro, according to a project which has been drawn up by one of the local companies. The project is now in a completed state and is to be laid before the council of the government Public Works Department. The total cost required by the present plans is figured at about $1,000,000. A. de C.

Great Britain.

London, October 12.—The London County Council got to work again this week after the summer recess, and naturally there were a good many matters demanding attention. In the first place there were the new tramway proposals for the coming Parliamentary session which, although containing no very drastic proposals, will involve a sum exceeding $1,500,000, of which two-thirds represents the cost of the necessary street widenings. The proposed new lines are all in the nature of link lines and tend to the unification of the system, which at present is somewhat isolated in parts. There were the usual party objections to the proposals, but they were all eventually agreed to.

The Board of Trade has intimated that it sees no reason to withhold its consent to the use of the G. B. surface contact system of electric traction upon the lines from Commercial Road to the county boundary at Bow. It will be remembered that in consequence of objections by the Stepney Borough Council to the adoption of the trolley system and the physical impossibility of using the conduit system owing to the proximity of a railway tunnel, the Council compromised affairs by suggesting the G. B. surface contact system. This was immediately met with a protest from tramway authorities outside the county of London—and who all own trolley systems—that the very desirable convenience of intercommunication would be precluded, although no good reason was vouchsafed. The intimation of the Board of Trade above recorded explains that the advice which it has received is to the effect that there is no engineering reason why the cars of any tramway authority should not be equipped for both systems—or, in fact, for the conduit system in addition.

An interesting piece of information is being brought to the notice of the Local Government Board by the electrical engineer to the West Ham Corporation. It relates to the life of cables and the period allowed by the Board for the repayment of loans for this purpose. Until comparatively recently this period was 20 years, but it has since been reduced to 15 years. The engineer at West Ham has had occasion recently to take up a piece of cable which has been in use, laid direct, for 10 years, and thus half the period of repayment has elapsed. This cable is in such a good state of preservation that it is suggested it would last for a considerably longer period than 20 years, and certainly far beyond the present limit of 15 years. The suggestion to put the facts before the Local Government Board is a capital one and ought to be productive of much good.

Several tramway accidents during the past week or so admittedly due to the failure of brakes to act will provide fresh food for study on the part of the Committee which is now making an investigation into this subject.

Objections continue to come in against the Home Office draft regulations concerning the use of electricity in factories, and it is quite evident that there will have to be considerable modifications. No public department dare try to enforce the regulations as they now stand in face of the powerful opposition which is gradually being developed.

The Postmaster General is being severely taken to task by the Hull Corporation telephone committee in regard to a statement made by him that considerable items which should have been charged to revenue have been charged to capital. This statement was made as showing how the Hull Corporation could charge such low rates and as a defense of the higher telephone tariffs now being introduced by the National Telephone Company. So keenly do the Hull people feel the insinuation that they offer to produce their books for a thorough examination.

With regard to the Franco-British exhibition in London next year, the Institution of Electrical Engineers is taking a keen interest in the science section, together with other authorities. It is stated that Canada has obtained 120,000 feet of space and Australia 40,000 feet. G.

Dominion of Canada.

Ottawa, October 19.—The gross receipts of the Toronto Railway Company for the financial year ended August 31st were $3,349,820, being an increase of $372,281 over the previous year. The percentage paid to the city of Toronto by the company amounted to $409,964, an increase of $73,333.

It is stated that the Pellatt electrical syndicate of Toronto is willing to quote to the Ontario government a rate of $10 a horsepower at Niagara Falls if it is given a 25-year contract. The Ontario Power Company, however, is quoting that price on a 10-year contract. It is not likely that the government will enter into the long-term contract, but some arrangement may be arrived at which will terminate the conflict between the government and the syndicate.

Engineer Sothman of the Ontario hydro-electric power commission has given an estimate to the civic authorities of the city of Hamilton, Ont., of the cost of installing a municipal lighting and power plant with underground service. For lighting alone, his estimate of the total cost was $175,580, with an annual cost of operation of $35,517, or $51 per lamp per annum, and the cheapest underground system for power as well as lighting, $198,973. It is the intention to prepare a by-law for submission to the ratepayers next January.

The town of Gravenhurst, Ont., has opened its municipal power plant at South Falls. The falls are in a branch of the Muskoka River and are 106 feet high. The works have a capacity of 750 horsepower, but it is estimated that some 4,000 horsepower can be generated from the falls at low water. The plant is said to be a model of mechanical and electrical perfection. The cost, including the transmission line, eight miles long, was $45,000.

In an address before the Board of Trade at Chatham, Ont., Hon. Adam Beck of the Ontario government, and head of the Hydro-electric Commission, spoke on cheap power, advocating public ownership of waterpowers. He said that the watersheds of Ontario were worth more than all the coal fields of Pennsylvania, as they were exhaustless, provided that the forests were preserved, but the people of Canada were in danger of seeing them monopolized. Public ownership, he said, has proved a success wherever administered with honesty and ability. W.

Winnipeg, Man., October 19.—Fitzgerald & Bennie, Canadian representatives of the American Electrical Furnace Company, have arranged with the Canadian Niagara Power Company to supply current to a plant to be constructed at Niagara Falls, Ont., not only for the demonstration of the utility of the present methods but also for investigation into improvements of fuming of metal by electricity. At first an 80-horsepower furnace of the Colby type will be set up. From England will be brought a furnace of the Kjellin type, which will require a current of 200 horsepower. The furnace is of the "tilting" type, and will yield 1,000 pounds of steel at a single heat and has a capacity of six heats in 24 hours.

Gratifying progress is being made in the installation of the chain of wireless-telegraph stations along the coast of British Columbia. Before the opening of the new year all these stations will be in operation and messages will be received from any ship off the coast which wishes to employ the most modern methods for life saving and aids to navigation. The Victoria station is now ready for equipment, and those at Estevan, Cape Lozo and Point Grey are at various stages of completion.

F. G. Cross, a Marconi expert, passed through Canada recently en route to the Fiji Islands, where the British government will install a wireless system. Although Mr. Cross was very reticent, it is understood the British government intends to link all British possessions by a system of wireless telegraphy, via the northern and southern halves of the two hemispheres.

A company has been organized at Dawson City, Y. T., for the purpose of building an electric tramway from Valdez, Alaska, to the copper fields, a distance of approximately 180 miles. A large gang of men is now at work on the line, and it is expected the first 30 miles will be graded this fall before frost puts an end to operations for the year. H. D. Reynolds, Seattle, Wash., and Valdez, Alaska, is interested.

Hon. Maurice Gifford, one of the directors of the British Columbia Electric Street Railroad Company, has arrived from England, and announces the company will spend approximately $1,500,000 next season in improvements.

With reference to the disposal of the street-railway system and franchise at Edmonton, Alberta, the city commissioners are at present engaged in collecting data and information with a view to bringing down to the council a recommendation asking authorization to make proposals for the purchase of the Strathcona franchise, with a view to shortly beginning operations with the Edmonton system. Since Strathcona has been considering the disposal of the franchise the Edmonton commissioners have come to the conclusion the two systems could be run more cheaply by one corporation. Mayor Mills or City Electrician Ormsby, Edmonton, Alberta, can give details. R.

New York.

New York City, October 19.—The Legislature adjourned last Saturday, and the Public Utilities Bill which has been before the House and which has been received with such divided opinion was lost at the closing session. The question of the "rate-fixing power" was hotly debated, but was finally amended to include this important point. The measure had passed the Senate unanimously.

William Barth, who was arrested recently for selling and installing a device consisting of a large electromagnet to "regulate the amount of electricity," has been found guilty and sentenced to three months in the penitentiary for stealing electricity from the Edison Electric Light Company. His device, which caused the meter to either cease registering or to run backward, did not, however, interrupt the flow of current. The lighting company estimates that it has been cheated out of many thousand dollars in the year, and that fully 30 persons to its knowledge have been induced to buy this "regulator."

Chairman Wilcox, of the Public Service Commission, announces that it has engaged the services of Bion J. Arnold and A. W. McLimont to advise the commission concerning the equipment of the surface and subway lines in and near New York and the construction and operation of the latter.

A dispatch from Paris states that wireless dispatches from Paris to New York will soon be possible, according to the belief of the French engineers now engaged in the installation of a new radio-telegraphic post on the Eiffel Tower. Gen. Drude, commanding the French forces in Morocco, has been in constant touch with the home government through the direct transmission of wireless messages ever since the present trouble begun. Messages are sent from the Eiffel Tower to the battleship Gloire, lying off Casablanca, without the slightest hitch. Measures are being taken to increase the power of the station.

According to the Public Service Commission Bill recently passed all gas and electric meters must be inspected. For this work a uniform and reasonable charge is prescribed by the commission, which the law provides shall be done to meet the expense. If the results of the test show the meter to be two per cent or more fast the customer gets his fee back from the company and is also entitled to a rebate upon the bill rendered him. To simplify the work of inspection the field of operation is divided into four districts with headquarters at Albany, Poughkeepsie, Rochester and Buffalo.

Arrangements have been made by the authorities of Columbia University for a series of lectures during the winter on subjects in connection with the recent advances in science. The lectures will be open to the public and will be given in such language as will be readily understood by persons of ordinary intelligence. The course opened last Wednesday and will be conducted by professors of the college.

A course of lectures on radiation, light and illumination will be delivered by Dr. Charles P. Steinmetz at the Polytechnic Institute of Brooklyn. The lectures will be given in the evening and will be illustrated by occasional experiments. The dates and subjects are as follows: November 7th, Radiation as a Form of Energy; Physical and Chemical Effects of Radiation. November 21st, Physiological Effects of Radiation; Visible, Infra-red, Ultra-violet and X-radiation. December 12th, Black-body, Gray-body and Colored-body Radiation. January 9th, Selective Radiation of Gases and Vapors, Arcs and Discontinuous Discharge. January 23d, Efficiency of Transformation into Radiant Energy. February 13th, Measurement of Radiation and Photometry. February 27th, Commercial Illuminants, Flames, Incandescent Lamps and Arc Lamps. March 12th, Illumination and Illuminating Engineering. E. H. S.

Southeastern States.

Charlotte, N. C., October 19.—The Macon (Ga.) Railway and Light Company has passed into new hands, with a partially reorganized board of directors. The new president is W. Jerdon Massee. Among the new directors are W. J. Massee, M. Felton Hatcher, John T. Moore, F. B. Stubbs, A. T. Small and J. N. Neel.

The stockholders of the Long Island Cotton Mill Company, near Statesville, N. C., will erect a dam across the Catawba River for generating electric power for use at the cotton mill. The company will increase its capital from $50,000 to $200,000.

The Carnegie Trust Company will take a large portion of the new bonds issued by Col. M. E. Thornton and others, owners of an electric power plant being developed on the Catawba River near Hickory, N. C. The available power which will be developed is estimated at 3,000 horsepower.

The new Salisbury-Spencer (N. C.) electric railway will be operated by power purchased from the Southern Power Company, Charlotte, N. C., which is developing large water powers on the Catawba River in South Carolina. The distance to which the transmission lines are run is 93 miles. The contract is for 500 horsepower.

The Waycross (Ga.) electric railway, with $300,000 capital, will begin construction work in a few days, having applied for a 99-year franchise.

A consolidation is being quietly worked out, it is said, involving the Baltimore Electric Company and the Consolidated Gas, Electric Light and Power Company on one hand and the Maryland Telephone Company and the Chesapeake and Potomac Telephone Company on the other hand. Those interested have denied that a merger was in sight, however, but in financial circles the report appears to have gained a measure of credence.

The receivership of the North Georgia Electric Company has been dissolved. Directors and stockholders representing 90 per cent. of the stock and representatives of 75 per cent. of the creditors have agreed to drop the bankruptcy proceedings and give the company an opportunity to work out is business in its own way and settle its obligations. L.

Ohio.

Toledo, October 19.—The retail electrical houses have experienced a brisk picking up in nearly all lines.

The Marion County Telephone Company is short of girl operators and is anxious to enroll a number of girls as exchange operators. Good wages and short hours are offered.

The Home Electrical Supply Company is the name of a new establishment recently opened up in Tiffin, Ohio. It will be under the management of Edwin R. Strohm, superintendent of the Home Telephone Company, and Harry C. Frazier will be in charge of the store. They will carry a complete line of electrical goods.

The contracts for the new muncipal lighting plant at Arlington have been signed and the work is now under way. It is expected that the plant will be in operation within 90 days. The town has been without light since last July.

Rollo Stevens, formerly in the contract department of the Central Union Telephone Company at Columbus, has been promoted to a more responsible position with the sub-license department of the same company. He will spend the greater portion of his time traveling.

Jesse Cochran, electrician for the Ft. Wayne, Van Wert and Lima Traction Company, is removing his office from Van Wert to the company building in Lima.

The entire telephone plant, complete and in operation, of the Kelley Island Telephone and Electric Company at Sandusky, Ohio, will be sold at public auction on November 7th by Dorr E. Warner, the assignee. The company has 86 subscribers, franchises, poles, wires, telephones and other personal property appraised at $5,000. H. L. S.

Indiana.

Indianapolis, October 19.—It is reported that the Winona Interurban Company's line southwest of Warsaw is soon to pass into the hands of the Murdock syndicate, which controls the Northern Indiana system of interurban lines.

The American Engineering Company of Indianapolis has decided to abandon that portion of the "Educational Interurban Route" between Greencastle and Crawfordsville, because the commissioners of Putman County refused them a right-of-way through the Big Four Arch north of Greencastle. The promoters say it would be very expensive to build a viaduct over the track of the steam line at so great a height.

Regular passenger service was established on the 17th inst. by the Indianapolis and Louisville Traction Company on its new line between Jeffersonville and Scottsburg.

The Chicago, South Bend and Northern Indiana Electric Railway Company has begun the work of constructing new car barns and repair shops in South Bend. The new building will be of steel and brick construction.

Work on the actual construction of the Fort Wayne and South Bend Traction line will begin in a short time, according to statements made by President Perry A. Randall. A half-dozen towns in Elkhart, Kosciusko and Marshall counties are engaged in a lively campaign to induce the officials of this line to build its tracks through their corporate limits.

A large number of the citizens of Huntington have petitioned the City Council to grant to the Fort Wayne and Wabash Valley Traction Company a franchise to sell electricity in the city. If granted, the company will generate the current at its Fort Wayne plant and use the present power house in Huntington for a sub-station. The company proposes to furnish electricity for heat, light and power purposes at a less rate than that charged by the local electric-light company.

The use of natural gas is being revived in a number of Indiana cities. The Union Gas Light and Fuel Company of Anderson is constructing a $75,000 gas holder and laying a new pipe line to six new gas wells drilled within a few miles of the city, that promises an abundant supply. The gas holder is intended to take care of the surplus gas during the night for distribution during the day, when the demands on the company will be the heaviest. At Elwood and other towns old wells have been cleaned out, and the supply promises good service during the winter. In Vincennes and other Southern Indiana cities pipe lines are being constructed, and the supply of natural gas promises to reach a volume sufficient to supply a good service to all the inhabitants of the fortunate cities. The rehabilament of the old wells in several of the old gas territories, where good supplies are again being obtained, is regarded as proof sufficient that natural gas is continually being generated in the Trenton rock.

The commissioners of Tippecanoe County have granted a franchise to the Chicago and Western Indiana Traction Company to construct and operate an interurban electric railway from the city limits of Lafayette through Fairfield, Wea and Randolph townships.

The Grand Central Traction Company, proposing to build an electric line from Indianapolis to Evansville, has applied to the Indianapolis Board of Public Works for the right to enter the city.

The managers of the Fort Wayne and Wabash Valley Traction Company are planning to put on two or more extra freight cars between Fort Wayne and Lafayette. Since the opening of the west line the business has increased so rapidly from the numerous small cities along the line that the freight traffic has outgrown all the original calculations. The baggage compartments of the passenger cars have been crowded in order to relieve the freight cars, which have been unable to carry all the freight and express offered.

A new car on the Chicago, South Bend and Northern Indiana electric road made a run between South Bend and Warsaw in half the usual time, maintaining a speed of 60 miles per hour for a portion of the distance. This car is the second of the new high-speed cars recently purchased and put on the line to complete its limited service.

The new electrical plant in Greenfield is almost completed and is said to be one of the best in the state. It will have a capacity far beyond present demands. It is the intention to supply 24-hour service, which has long been desired by owners of small manufacturing plants. The plant is owned and operated by the city.

The sale of the property of the East Chicago Water Works Company and the East Chicago Light and Power Company, practically one concern, has been confirmed by the federal court at Indianapolis. The property was sold to Leonard Metcalf, who, it is understood, was acting for the bondholders. It is understood that the city received $150,000 for its interest in the plant and for two new franchises for the East Chicago and Indiana Harbor Water Company and the Indiana Harbor and East Chicago Electric Company, recently incorporated, which will take over the property of the two companies. In addition the city is to receive certain concessions in the way of reduced rentals for light and water.

The Board of Public Works of the city of Kokomo is asking for sealed bids until November 8, 1907, for furnishing electric lights for the city according to plans and specifications now on file with W. T. Meck, city clerk.

The Tarr Electric Company of Farmersburg has incorporated with a capital stock of $20,000. The declared object of the company is to construct and equip a plant to generate electricity for light, heat and power. The directors are A. D. Tarr, E. W. Jennings and W. F. Baldridge. S. S.

Illinois.

Peoria, October 19.—The City Council of La Harpe is investigating a proposed change in the lighting system from arc to incandescents.

A new time card has been put in effect by the Illinois Traction Company, affecting the cars out of Springfield. The sleeping car now leaves every night at 11:30 for St. Louis and runs through as a limited car. A local car follows the limited.

Senator Putnam of this district has introduced a bill that declares the Illinois and Desplaines rivers to be navigable streams, and this prevents the erection of obstructions by private concerns and individuals. The waterpower that will be generated between Lockport and Branden Bridge, a distance of five or six miles, will be worth to the state between $2,500,000 and $3,000,000 a year. He says that private persons stand ready to improve the channel of the river in exchange for the power for 15 years. This improvement will cost $20,000,000, and this is what it is proposed to issue bonds for.

J. H. Sullivan, who has been manager for the Pekin Telephone Company at Havana, will have charge of the exchange at Petersburg, being succeeded by W. K. McQuown at Havana.

The Litchfield Gas and Electric Company has about completed the work of installing alternating series enclosed arcs in place of the old open arcs that were formerly in service for lighting the streets.

The Hillsboro Electric and Power Company is installing a new 200-kilowatt Western Electric generator, direct connected to a 315-horsepower engine.

The electric railway being built at Hillsboro will be operated by current furnished by the glass factory, to which it runs. The line is built to handle passengers and freight and coal to and from the factory.

The Saybrook Electric Transmission Company is building a transmission line to Arrowsmith, a distance of 10 miles. At the city limits of Saybrook the voltage will be stepped up to 6,600. The company has a contract for the lighting of the streets, and will also do commercial lighting. The company proposes to operate a telephone line to the village on the same pole line. A four-pin arm will be used, two pins on the same side of the pole for the single-phase power-transmission line and the other two pins for the telephone system. At certain times the operator at the power station at Saybrook can throw a switch to cut out the telephones and use the wires to do the street lighting at Arrowsmith.

The Watseka Electric and Heat Company has purchased material for a three-phase transmission line to Milford, using 16,500 volts with a bare wire. The line will touch Woodland on the way, which is 3½ miles from Watseka. The same company owns the plant at Milford, which will be closed down; the total length of the line is about 11 miles.

Work on the Lincoln-Mackinaw line of the Illinois Traction Company is progressing rapidly. The line will connect with the Peoria-Bloomington line just west of Mackinaw, giving Peoria a more direct route to St. Louis. V. N.

Pacific Slope.

San Francisco, October 17.—The large number of accidents, exceeding 2,000, that have occurred on the lines of the United Railroads of San Francisco since the carmen's strike began a few months ago, has excited the attention of the Board of Supervisors as well as the public, and every possible means is to be tried to improve the operating conditions. The shortage of electric power in San Francisco is blamed for the inability of the street railway company to operate sufficient cars to accommodate the traveling public and to avoid distressing delays to traffic at the rush hours.

Officers of the San Francisco Gas and Electric Company, which is supposed to supply the current needed by the United Railways under a long term contract, deny that they are unable to furnish all the power that the former company is willing to pay for, and relations became temporarily strained. It is probable, however, that within a few weeks the generating plants of the electric company in the mountains will be able to furnish a greater surplus for the use of San Francisco. After the rains have commenced there will be a better water supply for all of the hydro-electric plants in Northern California, and those which are short can be helped out by others.

The general curtailment of expenses which the Southern Pacific Railroad is said to be carrying out will not affect its plans for the improvement of the trans-bay service and the electrification of its local lines. Plans for the power house to be erected at Fruitvale show that it will be a two-story steel-frame, brick or concrete building. So far, only the Alameda mole system, with its branches at Alameda and Fourteenth Street, Oakland, have been authorized, and the necessary materials ordered. Eighty-five cars have been ordered, 45 of them being motor cars. The power house will be divided by a fireproof wall, on one side of which will be two turbine engines, the two generators being opposite them on the other side of the wall. The generators will each be capable of maintaining a continuous current equal to 6,000 horsepower. It will be about 18 months before the new electric trains will supplant the Alameda steam trains. No definite plans have yet been announced for the Oakland mole electric lines.

The San Luis Obispo Gas and Electric Company's electric power plant was damaged by fire last Sunday morning, the cause being an explosion of oil under the boiler. The damage to machinery is slight, and the building was injured to the extent of $2,500, fully covered by insurance. A.

PERSONAL.

City Electrician McCrossan of Vancouver, B. C., has resigned his position and the city is said to be looking for a competent man to fill the vacancy.

Col. Robert C. Clowry was re-elected president of the Western Union Telegraph Company at the annual meeting in New York October 16th. George W. E. Atkins, who for a year past has held the office of acting vice-president, was elected a permanent vice-president. All other officers were re-elected. Gen. Thomas H. Hubbard was elected to the executive committee.

Mr. C. I. Danielson, superintendent of the Park Ridge plant of the North Shore Electric Company, is severing a connection of six years with that company to become general manager of the Electric Light and Water Company of Grand Rapids, Wis. Mr. Danielson has had 17 years' experience in central-station operation and will take many good ideas to the Wisconsin company.

Mr. C. F. de Muralt, a well-known New York consulting engineer, has been appointed professor of applied electrical engineering at the University of Michigan. This is a new chair. Prof. Muralt, who has assumed his duties at the university, will continue in active practice, as it is the desire of the university authorities that the instruction in the new department shall be under one who is in close touch with the advances in the application of electricity in its various branches.

Mr. Frank J. Scherrer, private secretary to President Robert C. Clowry of the Western Union Telegraph Company, has about recovered from an attack of typhoid fever which confined him to his home at East Orange, N. J., for a long time. Mrs. Scherrer and daughter were also ill with typhoid, the fever having been contracted on board a lake steamer during a vacation journey from Buffalo to Duluth. The steamer is said to have been infested with typhoid, over 70 cases having been traced to it.

Mr. George Williams, general manager of publicity of the American Gas and Electric Company, is in Montgomery, Ala., where he will help Manager Armstrong of the Montgomery Light and Water Power Company to launch an energetic business-getting campaign. Mr. Williams is one of the foremost men in the United States in the art of central-station publicity and business getting. He began with Henry L. Doherty in Denver. With Mr. Williams are experts on industrial fuel and sign and outline lighting. They will assist the local company in demonstrating to the people of Montgomery the benefits of the new central-station devices.

ELECTRIC LIGHTING.

The citizens of McKenzie, Tenn., are thinking of organizing a stock company to install an electric-light system and also an ice plant and laundry. Those interested may address the McKenzie Banner, and their communications will be given to the proper committees.

Chinook, Mont., will vote on bonds to the amount of $14,500 for an electric-light plant.

Silver City, Iowa, will vote on the issuance of $4,000 in bonds for an electric-light plant.

Earl C. Westcott has secured a franchise for an electric-light plant in Plattsmouth, Neb.

L. E. Jenkins of Omaha and others propose putting in an electric-light plant in Central City, Neb.

C. C. Smith has been granted a franchise for the establishment of an electric-light plant in Exeter, Neb.

The Aurora Light, Power and Refrigerator Company of Aurora, Mo., is about to begin the construction of its plant.

J. W. Adams and associates of Chattanooga, Tenn., have received a franchise for operating an electric-light and power plant in Cleveland, Tenn.

The Burlington Junction Electric Light and Power Company of Burlington Junction, Mo., has been incorporated by D. T. Garrett and associates.

Temporary arrangements have been made between the City Council of Marengo, Ill., and Messrs. Fred E. Rispin and Earl Fish of Elgin whereby these gentlemen are to take charge and operate the light plant of Marengo.

The American Railways Company, through A. S. Kibbe, engineer, has awarded the contract for the foundations of the power house of the Home Electric Light and Power Company at Tyrone, Pa., to the Raymond Concrete Pile Company of Chicago and New York.

Bids for furnishing 2,500 arc lamps and their equipment to be used in extending the street-lighting system of Chicago, have been rejected by City Electrician William Carroll. The bids of five companies were identical, $84,395 being submitted by each, and the amount was considered excessive.

About one-half of the flaming-arc lamps in Madison Square Garden during the electrical show were of the Excello type, furnished by the Excello Arc Lamp Company of New York. The lamps on the tower, those at the United Electric Light and Power Company's space and the illumination of the Driver-Harris Wire Company were all Excellos.

The Foell resolution in the Chicago City Council, which carries with it a bill designed for the Legislature and intended to empower the city to regulate rates of public-utility corporations, is pending. If passed by the Legislature the bill would bring under the control of cities the rates of street and interurban railways, subways, tunnels, telephones, telegraph, gas, electric current, etc.

Better lighting of the streets of Grand Rapids, Mich., is proposed by the City Council. The Grand Rapids Gas Light Company and the Grand Rapids-Muskegon Power Company will compete for the contract, and, in order to demonstrate their systems, the gas company will install lamps with Welsbach burners on one of the streets and the power company will light another street with new metallic-filament lamps.

ELECTRIC RAILWAYS.

Judge Lawrence of the Common Pleas Court in Cleveland, Ohio, has rendered a decision holding illegal all franchises granted by the City Council for the three-cent-fare electric railway on the East Side, in Cleveland, except a small section constructed on East Fourteenth Street. The court invalidated the franchises because Mayor Johnson was interested financially in the street-railway companies. The franchises of the three-cent lines on the West Side are held good because they were granted before the mayor took a hand in them.

Fast limited service over the electric railways which connect from Rockford, Ill., with Chicago, was inaugurated on October 1st. The Rockford and Interurban Company carries the passengers to Belvidere, whence they are taken by the Elgin and Belvidere company to Elgin, and from Elgin to Chicago the run is made over the third-rail line of the Aurora, Elgin and Chicago electric railway. The distance of about 80 miles is covered by the limited cars in three hours and ten minutes. Stops are made only at the towns. Dining cars may be added soon.

The Detroit United Railway Company passed its quarterly dividend of 1¼ per cent. recently on account of the stringency of the money market and on account of the campaign being waged in Detroit to force universal transfers and a three-cent fare on the company. J. C. Hutchinson, president of the company, said that the rapid development of the territory which the company serves has necessitated large expenditures for equipment and extensions and that the present condition of the money market is such that the company is unable to reimburse itself through the sale of its bonds, at what it deems a reasonable price, for sums properly chargeable to capital account. The directors have therefore decided to omit payment of the regular quarterly dividend at this time.

The Chicago City Council has adopted a resolution by which is submitted to the state Legislature a plan, favored by Mayor Busse, to compel all steam railroads to electrify their lines within the city limits of Illinois cities of 200,000 population or over.

POWER TRANSMISSION.

The Albany (Ga.) Power Company contemplates constructing a dam and power house at Port Shoals on Flint River and installing machinery for generating and transmitting electrical energy.

The Arbuckle Mining and Milling Company, Binghamton, N. Y., proposes to construct a dam at Imboden, Ark., on Spring River, and use the power for operating an electric railway from Imboden to Smithville and Calamine, Ark., a distance of 25 miles.

An English daily newspaper prints the following advertisement: "An English engineer, owning the control of valuable water rights in California capable of generating from 50,000 to 100,000 horsepower electrical energy, in a locality where there is a good market for the power (as already commented upon in the native press), desires about £2,000 for expenses, preparatory to floating a large English company. A considerable amount of money has already been expended in engineering and construction work, besides the acquisition of all the necessary land and perpetual water rights. A bonus will be given to those supplying all or a part of the above required capital. A special inducement will be made to a young and competent engineer desiring to enter into the service of the company, if prepared to invest some capital."

PUBLICATIONS.

A well-illustrated booklet covering the features of the Pennsylvania Railroad tunnels and terminals in New York city is being sent out with the compliments of Eugene Munsell & Co. and the Mica Insulator Company, 68 Church Street, New York.

The Union Pacific Railroad has issued a handsome book in which are described and fully illustrated the various gasoline motor cars used on this railroad. These cars were constructed at the Omaha shops of the company and their actual operation is said to have thoroughly demonstrated their practicability.

A net booklet, well illustrated, entitled "Fuse Talks," has just been published by the H. W. Johns-Manville Company. In it the company gives some interesting short talks on the cause of the accuracy of Noark fuses. These fuses are said to be as near perfection as mechanical ingenuity, the highest skill in manufacture and the use of the best materials can produce.

Mercury arc rectifiers form the subject of Bulletin No. 4530, issued by the General Electric Company, Schenectady, N. Y. These simple and reliable devices produce direct current from alternating current for charging storage batteries and for many other commercial purposes. A brief outline of the theory of the apparatus is given in the bulletin, and various types of rectifying sets are described and illustrated.

M. O. Payne, general manager for W. H. Schott, Chicago, writes as follows to the Western Electrician: "It has been with a great deal of pleasure that I have read a number of articles contained in your Twentieth Anniversary Number, and I must say that I believe it is by far the best edition you have ever published. It certainly should appeal to the electrical men in general, and I think it is well worth preserving."

A neat little book of 98 pages, three by five inches, has been received from Mr. J. O. Little, manager of the publicity department of the Nernst Lamp Company, Pittsburg. It is Vol. II. of Lux, constituting six numbers of this interesting miniature magazine of "light" literature securely bound between heavy board covers. The volume contains much of technical value, its principal mission being to illustrate and describe the Nernst system of lighting.

The August number of the Bulletin of the Bureau of Standards, Washington, D. C., has just been issued. It contains four articles of scientific and technical interest—"Melting Points of the Iron Group Elements by a New Radiation Method," by George K. Burgess; "On the Determination of the Mean Horizontal Intensity of Incandescent Lamps," by Ed P. Hyde and F. E. Cady; "Simultaneous Measurement of the Capacity and Power Factor of Condensers," by F. W. Grover; "A New Determination of the ratio of the Electromagnetic to the Electrostatic Unit of Electricity," by E. B. Rosa and N. E. Dorsey. The last two articles are of exceptional theoretical value and give the results of exhaustive researches. The last article will be concluded in the next issue.

MISCELLANEOUS.

The management of the Electrical Trades Exposition Company aims to surpass anything of the kind ever held in this country with the Chicago Electrical Show in January. To meet the demand Manager Niesz is obliged to assign show space in the basement as well as the main floor of the Coliseum.

TRADE NEWS.

One of the American consular officers in France sends the name of an electric company there which is open to accept agencies of first-class American electric devices and supplies. Correspondence with this company may be carried on in English. He also sends a list of other firms engaged in this business. Particulars may be secured by referring to file No. 1533, Bureau of Manufactures, Washington, D. C.

The Central Electric Company of Chicago is receiving a great many inquiries and orders for the Just tungsten lamps, for which it is western distributor. The company is at present importing only the standard 40-candlepower lamp, Edison base, 105 to 120 volts. These lamps are said to consume but one watt per candle, representing a saving of 70 per cent. over the 3½-watt carbon filaments. The lamps are packed with the tip downward and shipped in a special package, to assure their being kept this way while in the hands of the transportation company, and since the adoption of this package the company asserts that reports from its customers of breakage of filament have been rare.

Sealed bids addressed to S. J. Clarke, chairman of the public works committee, Calgary, Alberta, Canada, will be received until noon, November 1st: (a) For the construction of about 12 miles of street-car track and overhead trolley work in the city of Calgary; (b) for building a steel bridge with concrete abutments over the Elbow River in the city of Calgary; (c) for six semiconvertible cars with electrical equipment, etc. Separate tenders will be received for each of the above. A check, payable to the city treasurer, for five per cent. of the amount of the bid must accompany each tender. Plans, specifications and form of tender can be obtained upon application to the city engineer's office, Calgary.

A Pittsburg dispatch to the New York Times is to the effect that the Westinghouse Machine Company, which established the town of Trafford City, just above the Westinghouse town of East Pittsburg, has announced that it will concentrate all the plants of the Westinghouse Machine Company at Trafford City. A large new plant will be erected at once and the total cost of the improvement will reach $6,000,000. The various plants of the Westinghouse Machine Company are located throughout Pittsburg and Allegheny, while another of its large plants is the Walker Machine Company at Cleveland. This, with all the others, will be taken to Trafford City. About 10,000 men are employed by the company in the machine shops.

BUSINESS.

The National Pole Company, Escanaba, Mich., successor to the cedar department of the Pittsburg and Lake Superior Iron Company, one of the largest producers of cedar poles and ties, is sending to its customers a bronze paperweight representing a carload of poles. This unique advertising novelty is greatly appreciated.

A. P. Munning, sales manager of the Cutler-Hammer Manufacturing Company, the well-known manufacturer of controlling devices, passed through Chicago this week. Mr. Munning said that the demand for Cutler-Hammer devices continues brisk, and he considers the outlook for fall and winter business bright. The Cutler-Hammer company has recently placed on the market a number of new controlling devices which, it is said, have met with instant favor.

"These pony rosettes are made every-which-way. Choice of three bases—cleat, concealed and molding; choice of two caps—fusible and fuseless; they all fit each other. And those new bases for concealed work are the best ever. Get one and look at the recesses for the ends of the tubes; they just cover everything up so slick and easy. Pony—a little horse with lots of go; pony rosette—a little rosette chock full of go. And they're going. A good many think my way and always specify, 'Paiste.'"—Aleck, in October Paistery.

A letter from H. T. Plumb, associate professor of electrical engineering, Purdue University, is said to be typical of many others received by the manufacturers of Dixon's graphite brushes, the Joseph Dixon Crucible Company. Mr. Plumb says: "The brushes were used on a 10-kilowatt exciter. This machine ran hot and gave continual trouble with sparking so that the commutators required dressing down every week. The graphite brushes have been in use now for more than two months, the commutator has a fine polish and has given no further trouble from sparking. I have recommended that the university purchase these brushes in the future."

The Central Electric Company of Chicago is sending out a flyer on portable lamps which shows some very attractive designs as gifts for the holiday season. The company has for some years devoted considerable attention to its fixture department, and this year special attention has been paid to this branch of the business, and to lamps for the holiday season. This flyer calls attention to the company's display rooms, and the lamps shown indicate that prospective buyers will profit by visiting these showrooms. The company will mail a copy of this flyer on request.

ILLUSTRATED ELECTRICAL PATENT RECORD.

Issued (United States Patent Office) October 15, 1907.

867,939. Line-wire Switch Frog for Electric Railways. Harry J. Beck, Winburne, Pa., assignor to S. B. Stine and J. C. Stine, Osceola Mills, Pa. Application filed January 7, 1905.

This switch frog has a number of splice-pieces for connection with the line wires. One of these is movable relatively to the others and has a pivotal connection with the body part. The line wire connection of this movable part is at the point of pivotal connection.

867,955. Circuit for Coin Collectors. Amos F. Dixon, Chicago, Ill., assignor to the Western Electric Company, Chicago, Ill. Application filed March 4, 1907.

This telephone coin collector provides contacts in the line signaling circuit that are closed by the dropping of a coin in calling for a connection and additional contacts in the same circuit that are automatically opened during the operation of the toll indicating mechanism and reclosed only when this mechanism is brought again to its initial position.

867,985. Apparatus for Locating Submerged Objects. Simon Lake, Berlin, Germany. Application filed March 22, 1907.

The apparatus consists of a sweep line towed between two vessels and on this line is a crab or finder electrically connected by cables to a third vessel. This crab has an electric motor geared to a pulley engaging the tow line so as to propel the crab along the line. The crab also carries an electromagnet for attracting and holding it to iron bodies.

868,110. Electric Lamp. Alexander P. McArthur, Orange, N. J. Application filed October 9, 1905.

An incandescent lamp comprises a bulb, a stem for the leading-in wires, and a reflector inside of the bulb. The reflector is provided with an opening to receive the stem.

868,122. Electric Insulator. Francis J. Poinan, Rochester, N. Y. Application filed July 30, 1906.

This insulator is made of several parts. The lower part is of glass and has a sleeve and head fitting over the pin, and flaring conical petticoat. The top of the insulator is of different material and is made in three parts cemented together. (See cut.)

868,123. Cataphoric Apparatus. Thomas J. Randall, Los Angeles, Cal., assignor to the Sunset Hospital, Los Angeles, Cal. Application filed November 30, 1906.

An electric circuit is provided with two electrodes for attachment to the body of the patient. One of these electrodes is a medicine receiver.

868,128. Electrical Measuring Instrument. Frank W. Roller, New York, N. Y. Application filed April 25, 1906.

A D'Arsonval galvanometer suitable for use as a switchboard voltmeter has a scale inclined and in the form of a conical surface. The moving coil has two pointers, one in front of, and the other in back of the scale; the rear pointer projects above the scale. Two pointers are used to make sure that the observer will read the scale with his eye in a plane perpendicular to the surface of the scale, i. e., with the two pointers in line. (See cut.)

868,141. Fuse Box. John O. Stivers, Denver, Colo. Application filed October 26, 1906.

A base plate has apertures containing spring pressed contacts. A fuse carrier is pivotally mounted on the base plate and has a number of fuses mounted thereon. This fuse carrier is provided with contact plates, connected to the terminals of the fuses, and a pawl and ratchet for rotating it step by step, whereby it may be positioned to connect the spring-pressed contacts through any of the fuses.

868,171. Control of Alternating-current Motors. Friedrich Eichberg, Berlin, Germany, assignor to the General Electric Company, Schenectady, N. Y. Application filed January 26, 1907.

This method of controlling an alternating-current motor having a commutator and brushes short-circuiting the rotor on the line of magnetization of the stator winding consists in connecting the stator in series with half the rotor winding at starting by using the short-circuited brushes as one rotor terminal, and impressing a shunt excitation on the whole rotor winding when the motor is up to speed.

868,190. Dynamo-electric Machine. Charles D. Knight, Schenectady, N. Y., assignor to the General Electric Company, Schenectady, N. Y. Application filed February 11, 1907.

This is a construction for a rotor core which consists of a spider carrying the laminated core between two annular plates and clamping rings.

868,222. Electric-railway Switch and Signal. Alice A. Roth, Buffalo, N. Y. Application filed May 14, 1907.

The switch point is moved by a rock lever actuated by two electromagnets the circuits of which are closed by the trolley wheel. A signal circuit containing two differently colored lamps is also closed at the same time.

868,230. Electromagnetic Device for Use in Connection with Railway Appliances. Louis H. Thullen, Edgewood Park, Pa., assignor to the Union Switch and Signal Company, Swissvale, Pa. Application filed March 18, 1905.

An indicating mechanism for the lever of an interlocking machine has an alternating current coil energizing a core and a movable part inclosing a portion of the core and carrying a stem.

868,231. Signaling System for Electric Railways. Louis H. Thullen, Edgewood Park, Pa., assignor to the Union Switch and Signal Company, Swissvale, Pa. Application filed April 30, 1907.

The system is adapted to a double track road. Reactance bonds are placed across the rails of each track at the ends of each block. The bonds of adjacent blocks are connected together. An alternating signaling current is applied to the track circuits.

868,232. Relay. Louis H. Thullen, Edgewood Park, Pa., assignor to the Union Switch and Signal Company, Swissvale, Pa. Application filed April 30, 1907.

The novel feature of this relay is the insulating top consisting of a metal plate with proper openings and a peripheral flange. The top is entirely covered with insulating material.

868,233. Electric Igniter for Gas Stoves. Alfred M. Turkington, Berkeley, Cal. Application filed September 25, 1906.

An arm fixed to the inlet valve and movable therewith is arranged to engage with and operate a movable electrode and thus bring it in contact with a stationary electrode when the inlet valve is turned in one direction, but to swing on its pivot when moved in the opposite direction.

868,245. Audiphone. John A. Baker, Seguin, Tex. Application filed August 1, 1904.

This audiphone consists of a plurality of telephone receivers, the electromagnets of which are connected in series. The receivers are mounted parallel on a box and each has an exterior amplifying cone or megaphone.

868,253. Manufacture of Lithophones by Electrolysis. Jean B. Candau and Auguste Candau, Eaux-Bonnes, France. Application filed April 3, 1905.

The process consists in producing a solution of sulphate of zinc and a solution of caustic soda electrolytically from sulphate of soda and metallic zinc and then precipitating the sulphate of zinc by sulphide of barium to produce the lithophone.

868,254. Water-alarm Apparatus for Vessels. Francis Daniel, West Somerville, Mass. Application filed June 10, 1907.

A float has a vertical rod fastened to it which carries a circuit closer for several alarm circuits. The movement of the rod closes the circuits and rings the alarms.

868,272. Support for Electrical Resistances. Frederick Johannsmeyer, Milwaukee, Wis., assignor to the Cutler-Hammer Manufacturing Company, Milwaukee, Wis. Application filed February 21, 1907.

This support consists of parallel upright plates made of metal with a series of stamped apertures therein. Sheet-metal brackets adapted to hold the ends of the resistance units have lugs that are fitted into the apertures and then bent over to hold the parts together.

868,283. Electric Incandescent-lamp Base. Frederic H. Manchester, Providence, R. I., assignor to the Providence Gas Burner Company, Providence, R. I. Application filed January 31, 1907.

This base has a sleeve, a cap seating on the top of the sleeve, a contact shell secured to the sleeve and having its upper end extending thereabove to be bent to engage the exterior of the cap to secure the same to the sleeve, and a skirt having its upper end bent into engagement with the sleeve at the base thereof at points exterior of the lower termination of the contact shell.

868,300. Terminal or Connecting Clip for Electric Wires. Harry E. Sohner and William H. Benjamin, Montclair, N. J. Application filed April 13, 1906.

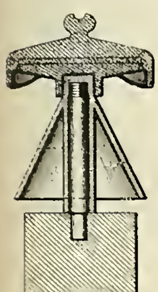
A terminal comprises relatively stationary and movable clamping members, one of which is formed with a depression and the other with an over-hanging spring hook adapted to enter the depression for locking the members in engagement with each other.

868,302. Signaling System for Railways. Louis H. Thullen, Edgewood Park, Pa., assignor to the Union Switch and Signal Company, Swissvale, Pa. Application filed May 28, 1906.

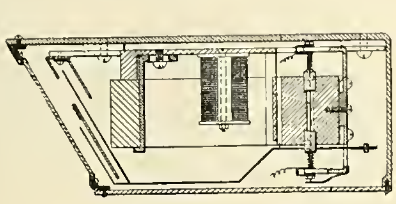
A block signal system for electric railways has relays at the ends of each block that control an alternating current signaling circuit and operate home and distant semaphores.

868,307. Thermostatic Appliance. George W. Wacker, Yonkers, N. Y. Application filed April 2, 1906.

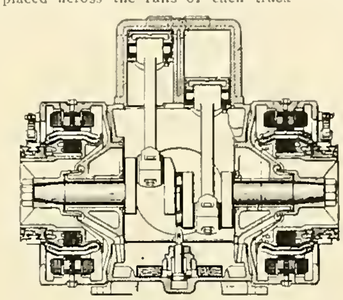
In a safety system for fire protection, a thermostat is operatively connected with a sealed valve in the water supply. An adjustable contacting part and a circuit and circuit connections to an alarm are all so adjusted and arranged that the alarm may be actuated for a definite time before the valve is actuated.



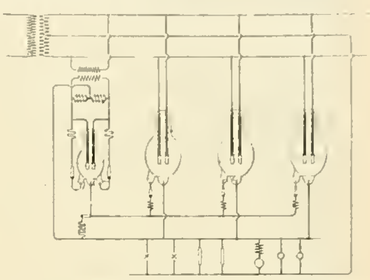
NO. 868,122.—INSULATOR.



NO. 868,128.—ELECTRICAL MEASURING INSTRUMENT.



NO. 868,362.—MOTOR-DRIVEN PUMP.



NO. 868,379.—SYSTEM OF ELECTRICAL DISTRIBUTION.

868,345. Process of Treating Ferruginous Blende. Woolsey M. Johnson, Iola, Kan. Application filed January 11, 1904.

This method of treating ores containing iron and zinc consists in first effecting reduction of iron in the form of particles disseminated through the charge, then passing an electric current through the charge containing the disseminated iron, thereby increasing the temperature and causing the iron to react to separate zinc.

868,348. Door-operated Electric Switch for Electric-light Circuits. John Kramer, Syracuse, N. Y. Application filed September 12, 1906.

A cabinet has a set of levers connected with the door and arranged to close a switch when the door is opened and open it when the door is closed.

868,354. Signal System. Bernard F. Merkel, Salida, Colo., assignor of one-half to George G. Griswold and Wade H. Green, Salida, Colo. Application filed May 1, 1907.

A signal target is provided with electric lamps on each side and rollers engaging a cable along which the target can move by gravity. The cable runs to a tower with a slot for permitting the target to enter and leave. Electromagnets controlled from a distance release the target from its normal position in the tower.

868,362. Motor-driven Pump. Edward D. Priest, Schenectady, N. Y., assignor to the General Electric Company, Schenectady, N. Y. Application filed February 15, 1905.

This machine is in three parts, the pump with two cylinders and crank shaft in the middle, and motor armature and bearings on each end of the crank shaft. (See cut.)

868,368. Wire Support. Louis Steinberger, New York, N. Y. Application filed October 5, 1906.

This wire support comprises a yoke, a cap mounted thereon and provided centrally with a stem and a block of insulating material threaded upon the stem and provided with a portion fitting into an aperture in the cap. A washer is mounted within the aperture and engaged by the insulating block, and means are provided for supporting a clip upon said stem.

868,376. Rail Bond. Darwin Ulke, Chicago, Ill., assignor to the General Electric Company, Schenectady, N. Y. Application filed July 28, 1906.

An electric rail bond consists of two terminal plates each having an extended contact surface fitted for soldering to a rail, a flexible conductor connecting the terminals, and a rivet stud projecting from each terminal at its junction with the flexible conductor and integral with the terminal.

868,379. System of Electrical Distribution. Ezechiel Weintraub, Schenectady, N. Y., assignor to the General Electric Company, Schenectady, N. Y. Application filed July 23, 1903. Renewed October 30, 1905.

This system employs mercury-arc rectifiers on a single-phase circuit. An auxiliary rectifier is provided which is supplied with current inductively from the alternating-current system and is used to produce a supplemental arc in the main rectifiers. (See cut on preceding page.)

868,380. System of Electrical Distribution. Ezechiel Weintraub, Schenectady, N. Y., assignor to the General Electric Company, Schenectady, N. Y. Application filed July 23, 1903. Renewed July 9, 1907.

In this system, which is a modification of the previous one, an auxiliary rectifier is arranged to produce a direct-current starting arc in any of the main rectifiers, which are is short-circuted as soon as the main arc is sprung.

868,381. Motor-control System. Harold E. White, Schenectady, N. Y., assignor to the General Electric Company, Schenectady, N. Y. Application filed February 27, 1906.

This is a system adapted to a shunt motor provided with an auxiliary series field. The controller first connects the latter field in series with a resistance to the source of supply and the armature in shunt with variable portions of the resistance. The latter is then cut out and finally also the series field, thus putting the armature directly across the line. To get the highest speed the shunt field is weakened.

868,384. Insulated Rail Joint. Benjamin Wolhaupter, New York, N. Y., assignor to the Rail Joint Company, New York, N. Y. Application filed January 26, 1907.

This rail joint consists of side joint plates each carrying a base plate section affording a support for one rail end and having a diagonally arranged reinforced end edge crossing the plane of the joint between the rail ends, and insulation between the rail ends.

868,387. Apparatus for Enclosing and Electrically Connecting Miners' Safety Lamps to Effect Electric Ignition. William Ackroyd, Leeds, and William Best, Albert E. Best and Robert O. Best, Morley, near Leeds, England. Application filed July 9, 1907.

A miner's safety lamp is provided with a cylindrical cover and with an electric igniting apparatus in the base; the latter consists of a battery and induction coil, the primary circuit of which is momentarily closed by turning the cylindrical cover to close the lamp.

868,404. Spark Plug for Explosive Engines. Francis W. Brady, Englewood, N. J. Application filed May 11, 1906.

This plug is provided with stationary and movable electrodes. The stem of the stationary electrode is supported in insulating bearings and surrounded intermediate of the bearings with an air-insulation space communicating with draining passages. The stem of the movable electrode is of reduced diameter for a portion of its length, the reduced portion being interposed in the path of the draining passages.

868,424. Signal System. Julian A. Gehrung, New York, N. Y. Application filed February 15, 1907.

This signaling system has a despatcher's office from which are selectively operated train stops at any semaphore station. At each of these semaphore stations manually operated means are provided for producing a checking signal at the despatcher's station showing that the train has been properly stopped.

868,427. Pool-ball Rack. George F. Goss, Walleceton, Pa. Application filed November 12, 1906.

A pool-ball rack has ball-receiving compartments, an adjustable guide for directing the balls into such compartments, and an electrical alarm having ball closed contacts arranged at the entrance end of the guide.

868,460. Coupling for Electric Cables. Gustave L'Hoest, Brussels, and Henri Pieper, Liege, Belgium. Application filed August 10, 1905.

A separable coupling for electric conductors comprises detachable electrical coupling parts separable under a longitudinal strain, and a protecting sheath for these parts that can be broken under a predetermined strain greater than that required to separate the electrical coupling parts and which incloses these parts.

868,464. Control System. Arthur S. Mann, Schenectady, N. Y., assignor to the General Electric Company, Schenectady, N. Y. Application filed December 18, 1905.

This is a control for a motor-driven pump. The motor is automatically started through a starting rheostat and the rheostat arm held in running position by an underload release magnet. The latter is operated by the check valve in the discharge pipe when the discharge is less than a predetermined value.

868,467. Brush Holder. Fred P. McBerty, Warren, Ohio, assignor to the Peerless Electric Company, Warren, Ohio. Application filed November 18, 1904.

The brush holder consists of a swinging arm with sides spaced apart and adjustable curve portions for engaging a conducting support, a split binding band whose ends are connected by a holding screw, a cross-pin supported by the sides of the arm, and a flat spring secured at one end by the holding screw and at the other end engaging the cross-pin, which is insulated from the spring.

868,468. Electromagnetic Apparatus. John McIntyre, Jersey City, N. J. Application filed May 16, 1906.

This apparatus is provided with an armature contact, a self-adjusting contact carrying a lug, and a support for the self-adjusting contact and having a slot for engagement by the lug to hold the self-adjusting contact against turning.

868,481. Air-brake System. Henry N. Ransom, Albany, N. Y., assignor to the General Electric Company, Schenectady, N. Y. Application filed June 1, 1906.

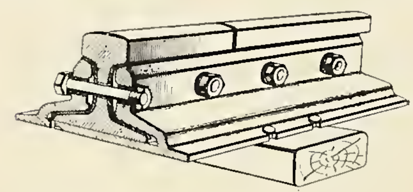
An electrically driven air compressor supplies a reservoir. The engineer's valve has three positions connecting the brake cylinder to reservoir, to atmosphere and to the compressor intake. Switch contacts controlled by the valve close the motor circuit when the valve is put in the third position.

868,495. Ice Machinery. Thomas Shipley, York, Pa. Application filed May 10, 1907.

The tank wherein the ice is formed is lined by sets of dividing plates of low electrical conductivity. These plates are placed tandem alongside of but out of contact with the freezing plate. Each set of dividing plates is composed of two upright plates joined by a bottom plate. The plates are connected to a current source when the cakes of ice are to be removed.

868,502. Arc-lamp Electrode. Charles P. Steinmetz, Schenectady, N. Y., assignor to the General Electric Company, Schenectady, N. Y. Application filed December 7, 1904. Renewed July 20, 1907.

The body of the electrode is formed of material which melts locally where the arc springs therefrom, and granules of relatively more refractory material mixed therewith, whereby, when the electrode is in operation, they protect above the liquid pool formed by the melted portion of the body of the electrode.



NO. 868,518.—INSULATED RAIL JOINT.

868,517. Insulated Rail Joint. Benjamin Wolhaupter, New York, N. Y., assignor to the Rail Joint Company, New York, N. Y. Application filed November 8, 1906.

The two opposite continuous side joint plates have each an integral base plate for one rail end only, the base plates lying in the same plane directly under the rails. Wooden filler blocks are interposed between the side plates and rail sides and also between the two base plates and between the rail ends. The parts are bolted together by insulated bolts passing through the web of the rail ends.

868,518. Insulated Rail Joint. Benjamin Wolhaupter, New York, N. Y., assignor to the Rail Joint Company, New York, N. Y. Application filed November 8, 1906.

In this joint the side plates are in the shape of angle bars fitting close to the flange, web and under side of the head of the rails, but insulated therefrom by a layer of insulation. Each side plate has a short length base like in the previous joint. (See cut.)

868,519. Insulated Rail Joint. Benjamin Wolhaupter, New York, N. Y., assignor to the Rail Joint Company, New York, N. Y. Application filed December 3, 1906.

Only one side plate is used in this joint. It has an L-shaped section forming a joint chair, the base under the rails being slightly tapered and separated from the rails by an adjustable insulating wedge. A wooden filler block is on each side of the web of the rails.

868,520. Insulated Rail Joint. Benjamin Wolhaupter, New York, N. Y., assignor to the Rail Joint Company, New York, N. Y. Application filed December 6, 1906.

The base is in two sections, one for each rail end. These base sections are trough shaped and their flanges fit into grooves in and near the bottom of the side girder rails. The parts are all insulated from each other.

868,530. Telegraph and Telephone Insulator. John A. Cooper, Mercury, Tex. Application filed June 18, 1907.

This insulator has a body portion having an opening, one wall of which is provided with a projection defining oppositely disposed seating grooves for the reception of the line wire, there being a slot formed in the opposite wall of the opening and communicating with the opening.

868,531. Controller-operating Mechanism. Clarence T. Crocker, Norwood, Ohio, assignor to the Bullock Electric Manufacturing Company, Cincinnati, Ohio. Application filed November 29, 1905.

A controller shaft carries a handle and a notched member. A pawl is adapted to engage the notches of this member, and means are provided for causing the pawl to engage one of the notches when the handle is moved forward, and to escape and move beyond the notch when the handle is moved slightly backward.

868,544. Telephone Attachment. Joseph A. Gordon, Shawnee, Okla. Application filed February 1, 1907.

An auxiliary mouth-piece for telephones comprises a disk formed with a central opening and with a marginal flange, an inclined flange projecting from the disk in alinement with the wall of the opening, a screen covering for the inner edge of the inclined flange, and locking levers carried by the marginal flange.

868,546. Signal Device. Peter Gray, Cambridge, Mass. Application filed November 21, 1901.

This signal device is a combination of a rotatable light-inclosing body provided with a number of signals, an indicator provided with corresponding signals, a common source of light constructed and arranged to illuminate the several signals, and means constructed upon revolution of the light-inclosing body simultaneously to screen similar signals of the light-inclosing body and indicator.

868,572. Shaft Oscillator. Charles E. Lord, Norwood, Ohio, assignor to the Bullock Electric Manufacturing Company, Cincinnati, Ohio. Application filed January 25, 1905. Renewed December 17, 1906.

A coil is in inductive relation with the end of the shaft and has a switch in its circuit which is intermittently opened and closed by the rotation of the shaft through a system of gearing. The time interval between successive openings of the switch is adjustable without changing the speed of rotation of the shaft.

868,573. Controller. Charles E. Lord, Norwood, Ohio, assignor to the Bullock Electric Manufacturing Company, Cincinnati, Ohio. Application filed August 30, 1905. Renewed May 20, 1907.

This controller has a main switch for regulating two electric motors in series and then changing them to parallel, a cut-off switch for cutting out either of the two motors, a stop for arresting the main switch in a predetermined position, and independent means for controlling this stop.

868,576. Pole-changer. Ewing McLean, Greencastle, Ind. Application filed March 14, 1906.

This pole changer is designed for changing direct currents to pulsating alternating currents. It has a pair of retractive spring arms between which an insulated vibratory arm is caused to vibrate by an electromagnet.

868,580. Dynamo-electric Machine. William D. Pomeroy, Norwood, Ohio, assignor to the Bullock Electric Manufacturing Company, Cincinnati, Ohio. Application filed January 2, 1906.

This patent covers an adjustable means for supporting the two feet of the yoke frame of a large generator. The feet rest on sole plates carrying a bolt for adjustment.

868,581. Self-winding Clock. Arthur F. Poole, Santa Barbara, Cal. Application filed February 10, 1904.

This clock has in combination an electromagnet with an oscillating armature, a circuit closing device mounted independently of the armature, a freely movable intermediate element loosely mounted on the armature shaft for operating the circuit closing device, and means carried by the armature for actuating the movable element.

868,587. Self-winding Electric Clock. Cleaver W. Wagner, Danville, Pa., assignor to the Automatic Clock Company, Danville, Pa. Application filed March 13, 1906.

A clock train with a propelling spring therefor has an electromagnet arranged to put the spring under stress at intervals. The circuit is closed between two contacts carried by the clock train.

868,591. Support for Cross-arms. Ernest E. Yaxley, Chicago, Ill., assignor to the Steel Gain Manufacturing Company, Chicago, Ill. Application filed June 4, 1906.

The pole has secured to it a pole plate. A cross arm plate has separate means provided for clamping it to the pole plate.

868,594. Attachment for Party-line Telephones. James H. Blythe, Denver, Colo. Application filed May 21, 1906.

This device permits all the telephones to be cut out of the circuit from the central exchange and then only one telephone to be connected to the circuit. Make and break contact wheels are provided for each telephone. Electromagnetic means are used for rotating them. (See cut.)

868,596. Potential-starter Attachment. Herbert W. Cheney, Norwood, Ohio, assignor to the Allis-Chalmers Company, Milwaukee, Wis., and the Bullock Electric Manufacturing Company, Cincinnati, Ohio. Application filed November 23, 1906.

A controller has a rotatable drum carrying a collar with projections on it that engage a spring-pressed lever when the controller is in "starting" position which tends to bias it to "off" position. This lever is disengaged when "running" position is reached.

868,621. Telegraphic Instrument. Jerome P. Zelenka, Chicago, Ill. Application filed February 4, 1907.

A box or casing that can be strapped to the body of the operator carries an electromagnet whose armature is adjustable through a screw projecting through an opening in the casing.

PATENTS THAT HAVE EXPIRED.

Following is a list of electrical patents (issued by the United States Patent Office) that expired October 21, 1907:

438,598. Electrical Water Alarm. F. M. Ashton, Lima, Ohio.
438,602. Alternating-current Generator and Motor. C. S. Bradley, Yonkers, N. Y.
438,603. Electric Motor. C. S. Bradley, Yonkers, N. Y.
438,619. Arc and Incandescent Lighting System. J. E. Giles, Hazleton, Pa.
438,620. Electric Crossing Gate. H. Gillette, Highland Park, Ill.
438,631. Telephone Transmitter. A. J. McDonald, North Tiverton, R. I.
438,632. Telephone. A. J. McDonald, North Tiverton, R. I.
438,653. Electric Guest Call. A. Striemer, Sleepy Eye, Minn.
438,656. Electric Motor. E. Thomson, Lynn, Mass.
438,657. Process of Electric Welding. E. Thomson, Lynn, Mass.
438,658. Electric Welding of Pipes. E. Thomson, Swampscott, Mass.
438,668. Brush Holder for Dynamo-electric Machines. C. F. Winkler, Troy, N. Y.
438,767. Electro-pneumatic Clock. V. Popp, Paris, France.
438,780. Electromagnet. F. M. Schmidt, Brooklyn, N. Y.
438,784. Telephone. J. C. H. Stut, San Francisco, Cal.
438,818. Telephone. J. W. McDonough, New York, N. Y.
438,827. Secondary Battery. E. N. Reynier, Paris, France.
438,828. Telephone. W. L. Richards, Malden, Mass.
438,837. Electric Drill. G. Buchanan, Chicago, Ill.
438,847. Electric Railway. R. M. Hunter, Philadelphia, Pa.
438,870. Magneto-electric Transmitter. A. E. Todd, Providence, R. I.
438,982. Telephone-exchange Apparatus. F. G. Beach, Chicago, Ill.
439,042. Electrical Transmission of Power. Wm. Stanley, Jr., Great Barrington, Mass.
439,047. Electric-lamp Socket with Regulating Attachment. W. F. Wollin and E. H. Werline, York, Pa.

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Some Features of the Rebuilding of Chicago's Street Railways.

One of the largest street-railway undertakings ever attempted is that of rehabilitating the surface street railways of Chicago, work upon which is now well under way. Readers of the Western Electrician are familiar with the terms of the measures known as the traction-settlement ordinances, which provide, under a plan unique in its methods, for the complete reconstruction of the transportation systems of the two great traction companies of Chicago. This work, planned according to the best engineering practice and having as a determining influence the growing passenger transportation needs of a great city, is now in progress under the direction of a body designated by the ordinances as the Board of Supervising Engineers, Chicago Traction. The Chicago City Railway Company and the Chicago Union Traction Company each has an engineer on the board representing its interests, and one engineer represents the city. The fourth member and chairman of the board is Mr. Bion J. Arnold, who may be said to have the unique distinction of representing the municipal government, all the companies and the general public. Mr. Arnold is also chief engineer of the work. The board has a large corps of assistants.

In the rehabilitation process a large amount of work has already been accomplished, more than 2,000 men being at present employed on track construction in a number of different streets. To complete the work planned, however, will require probably three years, not contemplating a possible subway system for the loop district.

There are a number of interesting features in connection with the work, among them being the use of electric welding outfits for welding the joints of the new rails, and the utilization of the old cable slots in streets where cable cars were formerly operated.

Among the accompanying illustrations are views in Milwaukee Avenue and Cottage Grove Avenue, two important trunk lines. Figs. 1 and 2 are views of the electric welding apparatus at work in Milwaukee Avenue, and Fig. 3 shows the method of laying from six to nine ducts of conduit in the old concrete cable trenches.

FIG. 1. ELECTRIC TRACK-WELDING OUTFIT ON A CHICAGO STREET.

The reconstruction is being done with the minimum amount of interference with traffic. Where the streets are wide enough a temporary track is laid near the curb, which permits of tearing up and rebuilding long stretches of road at a time. In other places only short distances can be worked at a time, and by the aid of numerous cross-overs the cars are kept operating by single track for short distances.

Cottage Grove and Milwaukee avenues are examples of the method of using the cable slots. If the usual method were followed in reconstruction the old trench would be filled at considerable expense in order to make a solid roadbed. Chief Engineer Fleming of the Chicago City Railway, however, devised a plan for utilizing the old cable slot as a conduit trench to hold the cables carrying the feed wires. The only impediment to this plan was to obtain a conduit of sufficiently high resistance and quality to allow of nine-sixteenths-inch walls, thus enabling the introduction of as many as nine ducts in the small slot space. A rigid test was imposed by the board, and the contract for the conduit was finally awarded to the Clay Product Company of Brazil, Ind. This company is manufacturing for this work a specially designed round-duct single conduit with equilateral octagonal exterior form, as shown in Fig. 6. These so fit into the trench (see Fig. 3) as to permit the laying of as many as nine ducts, and at the same time the complete arch construction of the conduit greatly increases their resistance to crushing force. The Clay Product Company is also manufacturing a triangular three-duct multiple conduit for slot construction where but three ducts are required.

At the various scenes of operation the first gang of about 150 men is engaged in taking up the old track and clearing the concrete cable slot of the old yokes and other scrap iron. The second gang of workmen lays the concrete in the bottom of the cable slot, and the bricklayers follow and place the ducts in the concrete, spreading six inches of concrete over all within the trench. Thus is formed a solid concrete bed, only broken by the circular manholes, which are placed between the rails at intervals of 350 feet.

The use of the cable slots tends to strengthen the roadbed. Where the concrete sides of the old trench extend into the space to be occupied by the ties, grooves are cut for the admission of the ties and fresh concrete is filled around.

Following the conduit gang, come the track men. There are three types of track construction in use, any one of which makes a very substantial road. By the end of this season, however, it is probable that one of the types, with a possible addition or change which may be suggested by experience with the three systems, will be adopted as the standard. Fig. 4 gives a view of a portion of completed track in Cottage Grove Avenue; also a stretch of track which has been lined and surfaced and is ready for the top finishing of concrete. This illustrates type No. 1 construction.

Briefly, type No. 1 is described as a surface-track construction, using a concrete bed and steel ties. Flat tie plates one-quarter inch wide are fastened to the ties by means of a specially designed clip and wedge device, the rail fastening being of the same type. Excavation is made to permit a concrete stringer 10 inches deep under each rail, the stringer being 18 inches wide at the base, the sides sloping to meet the concrete which forms the foundation for the pavement. Similarly the excavation is made so as to form a beam under the cross ties seven inches deep with a bearing width of 18 inches and 45-degree sloped sides. The ties are spaced four feet center to center.

FIG 2. FRONT VIEW OF ELECTRIC TRACK-WELDING OUTFIT.

In type No. 2 the bed construction with rail and cross-tie beams is the same as No. 1. Wooden ties of dressed yellow pine, six by eight inches by seven feet, are laid in the concrete, spaced four feet apart. Three-eighth-inch shoulder tie plates are fastened to the ties by means of lag screws, and the rails are fastened with three-quarter-inch screw spikes.

Type No. 3 is a surface-track construction. Wood ties are placed on crushed stone instead of concrete. Crushed stone to a depth of eight inches is placed in the bottom of the trench and rolled with a steam roller. The dressed yellow pine ties are spaced two feet center to center instead of four feet, and concrete is then placed from the bottom of the ties to a height allowing for properly layng the paving. More of this type of construction has been installed than of either of the other types.

Between the two sets of tracks a four by four-inch trench is left in the top of the concrete, into which is placed a bare cable constituting the negative return feeder. The sand and gravel base for the paving forms a loose bed for this cable, which is easy of access. Cross bonds are placed on the rails about 300 feet apart and connect to the return feeder.

The rails used in the reconstruction are of the grooved girder type, known as the Chicago rail. They are of 56 and 58-foot lengths and weigh 129 pounds to the yard. A section through the joint of the rail is shown in Fig. 5. Tie rods spaced six feet apart are placed between the rails.

The bolted joints shown in the picture are not used in Chicago, all the joints being electrically welded, and this forms an interesting feature of the work. In constructing the track temporary plates are fastened with a single bolt on each side of the joint. Temporary loose paving is then placed about the joint and this is easily removed when the welding process begins.

The electric-welding outfit shown in Figs. 1 and 2 is one of four such outfits owned and operated by the Lorain Steel Company. The illustrations are from pictures taken during operation in Milwaukee Avenue, Chicago. An outfit similar in general design is in operation on the South Side in Chicago. The process, it may be noted, was referred to in the Twentieth Anniversary Number of the Western Electrician (September 28, 1907) by Elihu Thomson in his article on "Electric Welding Progress." It necessitates some of the heaviest work done by electric welding.

Four cars, shown in Fig. 1, constitute the welding outfit, and the work is conducted by six men besides the general foreman. One man attends to the operation of the first, or sandblast, car with which rust and freign material is removed from the rail joints by sand under air pressure. The compressor outfit is operated by a small direct-current motor on the car taking current from the trolley wire. This car also carries the joint plates and other material. An ordinary railway motor is placed on each axle of each of the four cars for moving them from place to place.

The second and third cars constitute the welding

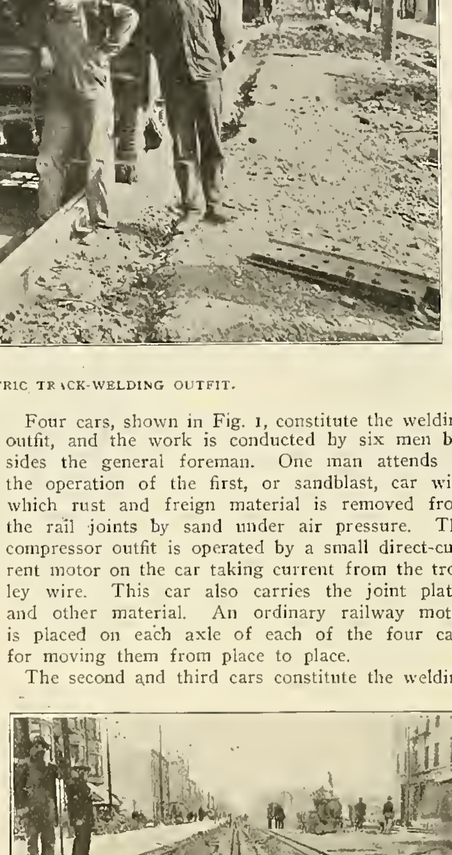


FIG. 3. FEEDER DUCTS IN OLD STREET-RAILWAY CABLE TRENCH, CHICAGO.

unit proper. The welding machinery is suspended from the front of the second car and is shown in the process of welding a joint in Fig. 2. The body of the car carries the auxiliary apparatus. The third car of the series carries the current converting and controlling apparatus. Direct current is taken from the trolley wire at any voltage from approximately 300 to 600 volts. It is transformed on the car by a specially constructed rotary converter to alternating current, and a potential regulator keeps this current at approximately 300 volts for delivery to the welding transformer. This latter process is made necessary by fluctuation on the trolley.

The welding transformer is mounted between the heavy welding clutches, as shown in Fig. 2, and finally reduces the potential to the welding voltage of about seven volts and increases the current volume to about 27,000 amperes for heating large sections. The splicing bars are held to the rail by the contact points of the heavy clamp, and by hydraulic means are given a pressure of 4,000 pounds per square inch.

Less than 15 minutes is consumed for each weld, about 4½ joints being welded hourly. Cooling water carried in a tank on the car is kept circulating about the welding machinery by a motor-driven pump to keep the apparatus from becoming overheated. The welder is raised and lowered and shifted from one rail to the other by small motors.

Four men are required to operate the welding unit—an electrician, two welding experts and a helper. The men in charge of the welding are especially trained for the work, as it is of a nature not common in the scope of the skilled electrician or mechanic. The outfit shown in the picture has been in service in several large cities, including Dublin, Ireland.

When the welding of a set of joints is completed the outfit is moved to the next joint and the fourth car is moved up to finish the work. This car carries a motor-driven grinder which is used to smooth the joint. The grinder consists of an emery wheel mounted in a carrier which is lowered to the track. The carrier is so adjusted that the joint cannot be ground deeper than the level of the surface of the rail, thus overcoming the possibility of grinding low spots in the rail. The grinding outfit is in charge of one man, half of the car affording desk and office facilities for the foreman.

No expense is being spared in making the rehabilitated street railways of Chicago first class in every respect. All material is of the best, and the work is being carried out by competent hands.

German-American Technical Societies.

In addition to the large engineering and technical societies known to everybody, numerous smaller organizations of like character exist among the various nationalities of this country. The Germans have an association covering the East and a part of the central states, the name being Deutsch-Amerikanischer Techniker Verband. It consists of eight societies in the following-named cities: Baltimore, Md.; Brooklyn, N. Y.; Chicago, Ill.; Newark, N. J.; New York city; Philadelphia, Pa.; Pittsburg, Pa., and Washington, D. C., with a total membership of about 900.

The main purpose of these societies is to avoid becoming one-sided. The constitution and by-laws therefore allow membership for everybody interested in the application of natural sciences, and the many papers read at the meetings cover technical, medical, esthetic and other subjects. The eastern societies have found it advisable to have an employment committee helping the newcomers to find a first place. Excursions to places of technical or historical interest are frequently made and are usually well attended.

The social side plays a somewhat larger role than in American technical societies. There are numerous young men receiving rather small salaries. They cannot afford to join clubs, etc., and welcome heartily what little social entertainment is offered by the Verband. This makes the life of the different "vereins" very active and pleasant.

The affairs of the association are managed by a head society, changing every year. For the year 1907-1908 Chicago is at the head, and the officers of the Chicago society are also verband officers. They are: President, F. Lubberger; vice-president, O. Eisenschiml; secretary, A. Heilbrunn, all of Chicago. August, 1908, will be the time of the next annual meeting in Chicago; it will be the twenty-fourth annual meeting of the association.

Mr. F. Lubberger, the new president, was elected at the meeting just held. He is an electrical engineer, with the Automatic Electric Company, and has lived in Chicago for six years. Mr. Lubberger is a graduate of Carlsruhe College, Germany, where he took a course in electrical engineering. On his graduation in 1899 he came to St. Louis and followed his chosen line of work. Two years later he came to Chicago to accept a position with the Western Electric Company, going later to the Automatic Electric Company.

Affairs of the Westinghouse Companies.

Naturally the fact that receivers were appointed on October 23d and 24th for some of the Westinghouse companies has created a deep impression in business circles. But it is the belief of the Western Electrician—an opinion shared, we think, by the electrical trade in general—that the condition is only temporary and is due to the great volume of business offered the companies which could not be financed in a tight money market. The companies are undoubtedly solvent. George Westinghouse, president of the Westinghouse Electric and Manufacturing Company, and head of all the world-wide and manifold interests which bear his name, made this statement on October 23d:

"When the Pittsburg Clearing House committee, after full investigation and conference with me, concluded that, although the Westinghouse Electric and Manufacturing Company and the Westinghouse Machine Company were solvent, receiverships were advisable as the best means of protecting the interests of all concerned, it was clearly our duty to follow their friendly advices.

"The necessity for the receiverships is due solely to the acute financial stringency and consequent inability to renew our maturing paper.

"Both the Electric Company and the Machine Company are solvent and are doing the largest and most satisfactory business in their history, and each company is earning liberal dividends on its stock and has quick assets substantially equal to its liabilities.

"I most confidently believe that every creditor of each company will be paid in full and that with wise management under the direction of the receivers appointed by the court the properties will soon be restored to the stockholders.

"The loans to the Security Investment Company and myself are secured by the stocks of the Westinghouse manufacturing companies, chiefly stock of the Electric and Machine companies, the sudden decline in the market value of which on Monday and Tuesday of this week has made it impossible for us to margin our loans.

"I strongly advise all holders of such loans to hold their collateral, the value of which, I am confident, will in time be sufficient to pay the loans. The sacrifice of the collateral in the present condition of the market can benefit no one. A policy of patience and forbearance is what the situation requires."

Receivers were appointed by the United States Circuit Court as follows:

For the Westinghouse Electric and Manufacturing Company—T. Hart Given, H. S. A. Stewart and E. M. Herr.

For the Westinghouse Machine Company—William McConway, W. H. Donner and E. E. Keller.

For the Nernst Lamp Company—W. P. Updegraff.

For the Security Investment Company (a company handling Westinghouse interests)—Fidelity Title and Trust Company.

The Westinghouse Air Brake Company and the Union Switch and Signal Company are not affected.

Of the receivers Mr. Herr is first vice-president of the Electric company, Mr. Keller is vice president of the Machine company, and Mr. Updegraff is Mr. Westinghouse's private secretary. The others are prominent business men. In Chicago Percy B. Eckhart and in New York Charles C. Burlingame were appointed ancillary receivers of the property of the Electric company, and, similarly, ancillary receivers were appointed in other cities.

In speaking of the receiverships a gentleman conversant with the situation said: "There has not been even a momentary pause in operations, and orders are being filled with dispatch. So much confidence is felt in the men appointed as receivers for the several companies affected, that the future success of these interests promises to be as marked as in the past. It is the understanding that no change in the general policy for the conduct of the business is contemplated."

A New York lawyer well versed with the situation said: "There has been no overproduction in electrical appliances. The whole situation has developed out of the money stringency. The company has great difficulty in getting cash, and carries on its books the securities of electric and other corporations which are their customers as security for notes, and during the acute money stringency of recent months they have not been able to realize the amount expected on these loans."

After a meeting of the receivers of the Westinghouse Electric and Manufacturing Company, Chairman T. Hart Given said: "The plants of the big Westinghouse Electric and Manufacturing Company will be kept in full operation. No employes need have any fear of the outcome. Arrangements have been made for continuing the plant."

This interesting statement was issued by Receivers McConway, Donner and Keller for the Westinghouse Machine Company on October 26th:

"We desire to assure the clients of the Westinghouse Machine Company and all others interested that there should be no occasion for apprehension because of the company's application for a receivership.

"This action was deliberately and thoughtfully taken as a sensible and logical measure for conserving the interests of the customers, creditors and stockholders of a solvent institution which is doing a large and profitable trade.

"From such examination of its affairs as the receivers have been able to make in the short time during which they have been in charge of the property it would appear that the Westinghouse Machine Company has been suffering from nothing more serious than a rapidly growing and profitable business. This has necessitated the employment of considerable borrowed capital and credit throughout the country, the sudden withdrawal of which would have seriously interfered with the manufacturing operations of the company.

"There has not been even a momentary pause in the operations of the company, and the personnel remains the same as heretofore. There will be no departure from the general policy that has hitherto obtained in the conduct of the business, and the receivers will, during their incumbency, spare no pains to foster and maintain the cordial relations that have always existed between the Westinghouse Machine Company and its customers."

Finished Track at the Right.

FIG. 4. NEW TRACK CONSTRUCTION ON COTTAGE GROVE AVENUE, CHICAGO

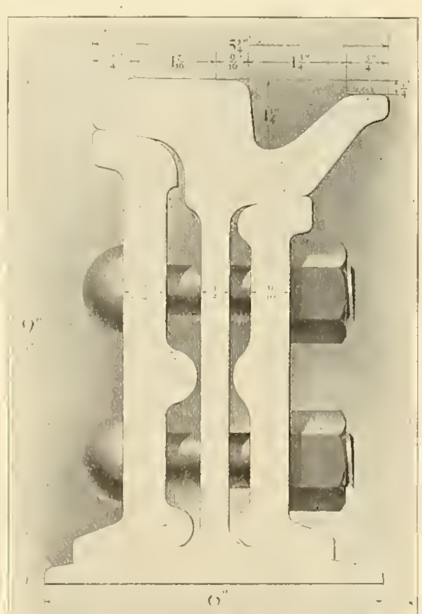


FIG. 5 SECTION OF 129-POUND CHICAGO RAIL.

Missouri Electrical Men Organize.

The Missouri Electric Light Association was organized at a meeting of representatives of lighting and street-railway companies from 25 cities of Missouri on October 21st. The meeting was held at the Marquette Hotel, St. Louis, where the delegates were welcomed by A. J. O'Reilly, president of the Board of Public Improvements. The local electric supply men and the lighting and street-railway companies entertained the delegates and their friends.

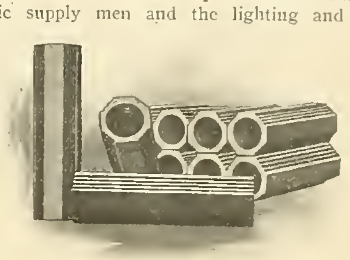


FIG. 6. OCTAGONAL CONDUIT USED IN CHICAGO STREET-RAILWAY REHABILITATION.

Permanent organization of the new association was effected by the election of the following-named officers: President, J. D. Porterfield of Cape Girardeau; first vice-president, W. B. Hayes of Poplar Bluff; second vice-president, W. H. Ledford of Bowling Green; third vice-president, R. Irvine of Marshall; secretary, C. Z. Pierson of St. Charles. The executive committee consists of C. L. Clary of Sikeston, Thomas Fox of Cape Girardeau, and Harry Markham of Brookfield.

The next convention will be held in May, 1908, the place to be named by the executive committee.

Electrodeless Ring Method for Measuring Electrolytic Resistance.

The Physical Review for October contains an article on a new method of "Measurement of Electrolytic Resistance" by W. S. Franklin and L. A. Freudenberger. Difficulties in this class of measurements have heretofore been caused principally by polarization at the electrodes, which gives an apparent resistance different from the true value. To neutralize this polarizing effect alternating currents have usually been used in these measurements. The authors determined, however, to minimize still further electrode troubles by doing away with the electrodes. This was done by putting the solutions into a ring-shaped glass tube which was used as the secondary of a small transformer. A similar transformer with an adjustable resistance as its secondary was constructed. The primaries were connected as adjacent arms of a slide-wire Wheatstone bridge. A 60-cycle 110-volt current was employed and a specially designed alternating-current galvanometer used in balancing. The results obtained on measurements of a number of electrolytes agree quite favorably with those of Kohlrausch and Holborn.

Maintenance and Inspection of Electric-railway Equipment.[1]

Part II.

Air Compressors.

Your committee recommends that air compressors be given a thorough overhauling and test, electrically and mechanically, at intervals not exceeding 50,000 miles and periodical inspection at 1,000-mile intervals.

Miscellaneous Motor Maintenance.

In considering the subject before it, your committee has felt that repairs of troubles to electrical equipment after they have occurred form only a part of its work; another part hardly less important is to consider the prevention of troubles before they occur.

In seeking preventive measures it is well to look into what our troubles really are; analyzing them, tracing cause and if possible devising remedy. The old adage, "No chain is stronger than its weakest link" finds application on many electric railways, the car motor proving to be the weak link in the chain. Neglect of inspection, continuous overloading or gross abuse of equipment on the road will naturally cause motor troubles, but assuming that these conditions are obvious enough on most roads to be kept within reasonable limits, there still remain troubles which warrant study and analysis.

Inasmuch as a large portion of motor troubles occur at the commutator, the estimated causes of commutator troubles, as shown by data sheets in answer to the following question, should be of interest. This was the question: "What proportion of your commutator and brush-holder troubles do you attribute to—

"(a) Fast feeding of controller?
"(b) Quality of brushes?
"(c) Quality of commutator bars?
"(d) Quality of commutator mica?
"(e) Design of characteristics of brush-holders?
"(f) Other causes?"

In a number of replies these figures were omitted, but from figures submitted, representing all parts of the country and nearly 10,000 cars, the averages were taken, each road's figures contributing to the average in proportion to the number of cars owned.

The percentage and relative magnitude of the several causes of trouble at the commutator are shown graphically in Fig. 1.

Referring to Fig. 1, let us follow the principle laid down by Abraham Lincoln, "One thing at a time and the big things first," and consider:

Fast Feeding of Controllers.—This is an evil which, in the opinion of your committee, will always exist so long as the rate of acceleration is dependent upon the judgment and thoughtfulness of the motorman. We recommended, wherever practicable, the use of such automatic devices, operated electrically or otherwise, as will limit to a fixed maximum the amount of current the motor may receive. Much of the fast feeding is done by motormen through thoughtlessness and not realizing its harmful effect upon the equipment. In such cases an educational effort, thorough and persistent, with the assistance and co-operation of the operating department, should be made, and your committee is confident that the resulting benefit will

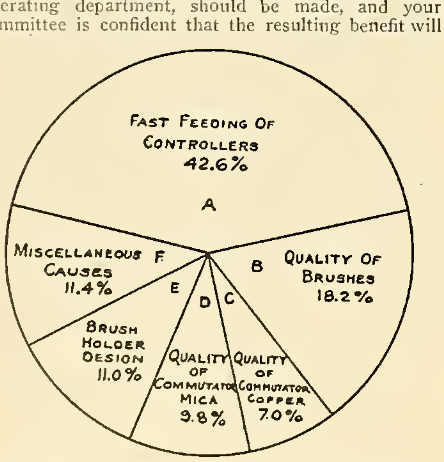


FIG. 1. CAUSES OF COMMUTATOR TROUBLES.

amply repay for the time and trouble expended. For interurban lines particularly there should be determined, experimentally, the distance a car will travel while building up from rest to full parallel, to receive the most rapid acceleration the motors can safely stand. This distance should be fixed as the minimum allowable and its observance insisted upon.

Quality of Brushes.—From data received of trouble experienced with quality of brushes, one road reports no brush trouble whatever, but aside from this one exception, prevalence of brush-holder trouble in some degree appears to have been well-nigh universal.

The widest variety of opinion is expressed describing the qualities of brushes most satisfactory. Regarding hardness, preferences run between soft, medium soft, medium hard and hard. Several replies in regard to hardness favor a brush hard enough to dress down the mica, but at the same time soft enough, or containing graphitic or other lubricant, to maintain a smooth commutator surface. Regarding price, one road uses the cheapest brush, while another holds the best is none too good. Regarding the conductivity of brushes, two roads prefer brushes of high resistance, one calls for a brush of low resistance and one advocates plating of brushes with copper to increase conductivity.

Regarding specifications, few roads have any, and those submitted are of a general character, calling for uniformity of size, evenness of quality, freedom from breaking and crumbling and, in general, that the brush must give satisfactory service.

In a few instances, beveled edges are advocated.

Regarding size of brushes, many replies urge the uniformity of size so that brushes shall be a good fit in the holders, not loose so as to rattle around, nor so tight as to stick.

Regarding treatment of brushes by boiling, a large proportion favor no treatment at all; 21 roads are opposed to boiling brushes in paraffine against seven roads which favor it and two additional which favor boiling if brushes are very hard. Five roads favor boiling in oil, two in vaselne and one in soap.

Test for Brushes.—Most roads have no test other than the test afforded by everyday service, while several suggest breaking the brushes, and the fracture will show the grain of the brush and whether it is homogeneous and free from lamination and hard specks to irritate the commutator.

Brushes in General.—Replies indicate the quality of brushes has caused a troublesome, and in some cases a serious, problem of maintenance, and that the problem is of sufficient magnitude to warrant

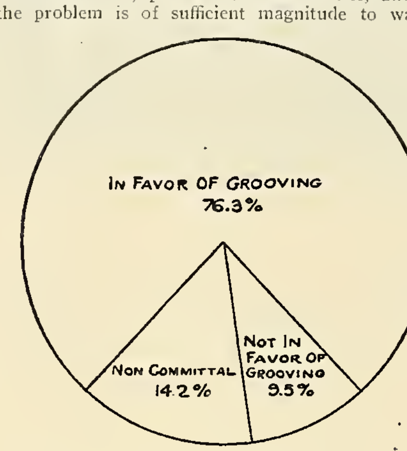


FIG. 2. OPINIONS AS TO GROOVING COMMUTATOR MICA.

careful investigation and study. Your committee feels very strongly that sufficient attention has not been given by operating men or brush manufacturers to obtaining brushes suitable to the various types of motors and conditions of operation, and it recommends that the further consideration of the association be given the subject either at the hands of a special committee, or that specialists of the manufacturing plants or research laboratories be invited to contribute papers throwing light on the only partially understood details of brush practice, pointing the way to the best and most intelligent methods.

Miscellaneous Causes.—Under this head, troubles reported form, in the aggregate, quite a feature of the total of bad results at the commutator, but no one item is pre-eminent. The troubles largely arise from local conditions of equipment and service.

The various items have been enumerated as follows:

Broken springs.
Loose holders or yokes.
Weak fields.
Reversing.
Wrong setting of brushes.
Insulation of commutator core.
Electric brakes.
Carbonized string bands.

Brush-holder design is a subject which your committee suggests receive the careful attention of each individual member, and errors of design or workmanship which may have escaped the attention of the manufacturer through their not having been brought to his notice by the user may be brought out and corrected. Improvements in electric machinery have been frequently made at the suggestion of the user, who has constant opportunity to observe its behavior in everyday service, and the progressive manufacturer is always glad to receive intelligent criticism from "the man behind the gun."

Quality of commutator mica is one of the causes which is very generally assigned for unsatisfactory results at the commutator. Interesting evidence of this is found in answer to question, "Do you consider grooving mica below the surface of the commutator effective in improving commutation?" Expressions from 33 roads, representing 13,810 cars, are as follows:

In favor of grooving mica, 23 roads, or 76.3 per cent of cars.

Not in favor of grooving, seven roads, or 9.5 per cent. of cars.

Non-committal, three roads, or 14.2 per cent. of cars.

These answers are represented graphically in Fig. 2.

One reply to question No. 8 is as follows: "Yes,

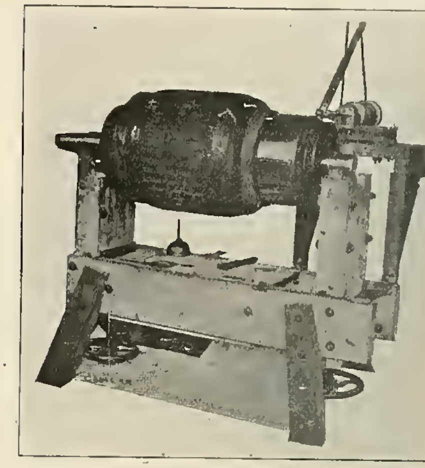


FIG. 3. COMMUTATOR-GROOVING DEVICE.

if using soft brushes of hard mica. Would do this more if it were easier to do." Those who approve of grooving and are prevented by lack of convenient facilities might look with favor upon a home-made device built at small expense along such lines as shown in the photographs, Figs. 3 and 4.

The apparatus consists of a substantial oak armature stand with V-blocks to take the end of the armature shaft. The V-block at the commutator end is adjustable vertically by a screw attached to handwheel shown beneath. The V-block at the pinion end can be adjusted laterally as well as vertically.

At the commutator end is a shelf on which are two slides carrying the boxes of a buzz-saw shaft. The saw is 1.25 inches in diameter, .02 inch thick, and is driven at about 1,000 revolutions per minute. The saw is fed the length of the commutator by means of a hand lever shown. On the opposite end of the shaft from the saw is a flywheel. It takes about five minutes to set the work and 25 minutes to groove a 75-horsepower railway armature of 117 segments, making a uniformly creditable job of the grooving. The principle of grooving mica appears to your committee to be correct, and in some cases more urgent than others, and it recommends that in cases of high mica or troublesome commutation a trial of grooving mica be made.

Motor Lubrication.—Reports from 34 roads show 29 lubricating on a time basis; three on a mileage basis, and two on a combination of the two methods. Of the 29 roads lubricating on the time basis, the figures are not in all cases complete or definite, but as nearly as may be determined the periods between lubrication are shown in Fig. 5.

Lubrication of Armature and Motor Axle Bearings.—One of the most important movements of recent years in railway-motor design has been the change from the old grease cup to the waste-packed chamber for lubricating motor and axle bearings. The replies received seem to indicate that all roads have not taken full advantage of this improvement, from the fact that a number of roads oil armature and axle bearings every night regardless of the fact that waste lubrication enables the period of lubrication to be extended from three to seven days with perfect safety and with a saving of both labor and lubricant. That in most cases the old design of motors required armature bearings to be oiled every night admits of but little argument, but your committee would urge that a sharp distinction be drawn between the types of lubrication, that the old-type motor be oiled every night or on a corresponding mileage basis, but that the modern motor be not oiled every night merely from force of habit, but that the period be lengthened to as great an extent as true economy and the proper lubrication of the bearing will permit. For this period 1,000 miles is recommended for a fair average.

Other Matters.

Truck Journal Lubrication.—For the interval between truck-journal lubrications most replies concentrate at the weekly and 30-day periods, both of which appeal to your committee as good practice; the weekly period for interurban and the 30-day period for city cars, or corresponding periods on the mileage basis.

Motor Gearing.—Your committee would recommend inspection of gears and pinions, each 1,000

1. This is a report presented to the American Street and Interurban Railway Engineering Association at Atlantic City, October 11, 1907, by a committee consisting of J. Lindall, chairman; W. D. Wright, E. T. Munger and L. . Smith.

miles, supplying lubricant if needed, believing that a small quantity of gear grease applied frequently will insure a better economy of lubricant than heavy doses administered at long intervals.

Your committee would call attention to the higher duty required of pinion material on the larger sizes of motors, as, for instance, a 40-horsepower motor pinion has a five-inch face while a 200-horsepower motor pinion has but 5.25-inch face. It is, therefore, of vital importance that consideration be given to pinion material being of quality suitable for the higher duty.

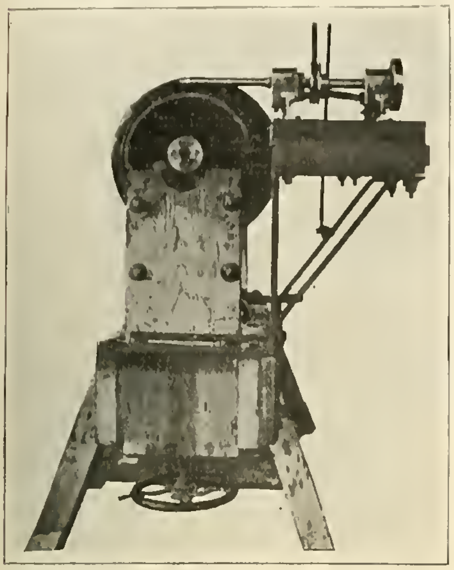


FIG. 4. COMMUTATOR GROOVING DEVICE.—ANOTHER VIEW.

Mileage versus Time Basis Governing Inspection.—Of 33 roads submitting data, three are governed strictly by a mileage basis, two used a combined time and mileage, while the rest are governed by time only. There seems to be a growing tendency, however, to give importance to the mileage element, and most roads keep a strict mileage record so that the mileage of any car can be readily arrived at between any two dates.

Your committee regards the miles run as a more rational measure of wear and tear on equipment requiring inspection than hours or days, and that the mileage sheet in the files is a more reliable guide than the calendar on the wall. Your committee recommends that the tendency to give weight to mileage rather than to elapsed time be maintained, and where consistent carried to its logical conclusion, viz., the mileage basis to the exclusion of the time basis.

The method of obtaining mileage is substantially uniform on the various roads. The individual mileage for each car is furnished daily from the transportation department, usually through the auditor's office, and is then transferred in the mechanical department to books, tables or charts and the total miles run from the first of the month, or first of the year, posted daily, so that to obtain the mileage between any two dates becomes merely a matter of subtraction.

The intervals between motor overhauling vary as widely as do the equipments and condition of service. Seven roads have no stated time, while from the rest the general average for interurban cars is six months; for city cars, one year.

Rules for inspection on a number of roads have been outlined on the data sheets. There is a general tendency in inspection to adopt the wise practice of specialization. The work is divided up and each man is assigned and made responsible for a certain part of the work on all cars coming under his care. For example, one man is responsible for the oiling; one man for brushes and brush holders, and one man and helper for brake shoes and rigging, etc. Your committee would recommend this practice and would have inspection report forms printed where the inspectors sign for each car inspected, and thus place themselves on record. In all cases records should be such as to enable the responsibility to be definitely placed and indicate when inspection and repairs were made.

CONCLUSION.

It has been our aim in the foregoing report to avoid exploiting the individual views of members of the committee, and instead, if possible, to make the report as based on the data sheets a composite of the best judgment of the railways of the association taken as a whole. We regret that many of the roads belonging to the association have failed to send in data sheets. However, a large number has been received, forming a representative and valuable showing, and your committee wishes to thank those members for their co-operation in furnishing the data and for the careful and painstaking manner in which it has been prepared.

Your committee desires to acknowledge and express its appreciation of the valuable assistance rendered by Messrs. E. H. Anderson of the General Electric Company and J. L. Davis of the Westinghouse Electric and Manufacturing Company in giving the benefit of their judgment and experience in the preparation of this report.

A New Resistance Coil.

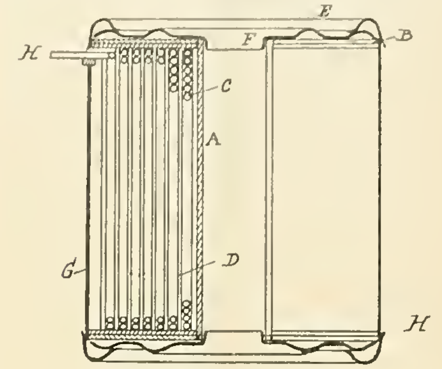
A new method of constructing resistance coils has been patented in France by Alexander Vosmayer of Holland, and the following particulars are furnished by the Paris correspondent of the Western Electrician. It applies to different types of resistance coils for commercial use, such as field or motor-starting resistances. Some advantages are asserted for the new process. One of these is the use of iron or steel wire, manganese steel, etc., or any other suitable wire. The accompanying diagram shows the manner of building the resistance coils, according to the patent specification. An advantage to be remarked also is that the method allows of winding the wire upon a convenient form of spool, as in the case of a solenoid, and each layer is separated from the adjoining one by a layer of asbestos or other incombustible material. Bare wire is used here, and the layer, instead of being wound as usual with the turns spaced apart, has all the turns pressed together to form a solid mass.

It is not necessary to provide means for cooling the resistance, as the manner of construction allows it to be operated at a high heat. For field resistances it is preferable to use a material for the wire which has a low value for the temperature coefficient, such as the alloy known as constantin. In the case of motor-starting resistances, steel wire can be used to advantage, and for balancing resistances for circuits the wire may be of smaller gauge and the current density is higher.

Referring to the diagram, (A) is a tube which serves as the base of the spool, and upon the ends of the tube are fitted two disks (B) of iron or other metal. Upon the spool which is thus formed is wound the wire (C), and a winding of seven layers is shown. Between each of the layers is wrapped a layer of asbestos (D) of the proper thickness. The whole is held together in a solid form by means of the two end pieces (E) and (F), which are preferably made of stamped sheet iron.

Around the spool is placed an outer sheet iron tube (G), which protects the winding. In the tube are two openings for bringing out the terminal wires of the winding (H), which are properly insulated from the metal. If desired, the wires can be made to pass out through the iron end plates of the spool.

To build a resistance of this kind in practice, a sheet of asbestos is first laid upon the tube of the spool and suitable washers of the same material are placed inside the end flanges. Bare wire is then wound on the asbestos, with the turns well



A NEW RESISTANCE COIL.

pressed together on the tube. Upon the layer of wire is placed a layer of asbestos, and so on, until the outer layer is wound. A final asbestos sheet is put around the outside layer of wire. Then the end caps (E) (F) are put in place, and also the outer tube (G), bringing out the two ends of the wire. Such a resistance can be used singly or combined in a number of units. It can also be wound so as to be non-inductive, for alternating currents. The principle of the resistance is that the current passes through the wire of the coil, and not, as might be expected, from one turn to another, even though the metal is placed directly in contact. This is due to the fact that the resistance due to the contact of two turns is much higher than that of the corresponding length of wire for one turn. Moreover, the voltage, which is determined by the product of the current by the resistance between two adjacent turns, is not sufficient to allow any appreciable current, as has been found by experiments on this form of winding. As the wire does not need to be cooled, the construction is a simple one and is quite cheap. All the space is utilized, which makes a small coil for a predetermined resistance, and it is found that the heat which is reached in this case has no bad effect upon the coil. As to the temperature at which such a coil can be conveniently worked in practice, it is found to be from 200 to 250° C.

TABLE SHOWING PERIOD BETWEEN TIMES OF LUBRICATION OF 29 ROADS

		DAILY	2 DAYS	3 DAYS	4 DAYS	5 DAYS	WEEKLY	10 DAYS	2 WEEKS	3 WEEKS	MONTHLY	6 WEEKS	2 MO.	3 MO.
A ARMATURE BEARINGS	OLD TYPE MOTORS	•••••••												
	MODERN TYPE MOTORS		•	••••		•	•••							
	OLD & NEW WITHOUT DISTINCTION	••••••••••••••	••	••										
B MOTOR AXLE BEARINGS	OLD TYPE MOTORS	••••												
	MODERN TYPE MOTORS		•	••		•	••				•			
	OLD & NEW WITHOUT DISTINCTION	•••••••••••	•	•	•		••							
C TRUCK JOURNAL BEARINGS		••••		•			••••••••••		••••		•••••••••••		•	
D AIR COMPRESSORS		•		•			•••••••	••	•••	•	••••			
E MOTOR GEARS							•••••• ※	•	••••		••••••	••	•	••

NOTE: EACH "DOT" REPRESENTS THE PRACTICE OF ONE ROAD.

※ INSPECT EVERY WEEK. LUBRICATE WHEN NECESSARY

FIG. 5. TABLE SHOWING PERIODS BETWEEN LUBRICATION.

Theft of Current in Boston.

The janitor of an apartment house in Boston was recently found guilty of stealing electricity and fined $25. His case came up in the Criminal Court and was interesting to electrical men. The plaintiff was the Edison Electric Illuminating Company, whose agent explained to the court how the defendant, by the use of a short wire, formed a connection between the circuit in the building on Batavia Street and had light where the company's power was supposed to be disconnected. It was not until much effort had been made and a well-laid trap sprung that the janitor was caught, and then he did his best to disconnect his wire before the inspectors had him. He admitted the theft of electric fluid, but said he thought the wires were those of a telephone company, and asserted that he was only doing a bit of experimenting.

Tungsten Lamps in Detroit.

General Manager Freshney of the Board of Public Works of Detroit, Mich., has decided to set aside Jefferson Avenue from Fulton Street to Wealthy Avenue for the demonstration of the new tungsten lights to be made by the Grand Rapids-Muskegon Power Company. This will be the resident street celebration, and the company is planning to also set its lamps on Canal Street in connection with the Business Men's Association of that street.

On Jefferson Avenue 60-candlepower lights will be used and they will be suspended on poles near the curbs at a distance of 200 feet apart. They will, however, be located at this distance alternately on the different sides of the street. They will be operated by current from the Croton dam.

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CORRESPONDENCE relating to electricity or any of its practical applications is cordially invited, and the co-operation of all electrical thinkers and workers earnestly desired. Clear, concise, well written articles are especially welcome; and communications, views, news items, local newspaper clippings, or any information likely to interest electricians, will be thankfully received and cheerfully acknowledged.

REMITTANCES.—All checks, drafts and other remittances should be made payable to the order of the publishers, the **Electrician Publishing Company**, and addressed to the offices of publication, Suite 507, Marquette Building (204 Dearborn Street), Chicago, Illinois, U. S. A.

CONTENTS OF THIS NUMBER.

DEPARTMENTS.

ELECTRIC CARS for city use with 400 horsepower in motors on the trucks will be of remarkably high power for cars of this description. Yet Mr. John I. Beggs said at the Atlantic City convention that cars of this type are being seriously considered in Milwaukee. Evidently such a car will have no trouble in hauling one trailer or possibly more than one in addition to a large passenger load of its own. That such powerful motor cars are under consideration shows the extent to which the electric street car has been developed since its introduction twenty years ago.

WE ARE INFORMED that radio-telephone outfits have been installed on the U. S. S. Connecticut and Virginia and that these battleships are the first vessels in the world to carry the wireless telephone. Voice communication by "wireless" is said to have been carried on successfully across a distance of 11 miles, while in one instance 25 miles was covered. No doubt the apparatus (which is the invention of Dr. De Forest) has not finally passed beyond the experimental stage, but its possibilities are nevertheless most interesting. In fleet maneuvers smoke sometimes interferes with flag signaling, and it would be a delightful thing to receive and transmit orders by telephone between ships under way and separated by several miles of water. In the Pacific cruise of Admiral Evans' fleet, now near at hand, several of the warships will have wireless-telephone outfits, and a report of the performance of this new apparatus under service conditions will be awaited with much interest.

THE REPORT of the Western Union Telegraph Company for the year ended June 30, 1907, recently submitted to the stockholders shows a greater increase in expenses than in revenues. There was also some increase in bond interest. Consequently, although the amount appropriated for dividends was the same, the surplus decreased from $874,519 for 1906 to $36,053 for 1907. However, as the book surplus of the company stands at nearly $17,000,000, this is not, perhaps, a very serious matter. Another interesting fact is that the average toll per message was higher in 1907 than in any year since 1884, while the average cost to the company of the message was higher than in any year since 1866, so far as the company's table of statistics shows. In 1907 the average toll per message was 33.7 cents and in 1906 31.6 cents. But in 1907 the average cost of the message was 30.2 cents and in 1906 the corresponding cost was but 27.6 cents. Thus while rates have been increased the expense of doing the business has increased in greater proportion. Part of this increased expense was due to a raise in operators' wages of 10 per cent., which went into effect on March 1, 1907. The report seems to justify the company's opposition to the granting of a second increase of wages this year, upon which the strike of operators, begun last summer and now apparently on its last legs, was largely based.

IT IS GRATIFYING to observe that manufactures are forming a larger share of the exports of the United States than ever before. They formed practically 44 per cent. of the exports during the nine months ended with September, 1907, while they had never but once reached 40 per cent. in any fiscal year covered by the records of our export trade. Manufactures formed in the fiscal year 1880 14.78 per cent. of the exports of domestic products; in 1890, 21.18 per cent.; in 1900, 35.3 per cent.; in the fiscal year 1907, 39.94 per cent., and in the nine months ended with September, 43.83 per cent. of the total exports of domestic products. These figures are compiled by the Bureau of Statistics of the Department of Commerce. A further fact of interest is that the United States exported manufactures ready for consumption to the extent of $377,500,000 for the nine months ended with September, 1907, and imported goods of the same class to the value of $287,230,000 during the same period. These statistics may surprise those who think the big figures of our export trade are altogether those of foodstuffs and raw materials. It is pleasing to reflect, also, that nowadays electrical machinery and appliances form a respectable proportion of the exports of manufactures.

THAT FAMILIAR subject of discussion, the electrification of the suburban service of the Illinois Central Railroad in Chicago, is brought to attention again by an interesting article in the Chicago Record-Herald of October 27th from the pen of the veteran correspondent, William E. Curtis. Mr. Curtis asked Mr. Harriman whether it was practicable to operate the Illinois Central suburban trains by electricity, and was referred, it seems, to John F. Wallace, formerly general manager of the Illinois Central, later of Panama Canal fame and now president of "a very important corporation which controls large electric plants in different parts of the country and is constructing others." Mr. Wallace accorded the journalist an interesting interview.

It was explained to Mr. Curtis that the chief reason for delay was the financial one—the difficulty of procuring the necessary funds, which might amount to $10,000,000. Another reason given as almost equally important was the wisdom of awaiting the test of experience in New York as between the single-phase, high-tension, overhead-construction system compared with the direct-current, comparatively low-tension, third-rail system. As is well known, the former is being tried out by the New York, New Haven and Hartford and the latter by the New York Central Railroad. The subject has been under study by the Illinois Central administration since 1891. "While it was desirable, on account of smoke and convenience, we were never satisfied that the Illinois Central could adopt electricity as a motive power with economy. The expense of operation was so much greater than by steam that it would be necessary to increase fares in order to cover the loss. The commission also recognized that the reliability of electricity was not yet assured." And Mr. Wallace adds:

"Electricity is adapted to the movement of small, light, frequent units of transportation like street cars. Steam is better adapted to the movement of heavy units of transportation over long distances at infrequent intervals; but electricity is continually extending its adaptability and encroaching upon steam. The most important example of this encroachment may be found in the recent installation by the New York Central and New Haven companies. But thus far their service is not complete; they are substituting electric for steam trains gradually, and the changes are made not so much for commercial advantages as to satisfy public clamor and obey the will of the Legislature."

Mr. Wallace concluded by saying that the Illinois Central suburban service is probably the greatest in the world. It has always been the intention to change from steam to electricity as soon as conditions would justify it.

Of course everybody knows that at all times a great problem in steam-railroad electrification has been the financial one. Will it pay? We believe that it has been demonstrated, in a general way, that the cost of operation is about equal with the two systems. There is no great preponderance of economy in favor of steam locomotives to be assumed at the outset in every case. Often careful estimates will show an advantage in favor of the electric system. Each case must be studied by itself. And again, Is it worth nothing to please the patrons of the road? If there were a "public clamor" in Chicago, such as Mr. Wallace speaks of in New York, no doubt the electrification would be speedily under way. Why delay accepting the inevitable to the very last possible moment and so continue the smoke and cinder and noise nuisance until the people are provoked to the last degree of exasperaton? We believe that either of the electric systems of which Mr. Wallace speaks is "reliable" enough, if properly installed, to meet every demand of the most exacting suburban service. The Illinois Central Railroad will do well to adopt the system which it is admitted passengers prefer before it is forced to do so by the pressure of public opinion, expressed, perhaps, in legislative enactment.

Death of Leroy B. Firman.

Leroy B. Firman, prominent twenty-five years ago in Chicago as the founder of the American District Telegraph Company and the Edison telephone exchange, died this week at the home of his daughter, Mrs. S. B. Slosson, Anaconda, Mont., aged 70 years.

His early work was as a telegraph operator on the Illinois Central Railroad line, and as operator and manager in the service of the Illinois and Mississippi Telegraph Company, which was owned or controlled by Judge Caton. It was at a time when the operator must not only send and receive the messages, but was expected on occasion to climb poles, and renew the batteries, buying the blue vitriol, it might be, at the nearest drug store. Judge Caton put a stop to this extravagant way of buying supplies. It was through the work of men like Mr. Firman that Judge Caton was able to give his company such a firm hold upon the business that the Western Union Telegraph Company took over Judge Caton's company on a perpetual lease of $50,000 a year, which established the fortune of the Caton family.

Mr. Firman came to Chicago in the '60's, when he was made chief operator of the city fire-alarm telegraph, of which service John P. Barrett was then chief. Mr. Firman established the Gamewell system of fire-alarm and the police-patrol call in Chicago. The American District Telegraph Company, established in Chicago in 1872, was conceived and placed in operation by Mr. Firman. The Field and Firman American District eleven call box was well known at that time. Three patents were granted him relating to this system of calls.

It was about this time that he became associated with General Anson Stager, prominent as an official of the Western Union Telegraph Company, who had recently moved to Chicago from Cleveland. General Stager was interested in whatever was electrical, and generously supported Mr. Firman in his management of the American District Telegraph Company, the business of which was to furnish messenger service, fire-alarm and police service and also telephone service after the invention of the telephone.

Mr. Firman was one of the organizers of the American Private Line Telegraph Company and was its superintendent and manager. This company furnished printing telegraph lines and instruments for a part of the service now rendered by telephone lines. Gray's printer, invented by Elisha Gray and manufactured in Chicago, had its first use on the line equipped by Mr. Firman's company; and when the telephone came out later, its first use was on these and similar private lines. This was before the telephone exchange with a central office to connect various lines together had begun to be a feature of the telephone business.

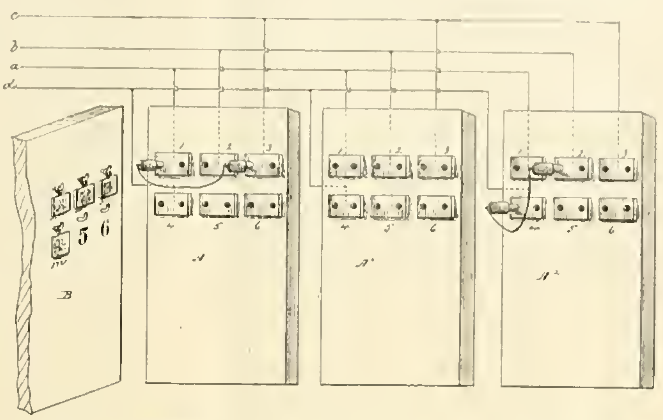
In the summer of 1878 the telephone exchange was installed at 118 La Salle Street by Mr. Firman as an adjunct to the American District system, of which he had been manager for some years. American District boxes scattered throughout the city, and their circuits leading to this central office, were made use of for receiving calls and signals to disconnect from subscribers. After a call was received over the American District wire, telephone connection was established with the subscriber calling, the order given, and then the switching was performed. It was in the development of this system that Mr. Firman made three important telephone-exchange inventions. One invention related to the arrangement of the call-annunciators of the switchboard. Another was upon the system of telephone exchange which was subsequently installed in New York, Philadelphia and St. Louis, and known as the Law system, the name being applied because it was first used in New York for the convenience of lawyers. This included a separate order wire, in addition to the regular telephone lines, and it was in every way successful.

Mr. Firman's fame in the telephone world is, however, based principally upon his multiple-switchboard invention. He was unquestionably the first in this field. The invention was developed at the La Salle Street office in the latter part of 1878, and was in actual commercial service in February, 1879 The claim of his patent lies at the foundation of the multiple-switchboard art The claim, which was sustained by the court, reads as follows:

"1. The combination of two or more switchboards at the central station of a telephone exchange system, to each of which the same telephone lines are connected, whereby any two of these lines may be connected together upon either of the multiple switchboards."

In his patent specification is the following: "I find by the use of my system of multiple switchboards, as hereinafter described, an exchange of a thousand or more subscribers may be successfully handled."

This was thought at the time to be rather a strong statement, he little dreaming that before his patent should expire 10,000 and more subscribers would be successfully handled upon a multiple switchboard, all in the same exchange, as has been done, nor did he think that before his death one hundred million dollars or more would be expended in the purchase of such switchboards.



FIRMAN'S ORIGINAL MULTIPLE-SWITCHBOARD TELEPHONE PATENT.

Herewith is the drawing of the Firman multiple-switchboard patent. The board (B), called a dummy-board, was not long used. It was provided with numbers corresponding to the numbers of the switch-plates of the different sections of the duplicate parts of the multiple boards, and when two lines were connected on one of the boards, targets were hung over the corresponding numbers of the dummy-board as a busy signal. In the diagram the board (A), (A′), (A²), it will be seen, are duplicates, one of the other, and each is provided with a separate terminal for each telephone line (a), (b), (c), (d).

About fifteen years ago Mr. Firman went to Fullerton, Kan., where he enjoyed life on a farm with his young people.

Exhibition Committee for National Electric-light Convention.

As readers of the Western Electrician will remember, steps were taken at the convention of the National Electric Light Association in Washington, last June, with the co-operation of the officers of the association, to place the annual exhibition in the hands of a committee of class D members, that is, member companies engaged in manufacturing and selling apparatus. A committee of three was appointed, after temporary organization had been effected, to nominate the proposed exhibition committee. This nominating committee consisted of George F. Porter, Atlantic Insulated Wire Company, New York; T. G. Whaling, Westinghouse Lamp Company, and Alex. Henderson, American Circular Loom Company. It has now reported, submitting the following exhibition committee:

F. H. Gale, General Electric Company, Schenectady.

J. C. McQuiston, Westinghouse Companies, Pittsburg.

W. S. Heger, Allis-Chalmers Company, Milwaukee.

Rodman Gilder, Crocker-Wheeler Company, Ampere, N. J.

H. M. Post, Western Electric Company, Chicago.

C. P. Frey, Weston Electrical Instrument Company, Newark, N. J.

Benjamin Wall, Metropolitan Engineering Company, New York.

James I. Ayer, Simplex Electric Heating Company, Cambridge, Mass.

S. E. Doane, National Electric Lamp Association, Cleveland.

No doubt the gentlemen named will be elected by vote of the class D members and serve as the exhibition committee of the next national electric-light convention.

Western Association of Electrical Inspectors.

The third annual meeting of the Western Association of Electrical Inspectors was held at Hotel Ryan, St Paul, Minn., October 22, 23 and 24, 1907 Thirty members were present, including 14 municipal inspectors.

Special committee reports were submitted and discussed from the committees on National Electrical Code outside wiring, theater wiring and show equipment, show window and display lighting, instructions to the public concerning the safe operation of electrical wiring and apparatus, wiring for electric cranes, laws and ordinances, and architects' specifications.

Addresses were delivered as follows: "Approved Electrical Fittings," by Dana Pierce, electrical engineer, Underwriters' Laboratories, Chicago; "Joint Construction Pole Line," by H. B. Gear, general inspector, Commonwealth Electric Company, Chicago; "Electrical Inspection from the Viewpoint of the Central Station," by A. G. Munson, assistant superintendent, St. Paul Gas and Electric Company, St. Paul, Minn.; "Electrical Inspection from the Viewpoint of the Telephone Exchange," by C. M. Manseau, general manager, Northwestern Telephone Exchange Company, Minneapolis, Minn.; "Flexible Cord for Pendants," by H. T. Wreaks, secretary, Wire Inspection Bureau, New York.

Of 73 proposed changes in the National Electrical Code 24 were approved and 13 were referred back to the committee for further consideration, with instructions to report back to the executive committee with power to act.

Tours of inspection were made to electrical installations, including the underground system of tunnels operated by the St. Paul Gas and Electric Company, conduit installation in reinforced concrete building, open wiring in can manufacturig plant, theater wiring equipment in two houses—one new and up-to-date, the other old.

Waldemar Michaelsen, city electrician of Omaha, Neb., exhibited a number of fittings and materials used in electrical construction work in Berlin, Germany. In most instances they suffer by comparison with those bearing underwriters' approval in the United States. Underground systems in vogue in Europe seem to be largely of the fixed-conductor type, comparatively few pull-in systems being employed.

Officers were elected for the ensuing year as follows:

President, E. R. Townsend, Chicago; first vice-president, George D. Bayle, Chicago; second vice-president, H. C. Harris, Columbus, Ohio; secretary and treasurer, W. S. Boyd, Chicago; executive committee, Fred G. Dustin, Minneapolis; George D. Bayle, Chicago; F. R. Daniel, Indianapolis; H. C. Harris, Columbus, Ohio; Waldemar Michaelsen, Omaha; J. H. Montgomery, Detroit; W. C. Stewart, St. Joseph, Mo.; E. R. Townsend, Chicago; F. D. Varnam, St. Paul.

The next meeting will be held in Chicago in October, 1908.

Coming Chicago Electrical Show.

Space for the third annual electrical show to be held in Chicago, January 13-25, 1908, is being eagerly sought by all lines of electrical manufacturers. The management announces that more than two-thirds of the available space has already been taken, and by reason of the unusually enthusiastic interest that has already been shown in this annual affair, the largest and most striking show ever held is assured. A feature of this year's show that will make it attractive is the scheme of booth construction, decoration and decorative lighting that has been arranged for. D. H. Burnham & Co., the well-known architects, have been engaged to design the entire installation and have planned it on a grand scale, in keeping with the high character of the exhibits, giving them a setting that will greatly enhance their value and effectiveness. This is a radical departure from previous shows, and will be appreciated by exhibitors, who will be relieved of a great deal of work, worry and expense incidental to the preparation for their exhibits in previous shows. All booths, railings, signs, wiring, etc., will be installed by the Exposition company.

Annual Meeting of the "Mechanicals."

The fifty-fourth annual meeting of the American Society of Mechanical Engineers will be held in the Engineers' Building at 29 West Thirty-ninth Street, New York, December 3-6, 1907. Symposiums on foundry practice, giving the experiences of prominent men in that work, have been arranged. The specific heat of superheated steam will be taken up; a very important and exhaustive work by a professor of engineering at Cornell will be presented. The utilization of low-grade fuels in gas producers, combustion control in gas engines, tests of producer gas engines, etc., will be given a session. Other live topics such as industrial education, power transmission by friction driving, cylinder port velocities, etc., will be discussed. The committee in charge is planning an excursion for Wednesday afternoon and an address in the evening, which will be especially enjoyable.

Annual Report of Allis-Chalmers Company.

Among the large industrial corporations of the country which the recent financial crisis did not affect adversely, Allis-Chalmers Company of Milwaukee is especially prominent, for the reason that its name has previously been coupled with various sinister rumors circulated largely for speculative effect. And the fact that it stands unshaken, despite the tremendous load of orders being executed in its shops and the necessity for large current funds which such a condition of prosperity inevitably entails, may be attributed in no uncertain manner to the wise foresight of its present management, which, perceiving the trend of events, made provision for it far enough in advance to effectually safeguard the company's interests.

The annual meeting of the stockholders, held in Jersey City on October 24th, at which the policy of President W. H. Whiteside was fully indorsed, brought to light the present strong position of this company, not only with reference to work actually completed or on order, but also from the standpoint of close alliances with many of the most powerful financial interests on this side of the Atlantic.

Among the present directors are Judge Elbert H. Gary, chairman of the board of directors, United States Steel Corporation, who is also chairman of Allis-Chalmers Company's board of directors; Charles MacVeagh, Edmund C. Converse and Alexander F. Banks of the United States Steel Corporation, the former being general counsel, and the others directors of that corporation, and also prominent in leading financial institutions of New York and Chicago; Cornelius Vanderbilt, whose name stands for the vast properties controlled by his family; William V. Kelley, president of the American Steel Foundries; Herman Falk, president of the Falk Company, Milwaukee; Edward D. Adams and William A. Read, well-known eastern capitalists; George Bullock and Joseph Neave, who control important business interests of New York and Cincinnati; Mark T. Cox, who, as a banker, has long been identified with leading industrial and railroad properties of the Central and New England States; Max Pam, a prominent attorney and financier of Chicago; Charles Allis of Milwaukee, and Lahman F. Bower and Henry Woodland, vice-presidents of the company, who, with President Whiteside, also a director, represent the company's home interests.

Walter H. Whiteside was unanimously re-elected president, thus insuring a continuation of the business-like policy which has characterized the operations of the company since he became its executive head. In the future President Whiteside, with Chairman Gary, will be in full charge of the affairs of the company, and its business will be continued along lines already laid down by them.

Reports made at the meeting show that the net profits in April were more than \$37,000; for May \$69,000, and for June \$93,000, with a total during the quarter from April 1st to July 1st of more than \$200,000. The company netted \$81,000 in July, \$101,000 in August, and \$106,000 in September. The profits for the half year netted nearly \$500,000. The company's orders on its books total more than \$15,000,000, and the business continues good.

These figures show steady and substantial improvement since April, 1907, at which time the company first began to receive benefits from the newly developed lines of machinery built in its enlarged West Allis plant, provided therefor, the net earnings in excess of all fixed charges for that period having been \$489,267.86.

The detailed quarterly reports are as follows:

For Quarter Ended June 30, 1907.

	April.	May.	June.	Total.
Gross profit...	\$228,660.31	\$268,892.81	\$282,724.06	\$780,277.18
Less general and selling expenses, interest on bonds, etc.	191,261.09	199,474.69	189,183.43	579,919.21
Net profit..	\$ 37,399.22	\$ 69,418.12	\$ 93,540.63	\$200,357.97

For Quarter Ended September 30, 1907.

	July.	August.	September.	Total.
Gross profit..	\$270,451.39	\$289,745.30	\$292,639.80	\$852,836.49
Less general and selling expenses, interest on bonds, etc...	189,449.62	188,045.07	186,431.91	563,926.60
Net profit...	\$ 81,001.77	\$101,700.23	\$106,207.89	\$288,909.89

From the foregoing it will be seen that profits have nearly tripled in the short space of six months, notwithstanding the fact that conditions during the last year have been generally unfavorable, due to a combination of circumstances beyond the company's control, including the general strike of molders throughout the country; the failure of contractors to complete buildings on time; the delayed delivery of equipment for the new shops, and the large expense contingent upon the organization of the new plant and necessary development of new lines of manufacture. On the other hand, such improvements in methods have been effected that, with a large increase in the number of workmen, being more than 38 per cent. for the year, the rate of production per employe per annum is now over \$2,000.

Beginning with the last quarter of the year, most of the adverse conditions were overcome, and the company entered an era of increasing net earnings, which have steadily continued. This important result, with the before-mentioned development and growth, the eminent position of the company in many lines, and the large volume of orders on hand, aggregating over \$15,478,000 on June 30, 1907, is evidence of future prosperity.

President Whiteside's Report.

Following are extracts from the annual report by President Whiteside to the stockholders of the company:

"During the past year much attention has been devoted to systematizing the work of the engineering department, improving and simplifying standard designs, thereby reducing cost of production and installation without impairing efficiency or sacrificing quality; perfecting new designs, which has greatly taxed our facilities for several years, as indicated in previous reports, and at the same time effecting economies and that close co-operation with the other departments so necessary to a proper conduct of the business.

"Development work in our several new lines of machinery, namely, gas engines, hydraulic turbines, steam turbines, turbo-generators, induction motors, transformers, etc., has been carried to practical completion, and has been extraordinarily large because of the wide range in the standard sizes and types adopted. The uniformly successful results that have been attained in practical operation, and demonstrated by various tests, are gratifying in the extreme, and it may be safely stated that the accomplishments of the past year mark an important step in advancing the engineering reputation of the company and strengthening its position in the trade.

"In order to protect our new and important designs in machinery and auxiliary devices, numerous applications have been made for letters patent covering many novel yet valuable features. A larger number of patents than ever before has been issued to the company, and healthy activity in this direction is manifest throughout the entire engineering organization.

"The past year has been marked by a very considerable increase in the sale of the products of the electrical and steam-turbine departments, in connection with the sale of our other products to regular as well as to many new customers. Thus we have introduced our electrical apparatus and steam turbines where other types were used exclusively.

Steam Turbines.

"Probably the most important work which has been brought to a commercial consummation has been in the development of our steam-turbine units, the unique features of which are fully protected by various patents owned by the company. In 1903 we designed and built our first turbo-generator, and its detail has required no material change—a strong testimony to the scientific accuracy of the principles first adopted. It is asserted with confidence that our turbo-generators are the best designed and most efficient machines on the American market. Sizes ranging from 500 to 7,500 kilowatts have been completed and tested, and the success of these units under actual operating conditions is thoroughly established.

"Notwithstanding our recent advent into this field, our sales of steam turbines have already reached nearly 100,000 kilowatts normal capacity, and, compared with the previous year, show in orders booked an increase of \$800,000.

Gas Engines.

"In this important branch of our business substantial progress has been made, each of our standard sizes has been designed, constructed and installed during the year, and our first gas engines are in successful operation.

"Orders to August 1, 1907, for the horizontal, twin-tandem, double-acting type of gas engines, ranging in capacity from 500 to 5,000 horsepower, aggregate 189,350 horsepower.

"One of our notable contracts covers the electrification of a steel plant requiring gas-engine-driven electrical units of an aggregate capacity approximating 60,000 horsepower. This order is believed to be the forerunner of a great many others of similar character, because of the great saving effected by this means in the utilization of gases produced in the manufacture of steel and hitherto wasted.

"Another important contract, which has been awarded us by an electric-railway company, is for traction purposes—the largest installation in America of electrical units driven by gas engines to operate on producer gas. The equipment comprises three horizontal, twin-tandem gas engines of 1,500 horsepower each, direct-connected to 1,000-kilowatt, three-phase, 25-cycle alternators of our manufacture, and includes all sub-station apparatus.

Hydraulic Turbines.

"Although we have but recently undertaken the manufacture of hydraulic turbines, we installed and placed in operation during the year ten complete hydro-electric plants, having a combined output of 105,000 horsepower, and it is gratifying to report duplicate orders from the largest companies interested in these plants. Particular reference is made to the highly satisfactory performance of a 32,000-horsepower installation furnished one of the largest waterpower developments in the South, for which we have recently contracted to supply six additional units of identical design.

Air Brakes.

"This department was organized about July 1, 1906, to exploit the sale of air-brake equipments, pursuant to an arrangement made with Mr. N. A. Christensen, inventor, whereby the company possesses the exclusive patent rights to manufacture and sell the 'Christensen' air brakes to urban and interurban electric railways. The 'Christensen' brake has been extensively used for years, and its merits are widely recognized. A reasonable degree of success has already rewarded our efforts to establish ourselves in this line of business.

Electrical Apparatus.

"During the last year we have completed the development and manufacture of large alternating-current and direct-current generators, rotary converters, induction and direct-current motors in all sizes and capacities, transformers for both power and lighting service, street-railway motor equipments and electric hoists; all of which are in successful operation.

Steam Engines.

"It is worthy of note that, notwithstanding the large inroads made by the steam turbine and gas engine, our Corliss-engine business continues in steady volume, particularly for the medium and smaller sizes.

Pumping Engines.

"Standardization of the products of this department has been carried to a greater degree than ever before, securing for our pumping engines the same manufacturing and commercial advantages applicable to power engines.

Flour-mill Machinery.

"We have just completed the largest flour mill ever constructed in Canada, having a daily capacity of 4,500 barrels. The contract covered an installation complete with power house and all machinery equipment. The successful starting up of this large mill, which is electrically driven, producing flour of the best quality within ten hours after turning on the wheat, is especially worthy of comment.

Saw-mill Machinery.

"The supremacy of our commercial position in the saw-mill trade has been fully maintained during the last year. Important improvements have been added to our complete line of machines.

Mining Machinery.

"Never before has such activity been witnessed in the development of mining, which has now assumed a more important position than ever among the country's industries. As usual, most of last year's important orders for mining machinery were placed with us, and the outlook is encouraging for a steady and satisfactory volume of business.

Crushing and Cement Machinery.

"Our sales of rock crushers and cement-making machinery, which for years has shown a steady growth, exceeded those of any previous year, and represent 50 per cent. of the country's total business in these lines.

Foreign Department.

"Foreign orders booked show an increase of 45 per cent. over the previous fiscal period. Arrangements have been concluded during the last year for a more systematic and energetic exploitation of our products in foreign countries, particularly Japan, China and South America.

"Great credit is due our engineering and manufacturing departments for their hearty co-operation and successful work, which has been faithfully performed under unusual and very trying circumstances. I desire also to express, with high commendation, my appreciation of the loyal and efficient services of all department and district managers and salesmen."

Following the established practice of the company, all expenditures during the year for repairs to and replacement of standard patterns, also for the general up-keep of the plants, amounting to \$854,503.32, together with \$253,987.42 for depreciation of property, a total of \$1,108,490.74, have been deducted in arriving at the net manufacturing profits. In addition to this substantial sum, the company has also reserved in the accounts and charged against the operations during the year \$73,000 for bad and doubtful accounts, etc. Losses for the year on account of bad debts amount to about one-twentieth of one per cent.

The most important transactions of the year reflected in the balance sheet relate to the bond issue. Of the \$15,000,000 authorized, \$12,854,000 has been issued, \$854,000 of which was to reimburse the company for expenses incurred by additions to the West Allis extensions, being a part of the \$3,000,000 of bonds reserved for specific purposes. Of the \$12,854,000, \$2,398,000 is treasury bonds, leaving a net amount of $10,456,000 taken by stockholders and the syndicate. The stockholders' subscriptions had been fully paid at the close of the fiscal year, but there were still outstanding the last two installments of the syndicate, both of which have since been paid, thus fully discharging the latter's obligations to the company.

The consolidated balance sheet of June 30, 1907, is as follows:

ASSETS.

Capital assets:			
Real estate, buildings, plant, machinery, patterns, drawings, good will, etc., as at June 30, 1906			$34,401,752.92
Additions thereto during the year ending June 30, 1907, consisting of West Allis extensions and additions to other works			2,626,367.68
			$37,028,120.60
Bonds and shares			254,200.00
Developments and patents:			
For the development and the purchase of rights for the manufacture of new lines of apparatus, including steam and hydraulic turbines, gas engines and other machinery, as at June 30, 1906		$662,321.76	
Further expenditures during year ending June 30, 1907		453,420.66	
			1,115,742.42
Discount and commission on bonds			2,614,000.00
Current assets:			
Notes and accounts receivable	$5,004,032.33		
Less—discounted	353,934.83		
		$4,650,097.50	
Stocks of merchandise, material and work in process, at cost		8,739,354.45	
Unpaid bond subscriptions due July 1 and September 3		*1,057,920.00	
Cash		889,828.24	
			15,337,200.19
Profit and loss—balance			229,816.95
			$56,579,080.16

LIABILITIES.

Capital liabilities:		
Allis-Chalmers Company—		
Preferred stock	$16,150,000.00	
(Dividends at the rate of 7 per cent. per annum accumulated from February 1, 1904.)		
Common stock	19,820,000.00	
		$35,970,000.00
The Bullock Electric Mfg. Co.—		
Preferred stock	$ 1,170,000.00	
(Dividends at 6 per cent. per annum, guaranteed by the Allis-Chalmers Company.)		
Common stock	600.00	
(The $1,499,400 remainder of the total authorized issue of $1,500,000 is owned by the Allis-Chalmers Company and deposited with the American Trust & Savings Bank of Chicago, trustee, under the mortgage securing the bonds of the Allis-Chalmers Company.)		
		1,170,600.00
First-mortgage 5 per cent. bonds issued	$12,854,000.00	
Less—in treasury	2,398,000.00	
		10,456,000.00
Loans and notes payable		4,873,431.61
Partly secured by the deposit of treasury and syndicate bonds to the amount of $3,457,000.		
Current liabilities:		
Accounts payable		2,815,226.09
Reserve:		
For depreciation		1,293,822.46
		$56,579,080.16

*Since paid.

Modern Improvements in Asia Minor.

Active preparations are now being made for the installment of an electric street-railway system in Beirut, Asiatic Turkey. In the old town a passage is being cut through an almost solid mass of square, flat-roofed stone houses erected more than a century ago. Of all the cities of the Ottoman empire, Damascus was the first to employ electricity. Beirut is now following in the wake. The concession for Beirut, which holds good for 99 years, was granted by the Sultan's government to an Ottoman corporation, which in turn leased its charter to a Belgian company. The company is spending some $500,000 for rails, rolling stock, machinery, cables, buildings, tools, etc., and a large portion of the material needed has been ordered in Belgium, some minor parts being ordered in Germany and France. For the generation of electricity the company has decided to use coal.

Electric light will speedily be introduced in Beirut by the owners of the present gas plant.

American trade in new markets would be greatly encouraged and promoted by American investments of capital for the development of natural resources which lie dormant, and in public works. Mr. G. B. Ravndal, United States consul-general at Beirut, recently wrote as follows to an electric manufacturing company in the United States:

"Usually corporations of this kind are formed by Ottoman subjects backed by foreign capital, and the material needed is bought in the country from which the capital is supplied. It would therefore be best for American manufacturers of electrical supplies to send agents to Constantinople for the purpose of securing concessions for such cities as have not already been covered by Germans, Belgians, etc. Turkey in Asia is a rich country and worth paying attention to by our manufacturers and merchants. It is just beginning to be seriously exploited. But unless Americans are prepared to invest money out here in railroads, irrigation works, mines, street cars, electric-lighting plants, hotels and tourist resorts or similar enterprises, American trade will not acquire deep roots in these regions."

ELEMENTS OF ELECTRICAL ENGINEERING.

By GEO. R. METCALFE.

XL. Electric Railways.

ELECTRIC BRAKES.

There are two styles of electric brakes which are considerably used on roads running through hilly countries, and both of these styles of brakes involve the same general principle of operation, which is, using the momentum of the car to operate the motors as generators. In other words, the stored energy of the moving car is utilized to stop the car. Electric brakes are operated by means of a controller which generally forms a part of the main controller dam and in other cases is a separate drum operated by its own handle. In the latter case the running handle and the brake handle are interlocked so that the brake cannot be applied until the controller is in the "off" position. The operation of the brake is as follows:

When the current is cut off from the motors the fields retain a certain amount of residual magnetism, and by throwing the controller to the brake position the armature leads are reversed and a certain amount of resistance is inserted in the circuit, according to the position of the controller handle. This connects up the motors as series generators, and they begin to generate current whose electromotive force depends upon the amount of resistance in the circuit. In this condition the motion of the car supplies the power for driving the generators, and this of itself comprises a considerable retarding force for stopping the car.

In one form of electric brakes this current generated by the reversed motors is used to energize a magnetic clutch which presses against a friction disk mounted on the car axle. It will be understood that the amount of current generated by the motors depends upon the speed at which the car is traveling, and as the car slows down, this current begins to decrease. If the brakes are to act evenly from the time they are applied until the car stops, it is necessary to move the controller handle with precision, so that the resistance is cut out steadily as the car comes to rest. The quickness of the stop depends upon the rapidity with which the controller handle is moved over the different brake points. As an electric brake will stop a car even more quickly than reversing the motors, the latter operation is never necessary on a car equipped with electric brakes. Moreover, notwithstanding the fact that the electric brake acts quicker than reversing the motors, it is not nearly so severe a strain upon the car equipment. In case a car has to be stopped on a grade, it is necessary to use the hand brake for holding the car after it has stopped, as it is evident that at that time no current will be generated, and the electric brakes will not continue to hold after the car stops.

The other system of electric brakes alluded to involves exactly the same principles of electrical operation as the one described, but differs from it in the method in which the current generated by the motors is utilized. In this case there is a track brake suspended from the truck between the wheel brakes, and which is connected to the wheel brakes by means of toggles. The current from the motors energizes an electromagnet which forces the track brake down against the track and at the same time applies the wheel brakes to the wheels. The system of toggles and levers connecting the wheel brakes and the track brake are so arranged that the energy of the electromagnet automatically divides itself between the two systems of brakes.

The track brake-shoe is divided into two or more separate parts, which form magnetic poles which complete their magnetic circuit through the track, and the attractive force of the magnets upon the rail is under the control of the motorman up to a pressure of 150 pounds per square inch of brake-shoe surface in contact with the rails.

With this style of electric brake, two resistances are generally used, one of which is placed inside of the car to act as a car heater in cold weather, and the other outside of the car for use when it is not desired to heat the car. As the retarding effect of this type of brake adds the magnetic attraction between the brake and rail to the friction between the wheels and the rail, it is possible to make much more sudden stops than with the usual form of brake.

On very hilly roads independent track brakes are used to a limited extent, and consist of shoes supported directly by the car truck wheels, by means of a system of levers, are pressed directly upon the rails.

Where it is necessary to make an emergency stop on a car not equipped with electric brakes, this may be done by simply reversing the motors with the current from the line applied to them. This, of course, tends to run the car in the opposite direction, and throws a very severe load on the motors, and is not altogether a reliable method, as the circuit-breaker is apt to be thrown open or the fuse blown by the excessive current which will be drawn, or the trolley may fly off from the trolley wire, in either of which contingencies the current would be cut off from the motor and the braking effect would then be entirely lost. If the current is entirely cut off, the motors may still be used to brake the car by throwing the reverse lever moving the controller handle to the multiple position on a car equipped with two motors. This arrangement permits one of the motors to generate current, which tends to drive the other motor in the opposite direction, which, it is apparent, tends to stop the motion of the car.

SAND BOXES.

Sand boxes are always used on electric cars to prevent the sliding or skidding of wheels when the track is wet or slippery. The sand box is located near the car wheels, and a rubber hose is carried from the sand box to a point directly in front of the wheels, so that when the motorman releases the sand by means of a foot push, it falls directly upon the rail in front of the wheel and prevents the latter from slipping. When a car is equipped with air brakes, pneumatic sanders are frequently used, in which a pipe from the air reservoir is carried into the sand box. By admitting compressed air to the sand box the sand is blown out through the hose onto the rail.

ROADBED AND TRACK CONSTRUCTION.

The great variety of roadbed and track construction found in electric-railway work involves a subject of considerable magnitude, and can only be touched upon briefly here. There are two general classes of roadbed construction, which differ very widely from each other on account of the different conditions under which cars operate. City service, or wherever cars operate on paved streets, requires a roadbed conforming to the kind of pavement used, whereas roads operating upon their own private right-of-way use an entirely different roadbed construction.

In most cities the railway tracks are used as much or more for ordinary vehicle traffic as they are by the street cars, and city authorities have, as a rule, insisted upon the use of a style of track which would be convenient for ordinary vehicles. This led to the use of various styles of grooved rails, which are not entirely satisfactory for street-railway use. In order to permit ordinary paving blocks to be laid close to these rails these grooved sections have been made with shanks about eight inches long, or more, in order that paving laid on top of the cross-ties which support the rails should come about level with the head of the rail. Such sections of rail are not only very expensive, but they have much shorter life than the ordinary tee rail used on steam roads, because, with the small amount of wear on the head of the rail, the flanges on the car wheel will come down to the bottom of the groove. Moreover, on account of the limitations in the possible size of the groove, car wheels having smaller than the standard sized flanges must be used, which reduces the useful life of the wheel and makes high speeds unsafe.

In order to secure a reasonably elastic track, wooden cross-ties were generally used at first under the rails, but their location kept them constantly wet or damp and the ties rotted rapidly and had to be replaced frequently. This not only proved very expensive in the matter of tie removals, but involved a heavy expense for labor in tearing up and replacing the pavement, and was also generally unsatisfactory on account of the frequency with which the streets had to be torn up. Numerous methods were employed for avoiding this trouble, and at the present time the use of solid concrete foundations for the rails is considered the best practice where the traffic is sufficiently heavy to stand the expense of such construction.

All of the girder and groove type of rails are more or less unsatisfactory because they do not permit the use of wheels with standard flanges,

NOTE.—This series of articles, intended to survey, briefly, the whole field of applied electricity for light, power and heat, was begun in the Western Electrician of February 2, 1907.

and in a number of cities where permission has been obtained to use the tee rail the latter has proved highly satisfactory both to the railway companies and the city authorities. Where tee rail is used with paving, a high rail known as the Shanghai tee is used, which is high enough to come about on the level with the paving blocks.

On all roads having a private right-of-way the common tee rail is invariably used and is supported by wooden cross-ties placed about two feet apart. A section of tee rail weighing about 70 pounds per yard is ample for almost all interurban roads, whereas the girder rails in paved streets frequently run as high as 100 or 125 pounds per yard. Wooden ties should be supported on some form of ballast, such as broken stone, gravel, cinder or similar materials, which will form a solid roadbed and which at the same time will drain readily so as to prevent the ties becoming soaked with water.

To make a first-class roadbed there should be at least eight inches of ballast under the ties.

Where ordinary tee rail is used the joints between the different lengths of rail are made with angle bars, which fit accurately between the head and the base of the rails and are bolted together through the web of the rail. This form of joint is most satisfactory where the track is exposed, so that the bolts can be frequently inspected and kept tightened up. In paved streets, however, and in cases where high sections of rail are used the angle bar joint is not so satisfactory, and numerous special types of joints have been employed.

Where the track is entirely open it is necessary to leave a slight space between the ends of abutting rails to allow for expansion and contraction, due to varying temperature. In paved streets, where the rail is practically all covered except the top surface of the head, the effect of expansion and contraction is hardly noticeable, and under these conditions welded joints have proved very satisfactory.

In all welded joints the abutting ends of the rails are welded solidly together, so that in effect there are no joints in the track whatever, as the rails form one continuous length.

Welded joints are either cast-welded or electrically welded. In the cast-welded joint the union of the two rails is not a true weld, as these joints are formed by casting a block of iron around the two ends of the rails. A mold is fitted over the joint, and the cast iron is poured into this mold at a high heat, so that the base of the rail, which lies in the molten metal, is more or less melted. This forms a very intimate union of the cast-iron and the steel rail and makes a very solid joint.

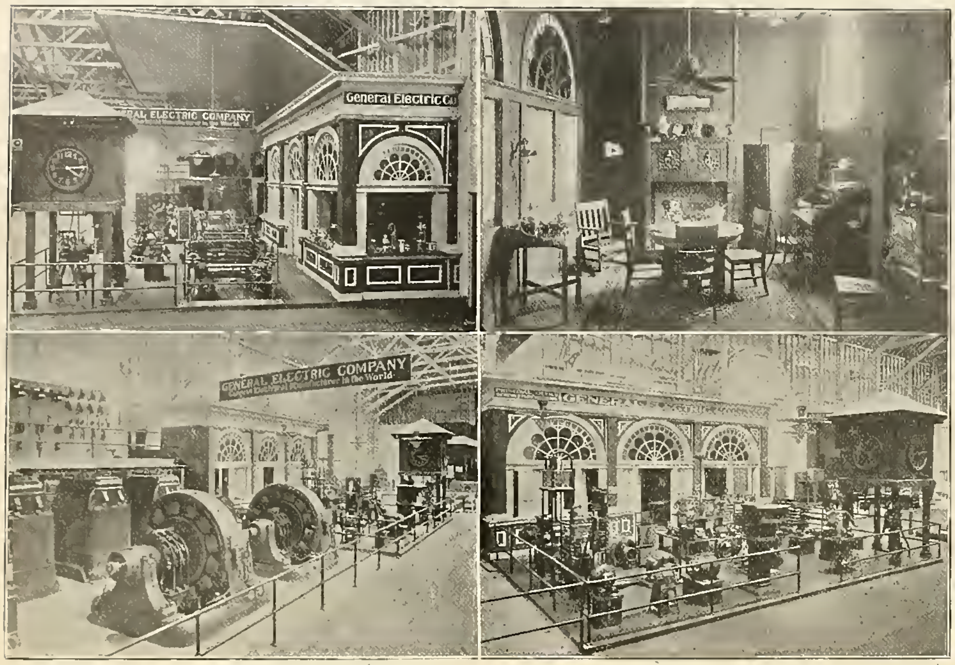
In electrically welded joints two bars are placed on either side of the joint, and a very heavy current passed through them, which raises the temperature of the bars and the web of the rails to a welding heat. The steel bars are then clamped against the rail under pressure and the current is shut off and the joint cools. This forms a true weld between the two abutting rails and the bars.

[*To be continued.*]

General Electric Company's Exhibit at Jamestown.

One of the especially attractive electrical exhibits at the Jamestown Exposition is that of the General Electric Company, several views of which are given here. A practical demonstration was given of the wide range of motor applications and the varied uses to which electricity is applicable in the factory, in the shop and in the home.

A portion of the company's space is partitioned off for a model electric dining room and kitchen.



Industrial Applications and Electric Kitchen. Reception Room.
Exhibition Sub-station and General View. Industrial Applications.

VIEWS OF THE GENERAL ELECTRIC COMPANY'S EXHIBIT AT JAMESTOWN.

The remainder is guarded with a brass rail, behind which is arranged a large variety of motor-driven tools and machinery. Adjoining is the sub-station, where the current generated at Norfolk is transformed and distributed about the grounds. The electric kitchen is finished in Mission style and equipped with all the company's domestic electrical apparatus and utensils. In the rear is the electrical stove, holding the electric oven, electric grid, broiler, toaster, water heater, etc. While the motor-driven washing machine is exhibited out in front, the ironing board with electric iron is located in the kitchen. The demonstrating windows are filled with a variety of fans, kitchen tools, etc.

The other end of the room is arranged as a reception room. It is furnished in Mission, with pretty rugs, pictures and a handsome mantel containing a luminous electric radiator. These rooms are not merely ornamental settings for the exhibition of electrical devices. The display is in charge of competent young ladies who make practical demonstrations each day. Guests are invited in to inspect electric cooking utensils and are asked to sit down while the cooks prepare an appetizing welsh rarebit, tea and toast, or other dainties.

The space devoted to the display of the industrial applications of electricity contains an automatic refrigerating plant made by the Automatic Refrigerating Company of Hartford, Conn. A portion of the rail is filled with the refrigerating liquid, so that curious visitors can see and feel just how cold it is. In one corner stands an electrically wound Seth Thomas tower clock, and near by is an Ingersoll-Temple electric-air rock drill. Among the other machines are a motor-driven sewing machine, blower set, coffee grinder, meat chopper, dough mixer, washing machine, buffer and grinder, and the automatic house pump. All of these devices are operated by General Electric motors.

Adjoining the exhibit space is the sub-station of the exposition, equipped with three 1,400-kilowatt air-blast transformers, two 500-kilowatt rotary converters, three 100-light arc-lamp transformers, and the switchboard, all of General Electric make. This station is also equipped with the latest type of remote control, electrically operated oil switches. Power for the exposition is generated in Norfolk, eight miles away, by three 3,000-kilowatt Curtis steam turbine units. This power is generated at a pressure of 11,000 volts and is transmitted at this potential to the sub-station, where it is stepped down for distribution.

About 45,000 eight-candlepower General Electric lamps are used in the decorative lighting of the exposition buildings and grounds, besides a number of 24 and 30-inch searchlights.

Ozone as a Water Purifier.

In addressing the Western Society of Engineers on the subject of ozone at a special meeting held on October 25th, Prof. Leon Gerard of Belgium first recalled the early steps in the study of ozone by Schoenbein, Berthollet and others. These studies were purely scientific and non-commercial up to 1890, at which time knowledge of ozone covered only the more academic information as to its atomic weight, solubility, compressibility, etc. In 1891, when the practical discovery was made by Froelich that ozone killed bacteria, ozone was as rare as radium is today. Froelich's discovery started warm controversies among bacteriologists, but within four years his announcement had been proved correct.

During the following years the commercial production of ozone was taken up by various experimenters, reducing the required energy rapidly, as will be seen from the following table:

Method.	Watts per Gramme of Ozone.
1895—Ruhmkorff coil and Bertbelot tube	9,000
1896—Transformer with Houzean tube	6,500
1896—Segny's tubes in oxygen	1,200
1897—Tindal Industrial Plant at Oudshoorn	300
1897—Tindal Plant—Brussels	274

The first satisfactory apparatus was the Siemens ozone tube, made of glass. Later a pair of such tubes was combined in a more efficient device, and still later glass-plate condensers were used. Professor Gerard's own work consisted largely in devising a cylindrical form of condenser, shaped so as to eliminate the danger of puncturing which exists at the corners of plate condensers; in using oil as an added dielectric and in doing away with the raised points which would heat unduly. His best results were obtained at from 25 to 50 cycles, the low rate of alternations being needed to keep the electrodes cool, as any heating above 270° C. disintegrates the ozone. As the result of his careful experimenting he was able to increase the output of ozone in grammes per kilowatt-hour of energy, the remarkable jump in efficiency being due partly to his eliminating the use of resistances and partly to his being able to use a much greater current density without overheating the electrodes:

System.	Ozone in Grammes per K. W.-Hour.
Siemens	18 to 37
Otto	25 to 30
Vosmaer	22
Schneller	6.4 to 7.5
De Frise	6 to 10
Gerard	80 to 110

To show the efficiency of ozonizing as a means of purifying drinking water, Professor Gerard presented microscopic slides showing the development of algæ in untreated and clear water in from three to nine days, and similar slides showing the entire absence of such germs in the same water nine days after being treated with ozone.

Sanitary engineers now know three methods of purifying water—chemical, mechanical and electrical. In the first method the coagulation by use of copper sulphate or alum leaves injurious chemicals in the water. The mechanical method, commonly known as sand filtration, depends for its efficiency on many variable factors, and often the bed of the sand offers a fine place for the rapid development of both animal and vegetable growths. In the ozone process there is no breeding place for germs, but those present are effectively destroyed, as was clearly proved at Paderbaum, where the Siemens installation has entirely checked the prevalence of typhoid, which previously claimed over a hundred victims annually.

The voltage used in the production of ozone varies with the nature of the dielectric, from 12,000 in some of the commercial forms to 120,000 in laboratory apparatus. At commercial voltages the remarkably efficient type of apparatus developed by this Belgian scientist requires only 50 watts to purify 1,000 gallons of water, thus bringing the cost where purification by ozone must command the attention of sanitary as well as electrical engineers.

Copper Market.

Copper was down as low as 12 cents or even 11¾ cents a pound last week. But it made a recovery, beginning on October 25th, and the quotations on October 29th were 13¼ to 14¼ cents.

The La Crosse and Winona Electric Railway Company is securing franchises for its proposed interurban line between La Crosse, Wis., and Winona, Minn.

SELLING ELECTRICITY.

Under this heading will appear, from time to time, articles, suggestions and examples which will be of assistance in the constant effort to increase the existing demand for electric current and to create new demands.

Increased Sales to the Present Consumer.[1]

By J. S. Skinner.

Since we are supplying the customer with all the goods he is using in our particular line, the question naturally arises, How much current ought that customer to use? We would answer, All that can be advantageously employed for his maximum comfort, convenience and economical use. Extravagant use of current should in no case be encouraged, for, sooner or later, extravagance will be cut off, and it is usually cut off before the electric-light company has received sufficient returns for its pains and expense in providing the extra current capacity. However, since few customers are using all the current that they can use to their best advantage, we are all seeking for the best methods to employ in securing an increased sale of current.

Under methods comes the question of service, care of customer, educational portion of the campaign with its reference to the customer's needs and use of appliances, advertising and personal solicitation.

Without doubt the first requisite is good service. The customer is using the goods, hence we must make the sample good, and give for his further requirements a little better service than the sample he is using. So far as possible any interruption to the supply of current should be avoided. Train everyone connected with the company's service, from the fireman or oiler at the plant to the officials and stockholders of the company, in order to secure an alertness to watch for and prevent trouble of whatever variety. Is not five dollars well spent if it will avoid a trouble or condition that would cost ten or fifteen dollars? There are two kinds of experts that command the best financial reward, one that has alertness for preventing trouble and another that has alertness in employing the best and quickest means in repairing the trouble and hasten the normal resumption of service. Sometimes both qualities are found in the same personality, but not always.

As far as possible it is best to maintain the same watchfulness over the customer's apparatus for which current is supplied. It is certainly desirable to have him point with pride to the fact that he has not had a moment's delay with his equipment. Then again when it becomes absolutely necessary to shut off the current, as at times happens in the best regulated plants, it may save some of the customers considerable annoyance and perhaps waste of material if you can let them know in time to make preparation for the momentary shutdown.

To a certain extent, increased sale of current to a customer is a matter of an educational campaign. First, it is necessary for the one supplying or figuring on the supply of current to be a thorough student of the needs of the customer. Second, in most cases you have to teach the customer how to use the current to the best advantage. You may think that if the customer is using a lot of 32-candlepower lamps in his show window where 8-candlepower lamps would be more effective you are ahead that much, because he does not know any better than to be using a lot of current where he does not need it. You may contend that it is all right and none of your business if the customer uses a 32-candlepower lamp in his bathroom where an 8-candlepower lamp would do fully as well, and a 32-candlepower lamp in a small hallway where an 8 or a 4-candlepower lamp would be sufficient.

If you let him use lights in that way and he forgets to turn them off a few times, at the end of the month the result is a large current bill, with the addition of a dissatisfied customer. You say people ought to know better, but this is just where trouble frequently begins, because they do not know the measurements as applied to electric current unless you take the trouble and pains to tell them. It pays to take the pains to see about the customer's illumination.

Especial attention should be paid to the lighting fixtures and shades. Frequently you will find that where a customer complains that he has not enough light to read by, the fixture is a combination one with the electric light placed at an angle of about 45 degrees, with a colored or thick shade that cuts off fully 50 per cent. of the light, and the only useful light it can deliver is from a small area at the base of the lamp and that at an angle as mentioned above.

Another thing that requires constant attention is the arrangement of lighting fixtures. Fixtures should be so arranged that when the furnishings of a room are placed to get the most benefit in daylight they will also be in a proper position to get the best results from the artificial light. In this matter one has usually to keep as emphatically in touch with the contractor as the customer. Right here let me state that it requires the same persistent effort in looking after the power customer if the best results for all concerned are obtained. As to the lighting customers, with properly arranged switches and fixtures, they can have all the light they want, when and where they want it, without the current bill for lighting being excessive.

Then comes an opportunity to introduce other appliances which build up the off-peak load that is especially desirable. The customer finds that he can use an iron or sewing-machine motor with but little extra expense for current compared with the advantages the iron and motor offer. Sometimes appliances can be used as an aid to get more lighting, but this is not usually the case. As a rule, women are slow to take advantage of these household appliances. The reason perhaps is that the more they spend for the home the harder it is for them to get the funds for other things they want, so in order to get them to try the appliances we usually have to see the men as well as the women and appeal to the man's pride in making things comfortable and convenient for his wife.

Perhaps no central-station manager escapes the flood of circular letters from firms ready for just a small sum to tell how to get more business. Some are quite anxious and persistent that you pay them for telling you how to run your business. This type of advertising, as a whole, is very much like the cure-all patent medicines. If the medicines were capable of doing all that is claimed for them there would be no need of a local physician; likewise, if these advertising firms could do all they claim there would be little need for local solicitors, superintendents and managers. The whole business could be handled on the mail-order plan.

However, the direct-by-mail advertising pamphlets accomplish some favorable results. A successful lecturer never says the same things in the same way to different audiences, but fashions the same lecture to fit the local conditions. The same holds true with these "ad" pamphlets. To accomplish the best results they will have to be made over to fit local conditions or they will be examined with about the same care as patent-medicine ads.

Short instructive newspaper ads may be used to good advantage in local daily papers. The customer may know that he has many advantages in having electricity in his home, but these descriptive articles make him better satisfied with what he has and serve to interest him how he may obtain still more benefit from electric current with but little extra expense.

An electric sign and a well-kept display room are splendid means to use in furthering the sale of current. People like to be shown, but if the company's headquarters are on a side street it is difficult to make a success of a display room.

All of these methods have their proper places, but if they are not followed up with earnest and persistent personal solicitation they are like a brilliant thirty-minute revival sermon without the succeeding hour's earnest exhortation. You may be giving good service, taking good care of the customers' interest, and they may have been well informed regarding their needs, so that they know what is best to do, but people do not always do what they know is best without some other influence is brought to bear on the matter. A few wise suggestions at the proper time, how the customer may have a few more lights or some of the appliances which will add much to the comfort and convenience of the home, or an additional motor in the shop which that particular customer may use to good advantage, will do much in encouraging a larger use of electric current.

We would like a rapid growth in the use of current on our present lines. A small number of large users for a long-hour average would be highly satisfactory, but the small satisfied customer of today, with proper attention, becomes the larger user of tomorrow. I think you will all agree that a gradual positive growth is more desirable than a rapid "boom" sort of growth.

With good service and due consideration for the customer's interest and equipment and a proper amount of stick-to-it-iveness, we have the right to expect a good substantial growth. We will get it, for the field broadens and brightens on before as electricity conquers new and valuable fields of usefulness every day.

1. A paper read before the Kansas Gas, Water and Electric Association at Topeka on October 9, 1907. The author is superintendent of the Lawrence (Kan.) Electric Light Company.

Special Circuits and Outlets for Heating Devices.

The "Manhansct" at Prospect and Longwood avenues was one of the first apartment houses to be built with special outlets for electrical heating devices. Mr. James F. Meehan, the builder, is making the same arrangements in his new apartment house at 163d Street and Prospect Avenue. Separate outlets in each bathroom make it easy to connect any small device such as a curling-iron heater, shaving mug or water cup, without using the regular lamp socket.

Mr. Charles V. Halley, in his new apartment house at Clinton Avenue and Croton Park North, has improved on this idea by installing a separate circuit from the panel box to an outlet in the kitchen. To this outlet any electric cooking device can be attached, thus making it possible for a tenant to do part or all of his cooking by electricity.

Every prospective builder of apartment houses should consider the special circuit question when a building is planned, as the expense of running heavy circuits for heating appliances after the structure is completed often prevents the owner from installing them. Electric heating devices are here to stay, and it is but a question of time when every apartment house and dwelling will have a special heating circuit. We congratulate those enterprising Bronx builders.—Bulletin of New York Edison Company.

A Simple English Story.

The following amusing skit appeared in the London Electrical Review as a contribution from "Innocens." It is a harmless bit of satire that will be enjoyed by American readers.

Now it came to pass that a certain Chief was seized of an idea. And as such seizures are uncommon and alarming, they are dangerous in the extreme. And as the Chief was under the influence (of the idea), he cried aloud and said, "Lo, I will boost this business with the biggest boost that ever began to be." For the Chief had been studying the art of alliteration with regard to advertising.

And when he had thus said he consulted his second, and said unto him, "How thinkest thou of this publicity business? Thinkest thou that we may add to our output forty and four thousand kilowatts per month by the writing of circular letters, even as they do in America?"

But the second was a Scotchman, and a man of slow mind, and knowing more of pistons than of printing, and of coal than of circulars, he answered and spake, saying, "Rats!"

Wherefore the Chief slanged him, and told him to go and see why in the name of the things that are under the earth, the stokers were making such a lot of smoke, for that was all he was good for. And he himself strove mightily within himself, and evolved four letters, which he called a follow-up campaign.

And the first letter thereof did commence:

"Dear Sir: Doubtless you are about as surprised to receive this letter as we were to write it. Don't be alarmed. There is no animosity. We only want to tell you about our best juice at 6d. per unit, which beats all other juices, including gastrick juices, off the face of the earth." For this was the style of the letters that are written in America.

And the second letter thereof read:

"My Dear Friend: I would like to tap you on the shoulder and ask you when you are going to wake up and realize that I wrote to you a few days ago about our Juice—juice, I tell you! If you miss this opportunity your gray hairs will go down in sorrow to the grave."

And the Chief smiled and thought that the Americans could not do better.

And the third letter thereof read:

"Dear James (or Charlie, or Willie, or whatever your name may be): Why don't you listen to the tip of an old pal who never wished you any harm? *Don't you know* that you are leading a blighted existence? *Don't you know* that you are an outsider, a hanger-on, a nonentity suffered to remain suspended by the eyebrows to the fringe of civilization? That is so long as you don't use our patent juice, generated from electric machines of unparalleled magnitude, which I keep under my personal supervision." And the Chief felt more pleased with himself than ever. But he reflected that the last letter, to be effective, must be a regular stinger and outshine everything that had gone before. Therefore he wrote:

"You there!

"Why in thunder don't you write back to me? Don't you know I am here to do you good? Don't disregard me. Think of what my juice can do for you. An electric shave will only cost you 0.000065d. per day. Your baby's milk can be warmed for a week at the same cost as your morning paper. I assume you have a baby. I am throwing money at you. Why can't you catch it?"

And the Chief leaned back in his chair with a satisfied expression, and half thought of showing the letters unto his second. But on second thoughts he reflected that a Scotchman wouldn't see the humor of the idea. And in this the Chief had made a great mistake, for the clerk subsequently showed the letters unto the second, and he saw the humor at once.

But the Chief went forth unto a local printer, whom he desired to get on to his supply—and sayeth unto him, "Lo, print these for me, and likewise knock me together two or three pamphlets on electricity, and I will pay thee well." And they struggled hard for many days, and after a season and half-a-season, produced a pamphlet of sorts. And the printer charged for it.

Now, therefore, the Chief issued these letters, and much notice was taken of them in the town, inasmuch as they were reprinted in full in the local newspaper, which was a very great advertisement. Moreover, the editor did write certain things concerning them in his wittiest vein, which caused many people to smile sinfully. Yet the Chief saw not the point of the jest.

And lo, many letters were returned unto him with rude and scurrilous remarks, written thereon. And the office boy snickered thereat. Yet came there no order for juice. And the Chief railed on the townsmen for a pig-headed generation. But, verily, there came unto him at last a visitor with reference to these letters, and the Chief's heart leapt for joy, and he cried, "Show ye the gentleman in." And he came in. And lo, he had a glassy eye and disheveled hair, and his appearance was one who seeth things in a vision. And he said, "Art thou he that wrote these letters, and didst thou verily send them unto me?"

And the Chief said, "Yes, verily, so did I. What can I do for thee?"

And the man cried, "Now, heaven be praised for that a deliverer hath been raised unto me. For many years I have feared the lunatic asylum, for that my father and my father's father have entered there, but I have read these, thy letters, and my mind hath stood the strain. Verily, I fear nothing more under the sun. And thou, do thou go unto the asylum in my stead, for thou art worthy."

And there came unto the Chief his manager, and did say unto him, "Thou fool, thou hast spoilt thy chance. Publicity is good. Thou mightest have reaped much benefit thereby. But why didst thou try to do it thyself? Are there not advertising specialists in England who know how to do these things without circus tricks? Go to, thou are not a babe; wherefore didst thou not see that American cribs will not work in England? Verily, thou hast made thy company into a laughing stock, and we must sack thee to save our face."

And it was so. But an American firm wrote and offered him the salary of many princes, for it recognized a genius!

The Department of Publicity.

At the recent convention of the American Street and Interurban Railway Association J. Harvey White, publicity manager of the Boston Elevated Railway Company, read a paper on the subject of publicity from the viewpoint of the street railway. Some extracts from his paper will be equally valuable to the central-station manager. Mr. White said that a loud and increasingly clamorous cry for corporation publicity is being raised by the public, press and political leaders who commonly represent that corporations are monsters of iniquity, plundering the poor defenseless public. So persistently have they been portrayed as institutions of dishonor, greed and oppression, that the public is disposed to believe any accusation against a corporation unless overwhelming evidence to the contrary is produced.

The problems involved in the public relations of large corporations today are quite as important as, and in many cases much more complicated than, those involved in operation. The public wishes to know and is being educated to the belief that it has an absolute right to know practically everything that relates to public-service corporations. A refusal to answer in full every question that may be proposed to a corporation is commonly regarded as prima facie evidence that it is afraid to have the truth known and conclusive evidence that it is arrogant, insolent and despotic.

Public opinion is a practically irresistible power. The company that stands discredited in public opinion is hampered and harassed at every turn. It does not receive fair treatment. Its merits are not recognized and every shortcoming will be magnified. On the other hand, if the public believes that a company is trying to give an efficient service and a "square deal," its excellencies will receive some recognition and its unavoidable defects will be tolerated with reasonable good nature by a large portion of the community.

The most efficient, available and practical agency for developing a fair and even friendly public sentiment is the local press. If the local newspapers constantly condemn the service and policy of a corporation, even though the criticism be unfair and unfounded, the public is certain to become antagonistic. If, on the other hand, the facts presented by the newspapers to their readers show that the company is alive to its obligations and is giving a reasonably good service and that its shortcomings are not due to indifference, inefficiency or wilfull disregard of public rights, public unfriendliness will be reduced to a minimum.

The first step toward securing fair treatment of a company by newspapers is fair treatment of newspapers by the company. This means the reversal of the old and rapidly disappearing policy of giving no information that can be withheld and establishing a policy of entire frankness and withholding nothing that can properly be supplied for publication.

If those whose duty it is to gather news learn from experience that all reasonable information is truthfully and promptly supplied to them and that it is only in rare cases that their requests are denied, they will learn to depend upon the company, as they ought to be able, for their news, and the stories that get into print will be more accurate and more satisfactory to both the publisher and the corporation.

The first essential for a department of publicity is ability to secure information quickly and accurately. The person in charge should have facilities for reaching every department and branch of the organization. The head of the department will be called upon to give information concerning operation, construction, equipment, discipline, law, legislation, accounting, finance, plans, policies, accidents, undertakings and occurrences of every description. It is not necessary for the head of a department of publicity to have a very profound knowledge of any particular branch of the business, but he should know a little something about nearly everything that pertains to or affects the company.

Next in importance to ability to get information quickly and accurately is to make the department accessible to the newspapers at all hours of the day and night. From midnight until about 10 in the morning there is seldom need of being prepared to furnish information about anything except accidents or other unusual occurrences, but from 10 o'clock in the morning up to midnight all sorts of inquiries are received and the department should be prepared to answer them.

Cost of Cooking by Electricity.

A determination of the cost to the average family of cooking by electricity is difficult to make because of the scarcity of authentic figures and the varying conditions in different cities and families. A letter published by the Portland (Oregon) Railway, Light and Power Company from one of its customers adds some data on the subject. In answer to a request from the company as to what it costs him to cook by electricity, Mr. Edwin F. Barbour says in part:

The outfit that I have in use consists of the following devices:

One oven.
One broiler.
One 8-inch disk stove.
One 7-inch frying pan.
One coffee percolator, 300-watt size.
One 5-inch frying pan.
Two 2-quart combination cookers.
One chafing dish.
One 1-quart water heater.

The average amount of current consumed per day during the test was 2.76 kilowatt-hours, which at five cents per kilowatt-hour amounts to 13.8 cents per day, or $3.87 for the 28 days of the test.

The first two weeks of the above record there were two in the family. The last two weeks there have been three. The cooking has been done by my wife all of this time, and all of our cooking has been done on the electric outfit.

Therefore, the cost per person per day was 5½ cents.

In comparing this with gas, I beg to advise that my gas bill used to run for the same service from $2 to $3.50 per month, depending on the time of the year. On a similar corresponding period I think the charge was about $2.75 per month.

The advantages of the electric outfit which would offset the difference in charge, in my opinion, are the cleanliness of the utensils and the easiness with which they are kept clean; also the absolute lack of offensive odor during the operation of cooking. The latter reason is practically the strongest point for use in Portland, as it was the principal cause which led me to install the electric outfit. My wife used to be so nauseated from the offensive odor of the gas that she was practically unable to eat after cooking the meal.

The Value of the Store Window.

There isn't a merchant in Boston having a store window who cannot turn it into a big asset—into advertising of tremendous value, says Edison Light of Boston. Passing some windows are at least 20,000 people every night—passing others are perhaps 2,000. The number must vary with the locality.

If those windows are dark—nothing doing. If those windows are illuminated everybody looks, some merely glance, some make a good long examination. And can there be better advertising than that which includes, or induces, examination of good goods?

It is small wonder, then, that merchants of Boston who have tried it speak well of electrically illuminated windows. One man says "by far the best advertising investment ever made." Another, not so warm, concluded that there was nothing he could do that was anywhere near so good. There are others.

And the cost—but really the sum expended should be regarded as investment, not as "cost"—and an investment bound to pay good, big dividends. However, whether you call it "cost" or "investment," the charge won't be large. Take a store using twenty electric lights in a window during business hours—and twenty lights will brilliantly illuminate a pretty big window—to keep those lights doing good work until midnight would cost about twenty-five cents a night.

James H. Collins of Chicago is said to be planning on building an electric railway from Iowa City and Cedar Rapids, Iowa, to Davenport.

Storage Battery of Hotel La Reine.

One of the recent examples of the value of a storage battery for continuous service in isolated-plant work is that of the Hotel La Reine, Bradley Beach, N. J., which is equipped with the "Unit" accumulator type of battery.

The Hotel La Reine was first opened to the public early in July of this year and is one of the finest of the Atlantic Coast seaside resorts. The

HOTEL LA REINE.

house contains 120 rooms, all of which afford a view of the sea, and the furnishings, etc., are in keeping with the general character of the place.

The power and lighting equipment is particularly notable in that it has been designed to afford absolute reliability and continuous service. No expense has been spared to this end. The power plant contains two Northern direct-current, 110-volt generators direct connected to Secor kerosene engines, and in the power house, but partitioned off from the engine room, is a battery of "Unit" accumulators consisting of 122 cells in glass jars. In the engine room a suitable booster is provided

STORAGE BATTERY OF HOTEL LA REINE.

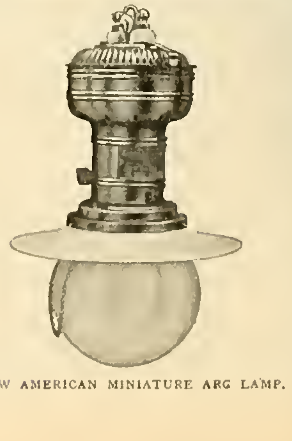
for charging purposes, and a special panel containing battery meters, circuit-breakers, end-cell switches, etc., is installed with the main switchboard.

The battery has a capacity of 40 amperes at 220 volts for eight hours on one charge and is principally designed to operate the elevator service of the hotel. The plant is arranged, however, so that the battery may be used for break-down lighting service or for watchman's lighting when it is not desired to run the main dynamos. The importance of continuous service, particularly for hotels, is readily appreciated. This consideration has brought the auxiliary use of storage batteries to supply this indispensable feature, ordinarily lacking in isolated plants, into prominence.

The power and lighting layout as well as the hotel itself was designed by Mr. John E. Nitchie of New York city, and the entire battery plant, which has been particularly satisfactory, was furnished and installed by the National Battery Company of Buffalo, N. Y., which secured the contract after keen competition.

New American Miniature Arc Lamp.

A new type of miniature arc lamp of extremely short length is shown in the cut. This new arc lamp is one that has just been brought out by the American Arc Lamp Company of Kalamazoo, Mich. It is only 18 inches long, with a weight of but 12 pounds. It is so equipped that it may be run with either five-sixteenths or three-eighths-inch carbons.



NEW AMERICAN MINIATURE ARC LAMP.

There is embodied in it, too, the "unit system of resistance." Another feature of the lamp and one worthy of especial mention is a new type of rotary switch that is simple and efficient and one not at all likely to be put out of action by continuous hard service.

The manufacturer claims for this lamp a long carbon life, accessible parts, extremely simple construction, and hence a minimum of repairs. As the maker puts it the lamp is "built to wear."

This lamp is made in sizes of 400 and 600 candle-power and is adapted to practically any kind of service—shop, office, store or outdoor where a short lamp is required. The company offers a free 30-day trial.

General Electric Single-phase Motor.

The increasing tendency of central stations to supply outlying districts by a single-phase distribution has greatly enlarged the field for the use of single-phase induction motors of moderate capacity. To manufacturers located in the outskirts of cities, sparsely settled territories and small towns the economy and unexcelled service of electric power thus becomes available. By means of the single-phase motor central stations are enabled to meet the growing requirements of these manufacturers, and can supply the most reliable and satisfactory operating power.

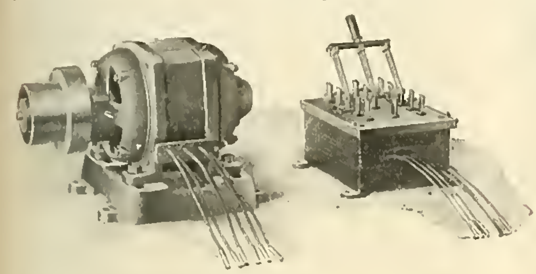


FIG. 1. GENERAL ELECTRIC SINGLE-PHASE MOTOR WITH STARTING-BOX.

To supply a motor which will meet the conditions above outlined, the General Electric Company has brought out its type IS form KG single-phase machines. It has incorporated in these motors, so far as possible, the characteristics of its polyphase motors, which have a high reputation.

As shown in Fig. 1, these single-phase motors are similar in general appearance to the polyphase motors produced by the same maker. In the smaller sizes, up to and including five horsepower, is embodied a unique form of construction known as the riveted frame. This consists of laminæ of soft iron riveted between cast-steel heads. In the larger sizes, 7½, 10 and 15 horsepower, the skeleton form of construction is used.

The rotor possesses the simplicity of polyphase construction, and the absence of all rubbing contacts and complicated internal mechanism removes possibilities of trouble or necessity for continual, careful attention. The rotor is of the well-known high-resistance, squirrel-cage type, while the stator windings are similar to those of the three-phase motor. The motors are adapted for either floor, side-wall or ceiling installation by shifting the bearing-head brackets, which are readily rotated 90° or 180°.

Motors of one horsepower and larger are made self-starting by means of a starting box of simple design, containing a resistance and reactance, and a double-throw switch. The switch is first thrown to the starting position, and when the rotor has attained almost full speed is quickly thrown over to the running position, the object being first to connect the resistance and reactance in circuit with the motor and later disconnect it when its function has been completed. The starting box, furnished with self-starting motors of one-fourth-horsepower and one-half-horsepower sizes, has a single-throw spring-release switch. In this case to start the motor the operator holds the switch blade down to the lower contact until the rotor has reached the necessary speed, when, on releasing the switch handle, the blades spring up into the running contacts.

The momentary starting current is comparatively small, varying from about twice to three and one-half times full-load current throughout the full line. It is to be noted that the maximum starting current mentioned is required only on small motors, one-fourth and one-half horsepower, hence does not assume abnormal proportions.

The manufacturer says that when connected to lighting circuits these motors can be thrown on the line through the medium of the starting box without appreciably affecting the lights on the same circuit, provided the circuits have proper transformer capacity, as usually provided for normal conditions. The motors in sizes of one-fourth horsepower to five horsepower, inclusive, are wound for 110 and 220 volts, 60 cycles, while the standard winding for the larger motors up to 15 horsepower is for 220 volts.

The clutch pulleys furnished with motors of one horsepower or larger are of simple construction. When the rotor has attained a given speed the friction band of the clutch, actuated by centrifugal force, engages the outer shell, and the applied load is assumed.

The General Electric Company's single-phase motors are adapted to the operation of all kinds of machinery where belts or gears are used, or can be direct connected where moderate starting torque is required, as in the case of fans, blowers, generators, etc. In the case of direct connecting to equipments requiring unusual torque, such as in starting pumps under load, clutch couplings are employed. Starting devices to start and stop the motor automatically can be supplied when regular attendance is not desirable, as when used in isolated

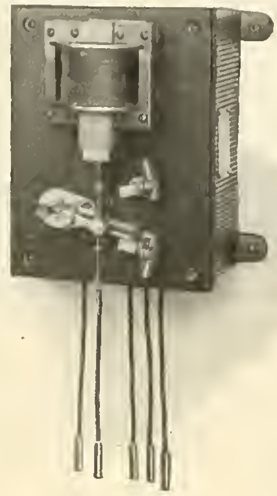


FIG. 2. AUTOMATIC STARTING BOX FOR SINGLE-PHASE MOTOR.

pumping stations, refrigerating plants, etc. Fig. 2 shows such a starting device which is simple, compact in construction and reliable in operation.

Victor Combination Meter.

An exhaustive study of conditions, uses and requirements of general meter practice has been carried on by the H. W. Johns-Manville Company with the announcement that a decided advance has been made over the earlier type of meters. The basis of all reliable direct-current measuring instruments, the company declares, has been generally recognized as the permanent-magnet, moving-coil type embodied in the d'Arsonval galvanometer principle. In accordance with this idea the Victor combination meter has been designed and consists of two separate and complete instruments in one case, so situated with respect to each other and to the scale that the energy consumption or output is directly readable in watts or kilowatts and horsepower at the intersection of the volt and ampere indicator needles.

The ammeter movement is constructed on the millivoltmeter principle, that is, a shunt carrying practically all the current, is placed in series with the line and the potential difference measured between its terminals. For switchboard meters this principle allows the shunt to be placed in a break in the bus-bar, and the meter (connected to the shunt with flexible conductors) is mounted wherever convenient, thus saving the cost of extra copper for connections, which is a large item, as in the case of high-capacity meters.

The Victor combination meter is essentially a direct-current instrument. It is designed to furnish in one instrument a simultaneous reading of volts, amperes, watts and horsepower on one dial. A rectangular coil of wire rotates in a small annular gap between a core and pole-pieces. This gap is traversed by a concentrated uniform field produced by a powerful permanent magnet. The current is carried into and out of the coil by means of high conductivity, non-magnetic spiral springs. The moving element is perfectly balanced, so that the action of gravitation plays no part in the position of the pointer, therefore the indications are correct for all positions of the instrument.

The portable Victor combination meters are for use on direct-current circuits where a high degree of accuracy is necessary. The greatest care is exercised in their calibration and general construction. The indicator needles are of the knife-edge design and the scale equipped with a mirror, eliminating all error due to parallax. The instrument is permanent and aperiodic and is direct reading in all cases, except where two or more scales are made in even multiples, so facilitating calculation. The scale is divided into substantially equal parts throughout and can be read with an accuracy within one-tenth of one per cent. of full capacity.

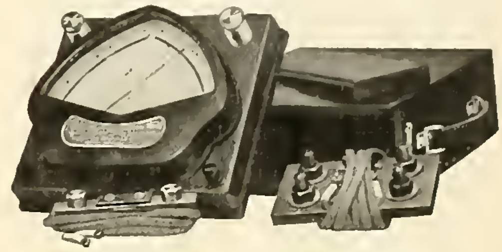
Type B-1 portable meter, illustrated herewith, is mounted upon a polished mahogany base and covered with a dustproof oxidized copper-finished top. It has a five-inch scale, divided into 100 to 150 small divisions, as ordered, with knife-edge indicator needles and mirrored scale. It is especially designed for all laboratory testing where the highest degree of accuracy is desired.

Type A-1 portable meter is in appearance similar to type B-1, but of smaller dimensions, having a 3¾-inch scale divided into 100 and 150 small divisions, as ordered. The meter is adaptable for all general testing and laboratory work where a short scale will give sufficient accuracy.

The type H-1 portable meter is designed for general testing purposes where an instrument with one or more self contained shunts of high capacities is desired.

The Victor shunts are constructed from two heavy copper terminals connected by and completely enclosing a single strip of resistance metal. They are strongly made and so designed that the heat generated is quickly carried off through the large rolled copper terminals. The resistance material used has a negligible temperature coefficient and no thermo-electric action when used in conjunction with copper, therefore avoiding thermal errors. The potential difference is measured between two points on the copper terminals where the flux density is most uniform. A thin sheet of the best grade of mica insulating compound is used to separate the copper overhang from the shunt material.

The principle of operation of the combination switchboard meter is ostensibly the same as in the



PORTABLE VICTOR COMBINATION METER.

case of the portable meter, or that of the d'Arsonval galvanometer pattern. Type B-U meter is mounted in an attractive dustproof iron case. This type is recommended for general switchboard practice where the reading may be taken at moderately close range.

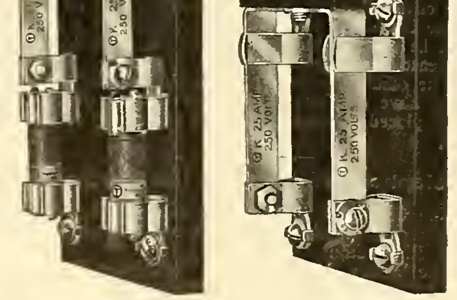
The type A-U meter is of smaller design, but similar to the type B-U. It is particularly adapted for use in connection with small machines and battery-charging outfits where a 3¾-inch scale will give sufficient accuracy.

The Victor combination meter, type V, is specially designed for use on electric automobiles, electric launches, etc. It is extremely dead-beat and rigidly constructed to withstand the excessive jar and vibration to which it must be subjected. Dust and moisture cannot reach the moving parts, which are protected by a neat and substantial case.

A complete and handsomely illustrated catalogue just published by the H. W. Johns-Manville Company, 100 William Street, New York, goes into the details of these meters.

The New "Kappa" Switch.

The accompanying illustrations show the new "Kappa" switch recently put out by the Trumbull Electric Manufacturing Company of Plainville, Conn. The switch is made in 25 amperes only,



"KAPPA" SWITCH, FUSED AND UNFUSED.

single-pole, double-pole and three-pole, unfused and fused, for both enclosed and open-link fuses, and has just been approved by the Underwriters. It is designed for light work and is intended to meet the demands for an inexpensive switch which is at the same time thoroughly reliable. The new switch is subject to Trumbull's regular system of inspection, and each one is guaranteed to be a carefully assembled article.

QUESTIONS AND ANSWERS.

A Remedy for Cross-talk.

E. G. A., Mescalero, New Mexico: "I have charge of a grounded telephone line about 19 miles long which is free from any disturbances except for about half a mile, where another grounded line parallels this line, which causes considerable cross-talk; and also lightning causes a lot of burn-outs. Will a metallic circuit remedy these faults, and should the wires be transposed? If so, how often? In a country with as much mineral soil as New Mexico, is there more resistance through 19 miles of a grounded line than the same distance of metallic No. 12 iron wire?"

ANSWERS.

The easiest way to overcome this difficulty is to string another wire over the portion of the circuit which is affected, transposing about every five poles. Connect the two wires at each end of the half mile to the two terminals of one coil of a good repeating coil. The other coil of the repeating coil has one terminal grounded and the other connected to the line. The line, then, instead of being a continuous grounded line, runs through the repeating coil to ground; the talking current is induced into the short transposed metallic circuit and flows past the troublesome half mile into the second repeating coil; this in turn induces it into the remainder of the line.

The repeating coils should have plenty of iron in them, and the core should form a closed magnetic circuit to give good induction. The windings on the coil should have the same number of turns. These coils are procurable in the market. There is a possibility of some difficulty in ringing over this line, but with good coils this is unlikely.

The cross-talk may be due to induction from the paralleling line, to difference of potential between the grounds, or to magnetic disturbances along the line. The breaking up of the line into three parts, as above suggested, will probably cure the trouble even if due to the latter causes.

There is much less resistance through the grounded line than through the No. 12 iron metallic circuit, if the grounds are moderately well made. The resistance of the earth path itself is very small.

A Strong, Light Back Brace.

The back brace for telephone construction illustrated here has recently been put on the market by the Peirce Specialty Company of Elkhart, Ind. It is made of channel steel, thoroughly galvanized to stand the most rigid tests, and is very strong, at the same time being very light. A one-inch channel back brace has a little more strength than a 1¾-inch flat brace and weighs only three-quarters as much. This new brace has pointed lugs thrown out on its inner surface which press into the pole at the center and into the cross-arm at each end, effectually preventing creeping and vibration.

CHANNEL-STEEL BACK BRACE.

Indiana Telephone Items.

A 50-year franchise has been granted by the town trustees of the new steel city of Gary to the Chicago Telephone Company. The field is regarded by telephone people as exceptionally rich in possibilities.

The Franklin Telephone Company of Franklin has notified its patrons of an increase in rates after November 1st. Party-line patrons outside of the city will be charged a monthly rental of $1.25, those inside the city limits $1.50, while $2 a month will be charged business houses. In each case the increase is 50 cents a month.

The officials of the Indianapolis Telephone Company have confirmed the report that an order has been placed for new equipment amounting to $155,-000. S.

Telephone News from the Northwest.

The Cannon Ball Telephone Company has begun constructing a telephone line between Mott, N. D., and Richardton.

The Rocky Mountain Bell Telephone Company has begun suit in the federal court at Helena, Mont., against a number of labor unions which were involved in the recent strike and boycott. Damages of $75,000 are asked.

The Northwestern Telephone Exchange Company will install an all-copper circuit between Brainerd and Bemidji, Minn., in the spring.

The Northwestern Telephone Exchange Company has recently made a raise in rates at Breckenridge, Minn., and there is a great deal of dissatisfaction thereat. Citizens talk of an independent exchange. ....R.

Steam Turbines and Generators in the Textile Industry.

Among the noteworthy features of the textile industry this fall has been the extensive ordering of steam turbines for installation in some of the largest mills of New England and the Central and Southern states. In the electrification of textile mills, steam turbines and generators, as well as induction motors for alternating current, are now playing a leading part.

Contracts recently awarded by textile manufacturers for the improved type of turbines built by the Allis-Chalmers Company include three turbines for the new 10,000-horsepower plant of the Pacific Mills, Lawrence, Mass.; one of 2,200 horsepower for the American Thread Company's Watuppa Mills, one of 3,000 horsepower for the Tremont and Suffolk Mills, and machines of 800 horsepower each for the Jamestown Worsted Mills and Cherry Cotton Mills. These turbines are of the same general type as the machines installed on the new record-breaking liners Lusitania and Mauritania.

TYPICAL STEAM-TURBINE UNIT FOR TEXTILE MILLS.

The accompanying illustration shows one of the Allis-Chalmers turbine units for manufacturing plants.

Advertising Public Utilities.

The first class in advertising in the new Cincinnati College of Finance, Commerce and Accounts held its initiatory session in the rooms of the college early last month. Ben Mulford, Jr., of the Blaine-Thompson Company, spoke on "Advertising, the Life Blood of Trade." He described successful advertising as "really typographical hypnotism that turns the hands toward the checkbook or the purse." Among other things, he said: "The tremendous increase in the demand for both gas and electricity as a result of the splendid campaign of the Union Gas and Electric Company in our Cincinnati papers, demonstrates the value of advertising of public utilities.

"I've seen this old country of ours pretty thoroughly between the oceans and the lakes and the gulf, and few cities have more beautiful trolley rides than are offered Cincinnatians. I believe the Cincinnati Traction Company could profit by the enterprise of the gas moguls, and turn out some trolley ads and illustrated literature which would make next summer's trolley travel break all records."

Wages and Hours of Labor.

The Bulletin of the Bureau of Labor giving statistics of wages and hours of labor and the retail prices of food, 1890 to 1906, has just been issued by the Department of Commerce and Labor, Washington, D. C. The average per cent. of increase for 1906 over 1905 in wages per hour of all industries is given as 4.5 per cent., and the decrease in hours per week 0.5 per cent. For the same periods the electrical industry shows an increase of 10.1 per cent. in wages with no change in hours. Comparing the year 1906 with the average for 1890 to 1899 there was an average increase in the wages of all industries of 24.2 per cent. and a decrease of 4.6 per cent. in the hours of work. The corresponding figures for the electrical industry for this comparison are 20 per cent. and 6 per cent., respectively.

GENERAL TELEPHONE NEWS

Consul George Heimrod reports that Apia and adjacent plantations in Samoa are now provided by the postal authorities with telephone communication. Within a radius of five kilometers the fixed rate for this service is 200 marks, or $47.60 a year, and for every 100 meters service beyond this limit an additional charge of four marks, or 95 cents, is exacted.

The last link in the long-distance telephone system connecting Lethbridge, Alberta, with the southern towns and cities in the province, was completed on October 22d. This line connects the two provincial long-distance lines already completed in the southern portion of the province, and Cardston is able to talk to Edmonton, a distance of 400 miles, over the provincial lines.

CORRESPONDENCE.

Continental Europe.

Paris, October 15.—At Lyons is to be held an exposition under the patronage of the Agricultural and Scientific Society. It relates to the application of electrical methods to agriculture and the industrial arts. Owing to the success of the last exposition, which was held in 1906, it was decided to hold another and much larger one next spring. The former exposition was chiefly devoted to small electric motors for domestic purposes. As Lyons is the center of a region which is covered with power lines coming from hydraulic plants having a total of 200,000 horsepower, there is a wide field for the use of motor-driven machines as well as improved lighting and heating methods. Small motors are especially desirable, and in the future it is expected to promote their use in agriculture throughout the region. In order to do this the society wishes to show the rural population what can be done with such motors so as to stimulate their use.

The Electrotechnical Institute of Grenoble, which also lies in the center of hydro-electric supply, is becoming one of the most important in France, and in order to keep pace with its development Mr. Brenier, president of the Chamber of Commerce, lately made a donation of a large tract of ground valued at $150,000 in order to erect new buildings.

A hydro-electric plant which will be among the largest in Switzerland is to be erected upon the Rhone near Geneva, according to the present project. A concourse of plans for the new station was held not long ago in order to select the best method. The new plant will lie below the present Chèvres plant on the Rhone at a point known at La Plaine. A supply varying from 120 to 600 cubic meters is expected at this point, using low-pressure turbines such as the Chèvres plant now employs. The head of water is about 40 feet at the most. Two-phase alternators with 5,000 volts per phase and 48 cycles will no doubt be used. Unusually long distances are to be covered by the pole lines, and these are to work at 25,000 volts. According to the present ideas there will be 10 or 12 main turbine-alternator sets in the main room, using vertical shaft machines. The latter are to have two separate revolving outer parts instead of one, as usual. But one revolving part will be used during the periods of low water. There will be four large exciter sets for these machines.

Among the new companies which have been formed in France I may mention the Britannia Electro-textile Company, whose headquarters are fixed at Paris; also the Pyrenees Electric Company at Tarbes in the south of France, which is to go extensively into hydraulic work. The Schiffers-Brice firm of Paris will be devoted to gas and electric-light appliances, while the Buchet-Pagnon firm, located at Villefranche, will enter the market with different electrical appliances.

From Holland comes the new project of an electric tramway which is to run between Middelburg and Flessingue, and it is also stated that negotiations are in progress for the changeover of the lines of the Goosche Stoomtram to the electric system. The latter is an extensive system of lines which has about 25 miles total length, and is located in the region to the south of Amsterdam and not far from the Zuyder Zee.

At the recent congress of the French Association for Advancement of Science there were about 400 members present, and among the subjects which were treated I may note the study of the arc light, upon which Professor Blondel of Paris read an instructive paper. Messrs. Guye and Zebrikoff gave the results of their work upon arcs of different kinds. In the field of electric waves Mr. Turpain read a paper on this subject, and Lieutenant Tissot's paper was especially devoted to radio-telegraphy in practice. A. DE C.

Great Britain.

London, October 19.—The annual accounts of the London County Council Tramway Department for the year ended March 31, 1907, have been issued. They show that 314,227,090 passengers were carried during the year in question and that the total revenue was £1,414,603, the working expenses being £1,075,116. The gross revenue was thus £339,487, from which has to be deducted an amount of £329,-814, leaving a net balance of £9,673. The system now comprises close upon 120 street miles, all of which is worked by the Council with one small exception. No less than 20 per cent. of the passengers were carried for one-halfpenny fares, and 63 per cent. at onepenny. The cost of power was 0.676d. per kilowatt-hour upon the 25,009,345 units generated at the Council's Greenwich generating station, but the actual figure for the whole system is higher than this on account of some temporary arrangements still being in force. The traffic receipts for the lines working electrically were practically one shilling per car-mile, a trifle less than last year, while the working expenses were 7.75d. per car-mile, also less than last year.

A series of summonses issued a few months ago against the Underground Electric Railways Company of London for permitting the emission of black smoke from the chimneys of its electric power house at Chelsea have been the cause of some interesting expressions of opinions as to what constitutes black smoke. So much so that the magistrates before whom the case has been heard are unable to come to a decision, and there have been several postponements. Mr. J. R. Chapman (formerly of Chicago), the chief engineer to the company (who, by the way, has just been appointed to the Board of Directors of the District Railway Company), contends that his particular smoke is not black but brown, and that anyone who contends otherwise must be color-blind.

There is a general outcry throughout the country concerning the noise made by electric tramcars, and the point raises a speculation as to the useful, not to say peaceful, life of a tramcar. In all cases where complaints have been made the systems are old ones, compared with the age of the industry, and the noise and rattle of the cars, which is not denied, through wear bears a close relationship to the depreciation or renewals account.

A definite proposal has now been placed before the Edinburgh City Council for the conversion of the existing cable tramway system to electric traction. There at present exists a private company in Edinburgh which owns the tramways under a lease from the Corporation, but this concern has expressed a willingness to part with the undertaking upon suitable terms. Before negotiations can be commenced, however, the consent of the Corporation must be obtained. The terms asked by the new syndicate, however, would seem somewhat prohibitive, viz., a lease of 60 years and the adoption of the overhead trolley system. The Edinburgh cable system is the only one in the United Kingdom, and is noted for its efficiency.

An electric-pumping plant which may be termed unique has just been put into operation at the Lindal Moor mines in the north of England. A group of mines has been unworked for a long time owing to their being flooded, and the difficulty to be solved was the rapid unwatering of them. In conjunction with the Electrical Company of London, a scheme was devised by which an electric-pumping plant was to be installed which involved the erection of a turbine-driven power house, the whole undertaking representing a cost of about $250,000. Power from the generating station is conveyed to the various mines by means of overhead mains, the pumps being capable of lifting from 1,000 to 4,000 gallons a minute. G.

Dominion of Canada.

Ottawa, Ont., October 26.—The Dominion De Forest Wireless Telegraph Company seems to be in serious trouble throughout the province of Ontario. A bailiff is now in charge of the local office at Toronto as a result of failure to pay rent. The office at Ottawa was closed up some time ago.

The Georgian Bay Power Company has completed its tunnel through the mountain at Ugenia Falls, Ont. The work was begun in February of last year, but the difficulties encountered were such that it is only completed now. The tunnel is 867 feet long, 9 feet wide and 8½ feet high, and it is 1,200 feet above the sea level. The big dam has not been commenced yet, but when it is completed a 52-inch pipe will be laid from it, through the tunnel, to the power house in the valley below. With a head of over 400 feet, it is expected to develop about 3,000 horsepower.

The International Waterways Commission has considered a proposition for the development of waterpower at a cost of $20,000,000 at Mille Roches, on the St. Lawrence. Application was made by the St. Lawrence Power Company of Canada and the Long Sault Development Company, a United States corporation. It is the purpose of the Canadian company to expend $5,000,000 and the American company $15,000,000. The Montreal Board of Trade and the Marine Association opposed the application, claiming that navigation would be impeded, which the promoters deny.

The application of the subsidiary company of the Ontario Power Company was laid before the International Waterways Commission, at its recent meeting at Toronto for authority to construct a tunnel on the banks of the Niagara River, one mile below the Falls, coming out below the Whirlpool. Objection was taken to this proposition, because it was alleged that the works might partially destroy the beauty of the rapids. A sub-committee will deal with the question. The next meeting of the commission will be held at Buffalo on November 20th.

The question of damming the Rainy River, at a point some distance below Fort Francis, for the purpose of generating power, was also discussed before the commission. The Canadian government has commenced important works on the river for the purpose of rendering the river navigable to larger vessels, and it is understood that fully $500,000 will be expended in constructing locks and dams. Inquiry will be made at Fort Francis and other places before a decision is reached. W.

Winnipeg, October 25.—A start has at last been made on the power development for the town of Battleford, Sask. Last week the contract for the erection of the power house was awarded to W. J. Broley of that town, but the arrival of power transmission poles is delaying the work considerably. B. Prince is mayor of the town.

W. J. Sutherland of London and New York has arrived in Vancouver, B. C., and is staying at the Hotel Vancouver. He is with a party of English capitalists who are interested in the Alaska Perseverance mine near Juneau, and the object of their visit is to make arrangements for operating the mine by electricity. Of the 40,000 horsepower to be produced the mine will only require 12,000, the rest being transmitted to the mines in the Silver Bow Basin. The English address of the company is c/o Burn & Berridge, 11 Old Broad Street, London, England.

It is expected that an announcement will be made within a few days regarding the tenders received by the city of Winnipeg for the power development at Point du Bois. H. N. Ruttan, city engineer, is now classifying these tenders, which are proving to be far more satisfactory than was expected before they were opened. In all over 100 firms have sent in tenders, but very few of them have tendered for the whole work. Cecil B. Smith, Winnipeg, Man., is civic power expert. Alderman Pulford is chairman of the power committee.

The power plant at Fort Saskatchewan, Alberta, which was owned by the town, was completely destroyed by fire. G. H. McAvoy may be addressed.

It is reported on good authority that the work on the big power dam at Fort Francis, Ontario, will be resumed in a short time under the management of George J. Huss, chief engineer of the Minnesota and International Railroad, now building into International Falls, on the American side of the river, opposite Fort Francis.

The City Council of Ladysmith, B. C., is considering several propositions to light the town streets. Alderman Robertson can give particulars, and it is expected that a local company will be formed for the purpose. R.

New England.

Boston, October 26.—Stone & Webster report net earnings for the month of August for the following-named companies: Brockton and Plymouth Street Railway, $7,662 in 1907, $10,435 in 1906; Cape Breton Electric, $11,246 in 1907, $10,921 in 1906; Edison Electric of Brockton, $5,866 in 1907, $2,685 in 1906; Lowell Electric, $7,109 in 1907, $6,698 in 1906.

The Consolidated Railway Company has awarded the contract for the construction of a trolley line from Middletown, Conn., to Middlefield.

The electrical engineering laboratory of the Worcester Polytechnic Institute has just received six special transformers from the Fort Wayne Electric Works. These transformers will be used in polyphase transformer experiments. They are of two kilowatts capacity and have a voltage ratio of 440 or 220 to 220 or 110.

A test was recently made by Charles S. Henshaw to see how far he could travel in an electric carriage on a single charge of the storage battery. It has been said that it was only possible to go 45 miles, but Mr. Henshaw declares that he went over 101 miles in his Columbia electric stanhope.

While at work at the station on October 13th Robert L. Mortimer, chief electrician of the Charlestown navy yard's wireless station, received a severe electric shock which robbed him of the power to speak. He remained in this condition until October 20th, when he received a second shock. The force of the shock was enough to throw him to the floor. When he arose he found his speech was fully restored. At least that is the story.

The Electric Cable Company of Bridgeport, Conn., has awarded the contract for an addition to its plant. The company is a manufacturer of magnet wire and electric cables. The new structure will be of brick, one story high, 60 by 120 feet.

The town of Fryeburg, Me., will soon secure a new source of power by the improvement of an undeveloped waterfall in the Saco River. The work of damming the river has been almost completed. Two large wheel pits have been built.

The Boston and Eastern Electric Railroad is now planning to build a tunnel under Boston Harbor and run by subway directly to the center of the city instead of running to the Sullivan terminal station of the Boston Elevated Railroad as first proposed. By this new route the distance from Lynn to Boston would be lessened about one and one-half miles. The company also proposes to build a terminal under Postoffice Square, Boston, Mass., large enough to accommodate 150,000 passengers a day. The matter will be brought before the railroad commission some time next month.

Plans for the Forest Hills Square station of the Boston elevated railway have been filed with the railroad commission. B.

New York.

New York City, October 26.—In a petition to the court, the receivers of the New York City Railway Company have been granted $3,000,000 for traction needs. It is stated that in the fire which destroyed the Lenox and One-hundred-and-forty-fifth Street barns 300 cars were destroyed and in the second fire on September 9th 80 cars were lost. The destroyed cars were of the winter or closed type, and the receivers said that it was imperative that an appropriation should be given them for new cars and other equipment. To operate the system properly the receivers also asked permission to replace the destroyed car barns, where repair shops were located. Since the fire the system has been at considerable disadvantage because of the lack of these shops. Cars have to be left on open switches at night, which not only injures the rolling stock but prevents proper inspection. The expenditures recommended by the receivers are approved by the United States Circuit Court.

The wireless telephones which have been on trial on the battleships Virginia and Louisiana of the North Atlantic fleet for several weeks were given formal indorsement this week by the purchase of 27 sets of instruments. The cost of this equipment, outside of the expense of installation, will be more than $35,000. The tests of the wireless telephones have proved satisfactory, apparently. One of the chief difficulties in the use of flag signaling is that it is likely to be obscured by the smoke which accompanies the fleet in its maneuvers. The work of installing these sets will be begun soon, and it is planned to have them in operation before the fleet sets out to the Pacific. The wireless-telephone system will also be installed on the supply ships Glacier and Culgoa, which will accompany the fleet, and on the Panther, now being fitted out at the navy yard as a repair ship. Probably this equipment will be extended also to the six torpedo-boat destroyers, which are to make the trial.

It is announced that the New York and Long Island Telephone Company, formerly the South Shore Company, which had its inception at Freeport, L. I., over 10 years ago and at one time covered a large portion of Nassau County and as far east as Amityville, Suffolk County, has gone out of existence. The company has frequently been absorbed by the New York and New Jersey Telephone Company. The Long Island company at one time had an excellent local business, but since the De Fere interests were bought out the company was allowed to deteriorate and the service dwindled till it died a "natural death."

The order for the consolidation of the American Society of Mechanical Engineers and the Mechanical Engineers' Library Association, as already announced in the columns of the Western Electrician, has been granted by Justice Blanchard in the Supreme Court. The large library interests of the association are still retained and form part of the fine library in the Engineering Societies Building.

Final order has been given the Forty-second Street, Manhattanville and St. Nicholas Railway to increase its trolley service below Houston Street. It directs that at least one-fourth of all the cars which are turned back at Houston Street shall continue to at least Murray Street between the hours of 6 a. m. and 6 p. m. Better destination signs must be put on all cars of this system, and they must be placed more conspicuously. The final order to compel the New York City Railway Company to increase its service on the Fourth and Madison streets lines is now being drafted and will shortly be issued. E. H. S.

Southeastern States.

Charlotte, N. C., October 26.—B. F. W. Bryant, Boston, Mass., has been granted a franchise to operate the Thomasville, N. C., Light and Power Company, furnishing the town with lights, it being proposed to erect a $20,000 plant and furnish a 24-hour service.

The Whitney Company, Salisbury, N. C., recently sent representatives to High Point to ascertain what amount of power that town could utilize. Rates are made on a basis of $20 per annum per horsepower and $16 per annum for night service.

The Richmond and Chesapeake Bay Railroad is ready to begin operations, running a 20-mile electric line between Richmond and Ashland.

The Newcomer-Manry Company, Atlanta, has the contract for supplies for the new electric-light plant, Lincolnton, N. C., the power to be supplied by the Southern Power Company.

An electric-lighting plant will be put in operation in Hamlet, N. C., the property being owned by J. A. Williams.

The electrical development at Blewitt's Falls, N. C., will not be affected by the recent suspension of the Knickerbocker Trust Company of New York, the bonds of the electric-development company having been sold to underwriters who are amply able to pay for the same when delivered.

Two electric companies will soon be competing in Hickory, N. C. The Horseford Power Company, with $125,000 capital, has been chartered to develop Odell Shoals, on the Catawba River, while the Water Power Electric Company will develop a waterpower one and one-half miles distant on the same river, Col. M. E. Thornton being active in the latter company.

After a discussion by a joint committee representing the city of Richmond on the question of requiring the Virginia Passenger and Power Company to install a double overhead-trolley system, to correct the electrolysis evil, the matter was referred to a sub-committee. The proposed work will cost from $750,000 down to $225,000, according to the point of view taken in the discussion.

Mr. George I. Whitney of Pittsburg, Pa., has visited the Cone Bros. at Greensboro, N. C., with a view to placing a contract to furnish electric power for the Cone mills from the Whitney plant on the Yadkin River, 45 miles distant. The cotton mill people are considering the proposition.

The Whitney Company has selected Salisbury, N. C., as the distributing point for the 45,000 horsepower electric plant being developed on the Yadkin River, 30 miles away, the power to be ready for general distribution about July, 1908.

The Southern Power Company has virtually completed its transmission lines to Newton, N. C., 90 miles west of the principal hydro-electric plants, and a sub-station fitted up with $10,000 worth of machinery will be erected.

The Southern States Electric Company of Atlanta has been placed in the hands of a receiver upon application of the Electrical Manufacturing and Equipment Company, also of Atlanta, owning the entire capital of $47,000. It is understood that the former company is by no means insolvent, but that the latter-named company proposes to take over the business of the former. The assets of the Southern States Company are $139,000; liabilities, $77,000.

L.

Mexico.

Mexico City, October 23.—The German government sent a commission of electrical experts to Mexico to inspect and investigate the great electrical power plants of this country. The German commission is headed by Geheimrath Wittfeld. It includes six other members. Its members were in Mexico for some time, and much of their time has been spent at Necaxa. They expressed amazement at the development of electric power at that plant. The original concession which the Mexican government granted to the Mexican Light and Power Company called for the development of 30,000 horsepower within 10 years. This was in the spring of 1903. Now, in a little less than one-half the time, 20,000 horsepower more than the required amount of 30,000 horsepower has been developed, while, with the vast improvements at the plant which have been under way for some time, this capacity will be increased to about 110,000 horsepower. The German commission also inspected the El Dura hydro-electric plant of the Guanajuato Light and Power Company, which furnishes many of the mines of the Guanajuato district with electric power, as well as lights for the cities of Guanajuata, Irapuato and other places of that region. A number of electrical men of Germany are accompanying the government commission on its trip.

The improvements and enlargements which the Compania Electrica é Irrigadora is making to its hydro-electric plants and transmission system in the state of Hidalgo will have cost more than $3,250,000 when completed. Plans have been adopted for the erection of a new hydro-electric plant which is to be located at Tetepango. Bids have been received from manufacturers of electrical machinery in the United States and Europe for electrical and turbine equipment for the proposed plant. The company is also installing a new plant at La Canada at a cost of about $750,000. This plant will have a capacity of 1,250 horsepower. The two plants which the company already has in operation at Juando and Elba have a total of 7,000 horsepower.

Manuel Cuesta Gallardo of Guadalajara will install a hydro-electric plant at Puente de Tololotlan, on the Santiago River, about 15 miles from Guadalajara. It will have an initial capacity of 2,050 horsepower. He has entered into a conditional contract to supply the mining districts of Etzatlan and Hostotipaquillo, state of Jalisco, with electric power. The prices quoted were $120 per horsepower a year in the Etzatlan district and $135 in the Hostotipaquillo district. Mr. Gallardo promises to invest not less than $1,000,000 in the project.

A syndicate of Montreal men which owns a concession to install a hydro-electric plant on the Conchos River in the state of Chihuahua have contracted with mine owners of the Parral district to supply them with 20,000 horsepower.

A hydro-electric plant of 1,000 horsepower is to be installed on the Ameca River in the San Sebastian district, state of Jalisco, by the Natividad Mines and Reduction Company.

Edward J. Cummings of Guanajuato is preparing to install a large hydro-electric plant on the Quiotepec River, near Tomellin, state of Oaxaca. The plant will have a capacity of 48,000 horsepower.

W. D. H.

Michigan.

Detroit, October 26.—The Superior plant of the Eastern Michigan Edison Company is nearing completion, and it is expected that one waterwheel will be in operation by November 1st.

The Detroit United Railway will postpone the trial of T rail on Jefferson Avenue until spring, as the council questions the authority of the commissioner of public works to grant permission for the trial, and by the time the question is settled it will be too late to begin the work this fall.

The new sub-station of the Mt. Clemens Electric Company is nearly completed, as is also the transformer house at Grosse Pointe. As soon as these buildings are completed, power will be received over the 22,000-volt, three-phase transmission line from Detroit, which has been completed for some time.

Electrical Expert H. H. Crowell, who was retained by the mayor to determine whether the rates of the Edison Illuminating Company were reasonable and equitable, made report of his investigation to the council this week. His report is very favorable to the company, and he finds that the rates are lower than in any other large city in the country except Buffalo. He indorses the rate methods of the company, particularly the differential rates. This will assist the council in considering the recent request of a few merchants for a uniform rate. Mr. Crowell says that the rate to small power users has done much to stimulate small manufacturing interests in Detroit. Mr. Crowell is engineer for the New York State Commission, and his findings carry unusual weight.

Mr. Joseph W. Martin of Detroit asked the Flint Council for a franchise for a new telephone company on the 21st inst. The ordinance provides that the company be allowed to build a telephone system and operate it for a period of 30 years. It passed its first and second readings and was referred to the committee on ordinances. The company is to be a part of the Grange telephone lines, covering a number of counties.

A new electric line from Coldwater to Lansing is proposed, touching Union City, Tekousha, Marshall, Eaton Rapids and a number of villages.

D.

Indiana.

Indianapolis, October 26.—The Grand Central Traction Company, which proposes to build an interurban road from Indianapolis to Evansville through intermediate towns and cities, has applied for 50-year franchises in Terre Haute, Evansville and Huntingburg. G. C. M. Shanks, representing the company, says that the road has been financed and that more than 80 per cent. of the right-of-way has been secured.

The Evansville Suburban and Newburg Electric Railway Company has begun the survey of a new line from Chrisney to Cannelton by way of Troy and Tell City.

That Terre Haute is destined to become an interurban center is evidenced by the announcement that no fewer than six new traction lines are being promoted to be built to or from Terre Haute. The latest company to seek admission to Terre Haute was recently incorporated at Quincy, Ill., to be known as the St. Louis, Terre Haute and Quincy Traction Company.

One of the finest and best equipped interurban-railway power plants in the country has just been completed by the Indianapolis and Louisville Traction Company in Scottsburg. It is built of brick, steel and cement and represents an expenditure of $260,000.

The terms upon which the City Council of Huntington offers to grant to the Fort Wayne and Wabash Valley Traction Company a franchise to furnish light and power to the city are not such as appeal to the company very favorably. The proffered franchise is for 25 years and provides that all electricity shall be generated in the company's power house in Huntington; for the payment to the city of 10 per cent. of the gross earnings each year; the right to terminate the franchise whenever the company ceases to use the local power house as a generating station; also for a rate of two cents a kilowatt-hour on power for operation of all city motors, pumps, etc., and that the maximum rate be 10 cents. The council declares that the citizens contributed $7,000 to procure the power house of the company in Huntington, which the company is about to abandon with the view of generating all the electricity in its large power house in Fort Wayne.

The Gosport Electric Light and Power Company filed articles during the past week with the declared purpose of building, equipping and operating an electric-light and power plant in Gosport. J. C. Brown, J. S. Davis and William A. Montgomery are directors.

In compliance with the vote of the people the City Council of Washington has passed an ordinance providing for the sale of the municipal electric-light plant.

The Town Board of Hagerstown has ordered plans and specifications prepared for the construction of a new city electric-light plant. The construction of the plant will be the result of a favorable vote by the people.

The National Electrical Company of Indianapolis is a new concern incorporated to manufacture electrical apparatus and to do a general business of constructing and installing electric-light and power plants. R. O. Balsey, Henry C. Schildmier and C. B. Campbell are directors.

A company of capitalists composed of R. E. Breed, Philadelphia; J. G. Masse, F. A. Ballou and Pardon Miller, Providence, R. I.; A. S. Cook, Woonsocket, R. I., and C. H. W. Fitz, Pawtucket, R. I., all bondholders in the American Gas and Electric Company, which owns a score or more of electric-lighting, heating and power plants, including the Marion Light and Heating plant and several other plants in the state, made a tour of inspection of said plants during the last week.

S. S.

Illinois.

Peoria, October 26.—Greenfield now has electric street lighting, the current having been turned on this week for the first time. The current is transmitted from Whitehall, which is 12 miles from Greenfield. The company is also furnishing a day circuit.

The Pekin Light, Heat and Power Company has placed the new battery of boilers in commission and is now prepared to take care of its increasing load without further trouble. The company has been securing steam from a neighboring factory for a week to carry the load while the change was being made.

The city of Pekin has discovered that the contract for street lighting expired the 30th of last April. Bids for the lighting of the streets will probably soon be advertised for as soon as the council meets.

The municipal lighting plant at Springfield is badly in need of repairs, and the question of rewinding the seven armatures is now before the street-lighting committee of the City Council, and it will take some prompt action. The committee has received a bid to rewind the armatures, of $165 each, with a guarantee. As it takes six machines to carry the street lights, and as one of the aramtures is now burned out, something must be done or the city will be without light. Mayor Reece has appointed a committee to appraise the plant, as by the new system of bookkeeping the plant has to be carried at a valuation, to ascertain the exact amount of the city's assets and liabilities.

The Illinois Traction Company is now running its cars into the business district of the city of Lincoln.

Manager Linn of the Illinois Traction Company says that the line between Mackinaw and Lincoln will be opened to traffic about the first of the year. The road runs in almost a straight line from Lincoln to Mackinaw, a distance of 27 miles, and will make a short cut from this city to Springfield and St. Louis. There is to be an overhead crossing of one steam road and a subway for another.

The City Council of this city and the officials of the Western Union Telegraph Company had a conference as to the wires of the company being placed underground, with no signs of reaching an agreement. The company flatly refused to pay an annual rental for the streets of $1,000, as it would establish a precedent. It is willing to put its wires underground, but wants till the first of January, 1909, to complete the work. The Postal Telegraph-cable Company and the American District Telegraph Company have also been cited to appear, although the Western Union may take care of the wires of the American District Telegraph Company.

V. N.

Northwestern States.

Minneapolis, October 26.—The Mississippi River Electric Power Company, which already owns power rights at Elk River and Clearwater, Minn., has purchased another dam site and flowage rights near Anoka, Minn. This is 12 miles nearer Minneapolis than the Elk River location and will probably be the first to be developed.

The Lake Andes, Wagner and Armour Traction Company has been granted a franchise to build a trolley line into Aberdeen, S. D., and to operate a local service as well as a lighting system.

Stock has been subscribed for the new Boone-Webster City (Iowa) interurban line.

The Keokuk-Columbus Junction (Iowa) Interurban Company has filed articles of incorporation.

Bonds have been voted at Wood River, Neb., for the construction of an electric-light plant.

There is talk of starting an electric-light system at Emerson, Iowa.

A contract has been granted to the Chippewa Valley Construction Company to furnish electric-lighting facilities at Ashland, Wis., for 15 years. A plant is to be built at Copper Falls and 3,000 horsepower developed. Power will also be supplied.

R.

Pacific Slope.

San Francisco, October 24.—While the Southern Pacific Railroad Company is still actively engaged in putting into effect its plans to run the suburban lines in the neighborhood of San Francisco Bay by electricity, it has been decided to postpone the acquisition of certain necessary franchises and secure all the franchises at once after the plans have been more fully developed.

Mamoru Tashiro and Morisaburo Tonegawa, officials of the Imperial Telephone Company of Japan, a corporation backed by the Tokio government, arrived here last week from Vancouver, B. C. They are commissioned to inspect the various telephone systems throughout the United States, with the object of using whatever information they gain in perfecting the Japanese system. After an investigation here they will proceed to the cities of the East.

High-tension wires carrying power from the California Gas and Electric Company's plant to the United Railroads in San Francisco were short circuited one night last week by miscreants, and for an hour or more all electric street-railway lines north of Market Street were out of operation.

The $100,000 which the eastern backers of the electric road from Baker City, Ore., to Eagle and Pine valleys required to be raised in that section before beginning work has been subscribed and the actual work of construction has begun.

The town of Chewalah, Wash., has applied for a franchise to construct a line of poles and wires to convey electricity for lighting purposes from the source of power on Chewalah Creek to the town over the public roads. The city proposes to install and operate its own lighting plant.

The Arrowhead Reservoir Company is spending $4,000,000 on developments in the San Bernardino Mountains, where a power house will be erected to develop about 10,000 horsepower of electricity from the waterpower.

E. S. Babcock, president of the Los Angeles and San Diego Beach Railroad, says that when the line is electrified in the near future it is probable that the company will use the catenary bracket suspension system for stringing the trolley wires, and that on the cars either the bow or pantagraph trolley will be used. An extension of time has been granted the company for the construction of trolley lines in San Diego.

The monetary stringency in the East makes it difficult to secure funds for carrying out the plans of new electric railroads and other engineering projects still in the promotion stage. The Knickerbocker Trust Company, which was involved in difficulties among the first, is one of the financial backers of the Stanislaus Electric Power Company of San Francisco. The management of the power company, which is rapidly completing its long-distance transmission line from the Stanislaus River to San Francisco, has received a dispatch from the Knickerbocker company to the effect that work is to be continued on the project without fail and that arrangements will soon be made to tide over the emergency. The Metropolitan Gas and Electric Company, successor to the San Francisco Coke and Gas Company, was also financed by the Knickerbocker Trust Company, but a large proportion of the bonds have been sold and the new plant is paid for. The company owns and operates the only independent gas plant in San Francisco and has plans for installing an electric distributing system to handle the current transmitted to this city by the Stanislaus Electric Power Company at retail.

The Oro Water, Light and Power Company has for some time been supplying light and power for Oroville, Cal., and a number of the dredgers operating in that district, from its small plant near Pentz, is now making a ditch to carry water to its projected plant, which will probably not be constructed for two years. The new ditch will carry 5,000 miners' inches with a fall of 1,850 feet.

Carl F. Schrader is preparing to install an electric-light system in Needles, Cal., power for which will be obtained from the Victor and Virgin Mining Company. A.

PERSONAL.

James S. Collins of Savannah, Ga., is the new vice-president and general manager of the Macon Railway and Light Company of Macon, Ga.

D. J. Burns, sales manager of the Ward Leonard Electric Company, Bronxville, N. Y., is making a trip to Chicago and vicinity in the interests of his company.

D. W. Dozier has resigned his position as chief engineer and superintendent of the power stations of the Twin City Rapid Transit Company. He is succeeded by George Caywood of Milwaukee.

Mr. George W. Jackson, the well-known engineer and contractor of Chicago, was taken ill a week or so ago as the result of directing work on the southwest land and lake tunnel from an open boat. Mr. Jackson was seriously ill for a time, the ailment having been diagnosed as pneumonia, but his condition is understood to be improved.

C. M. Lowe, manager for the Postal Telegraph-cable Company at Oklahoma City, has been transferred to Little Rock, Ark. Mr. Lowe has been manager of the Oklahoma city office for three years, but will be special agent at Little Rock, having charge of Arkansas and part of Texas and Louisiana. Joseph Coffer, now manager at Muskogee, will be transferred to Oklahoma City.

Richard R. Smith, general manager of the Evansville and Southern Indiana Traction Company, has tendered his resignation and will go to Louisville to become the manager of the Louisville City railway system. During the two years of Mr. Smith's supervision of the Evansville and Southern system $300,000 has been expended in improvements. The Louisville company operates 200 miles of track and the general management of such a large system places Mr. Smith in company with the leading electric-railway managers of the country.

Theodore N. Vail and Edward J. Hall of Boston, president and vice president of the American Telephone and Telegraph Company, were in Minneapolis recently on their way to Colorado Springs.

John M. Robb, who was formerly secretary and treasurer of the Peoria Gas and Electric Company and who recently accepted the management of the Chattanooga Gas Company at Chattanooga, Tenn., became temporarily insane from overwork and wandered from his home in Chattanooga on October 11th. He was last seen at the naval recruiting office in St. Louis, Mo., where he attempted to enlist as a coal passer. A reward of $100 for information as to his whereabouts is offered by his relatives, who live in Peoria. Mr. Robb is well liked, and has many friends in Peoria and elsewhere, who earnestly hope that no harm has come to him as the result of his misfortune.

The recent death of Ernst Danielson has again brought attention to the important work of that well-known Swedish electrical engineer. Although only 43 years old, his achievements were well known to the technical men of both Europe and America. From 1890 to 1892 he was in this country, connected most of the time with the Thomson-Houston Company of Lynn, Mass., where he was in charge of responsible work. For a long time he was chief engineer and later technical director of the Allmanna Svenska Elektriska Aktiebolaget of Westeras, Sweden. From 1895 to 1900 he had an extensive consulting engineering practice in Stockholm. The most important work of Danielson consists of his researches in the three-phase system and its utilization for power transmission. His faith in the system was shown by his design of what was perhaps the first hydro-electric power transmission on a large scale, the well-known Hellsjön-Grängesberg installation.

ELECTRIC LIGHTING.

An electric-lighting system will be established at Falls City, Neb.

E. E. Wescott has been granted an electric-light franchise at Plattsmouth, Neb.

Otto Eckhoff of Wittenberg, Wis., will apply for a lighting franchise at Crandon, Wis.

The Piatt Electric Company will establish an electric-lighting plant at Cooperstown, N. D.

The Electric Light Company has been granted a twenty-year franchise at North Platte, Neb.

Bonds to the amount of $10,000 have been voted to install an electric-light plant at Akron, Iowa.

Work has been commenced on the electric-light plant at Tecumseh, Neb. J. E. Martz is superintendent.

The city of Waterloo, Iowa, has voted bonds for the purchase and improvement of the electric-light plant.

An electric-light franchise has been granted at Central City, Neb., to L. S. Jenkins and H. D. Forrest of Omaha.

The Midland (Tex.) Light Company has been incorporated with a capital of $15,000 by E. R. Bryan and others.

The Burlington Junction (Iowa) Electric Light and Power Company has been incorporated with a capital stock of $6,000.

The Chippewa Valley Construction Company has been granted the franchise for an electric-light plant in Ashland, Wis.

The contract for installing a new electric-light plant at Tekamah, Neb., has been let to Bortenlanged & Co. of Omaha.

The Citizens' Light and Power Company has been organized with $250,000 capital stock to build an electric-light plant at Putnam, Okla., and later to enter Oklahoma City. C. G. Jones is president, W. H. Philipps vice-president, W. L. Peck treasurer, W. E. Grisby secretary, and F. H. Peck general manager. Mr. Peck comes from St. Louis and will have personal charge of the erection of the plant.

Preliminary work is to be pushed at once on the plan for artistically illuminating Dearborn Street between the river and Van Buren Street, Chicago. It is announced that an engineer is to be secured by the Dearborn Street Improvement Association to work out the plan. It is intended to use pedestal lights with four globes. Merchants on Madison and other streets are talking of a similar plan, so that downtown Chicago may soon be attractively and brilliantly illuminated.

Bids were opened on October 26th in the office of City Electrician Carroll of Chicago for the supply of street-lighting material which will utilize current from the Lockport plant of the Drainage Canal. Besides a few minor accessories the specifications called for 2,500 alternating-current series arc lamps, 50 inductive regulators and 10 single-phase 60-cycle oil-insulated self-cooled step-down transformers. The several bids each aggregated $84,395 for the entire lot. Awarding of the contract was deferred.

Sealed bids will be received at the office of the village clerk, Newburgh Heights, Ohio, until November 18th for supplying the village with street lighting. All bids must be made upon forms furnished by the clerk, 613 Garfield Building, Cleveland. P. S. Ruggles is village clerk.

The high-school committee of the Central Board of Education in Pittsburg has decided to install an electric light plant in the Fifth Avenue High School. Since the opening of night classes the 1,500 lights in the building have been in almost constant use and the bills will be high. John H. McIlroy, chairman of the repairs committee, presented some estimates of cost he had secured, and they indicated that the total would be about $7,000 for a first-class plant. The secretary was instructed to advertise for bids.

The board of aldermen of Thomasville, N. C., has granted B. F. W. Bryant of Boston, Mass., a franchise for furnishing electric lights and power for the town. A contract was made to light the town for 10 years. The franchise will be turned over to a company being known as the Thomasville Light and Power Company. The company proposes to erect a modern plant at a cost of $20,000, and it is agreed to furnish the town with 24-hour service. This enterprise will be a great help to small industries to obtain power cheaply.

The Pacific Gas and Electric Company of San Francisco reports the combined income of all properties owned and controlled for the year ended June 30, 1907, as follows: Gross earnings, $12,164,399; operating expenses, taxes, etc., $7,016,507; net earnings, $5,147,892; interest and sinking funds of subsidiary companies, $2,497,414; surplus available for interest and sinking funds of Pacific Gas and Electric Company, $2,650,478; bond interest and sinking funds Pacific Gas and Electric Company, $1,010,673; balance, $1,639,805; preferred-stock dividend accrued, $600,000; final surplus, $1,039,805. This final surplus is equivalent to about five per cent. on the $20,000,000 authorized common stock of the Pacific Gas and Electric Company.

The export business of the Westinghouse Electric and Manufacturing Company has been unusually flourishing of late, and among the contracts taken by the company, two from the Republic of Colombia, South America, are of more than ordinary interest. This work calls for the complete equipment of two city electric-lighting plants. One is for the city of Tunja and the other for Bucaramanja. Tunja is located 9,000 feet above the level of the sea in the Colombia Mountains, while Bucaramanja is located 2,000 feet lower down the slope. The electric plant for the former will be steam driven, but at Bucaramanja is a splendid waterpower, and the plant will be operated in that manner. A peculiar feature of this mountainous country is that the mule back is the only method of transportation, and all the apparatus, boilers, steam engines, electric generators, switchboard appliances, etc., will have to be hauled from the seaport up into the mountains by pack animals.

ELECTRIC RAILWAYS.

It is reported that the electric road being built from Fort Dodge to Spirit Lake, Iowa, will be extended to Fairmont, Minn.

The Oklahoma Street Railway Company has just completed its new electric locomotive of 250 horsepower for use in hauling material to the Belle Isle and Britton extensions.

The Belleville and Interurban Railway Company of Belleville, Ill., has just been incorporated, capitalized at $100,000, and proposes to build an interurban electric railway from Belleville to Smithton. The board of directors is headed by Jacob Gundlach, Jr.

According to figures made public by the Wisconsin Railroad Commission, the Milwaukee electric railway in the year ended June 30th had the peculiar record of killing more people than the number injured. Thirty-five persons are said to have been killed in accidents and only four were injured.

Reports of the three companies comprising the holdings of the Chicago Union Traction Company for the year ended June 30, 1907, have been compiled and show a net deficit of $300,049 for the combined properties. The North Chicago Street Railroad shows a surplus of $23,893, the West Chicago Street Railroad came out even, as has been its practice, and the Consolidated Traction Company had a deficit of $323,942.

Through service from Evanston to Milwaukee will be established, it is said, on December 1st by the Chicago and Milwaukee Electric Railway Company. Although it has been possible hitherto to go all the way to Milwaukee by electric car, it was necessary to use the Milwaukee city system's line from Racine northward. Permanent stations are being built at various points between Racine and Milwaukee. The track work has been of the highest steam-road practice and the rails and ballasting are of such a character that the heaviest of cars can be used at their highest speed. Practically all the rolling stock for the through service has been received and is being tried out in the local runs between Evanston and Racine.

TELEGRAPH.

The direct New York-Havana cable of the Commercial Cable Company has been completed, the final splice having been made on October 18th at sea, 120 miles from Coney Island. Messages were exchanged between the provisional governor of Cuba and the president of the Commercial Cable Company.

By an agreement which became effective October 1st the Pennsylvania Railroad lines will for 25 years use the Western Union wires exclusively and permit its wires to be strung along the right-of-way. In exchange for this contract the Western Union drops all suits for damages and other litigation not only against the Pennsylvania lines but against the Pennsylvania company as well. The present arrangement indicates the restoration of friendly feeling between the Pennsylvania and the Gould interest, between whom acute hostility developed five years ago.

POWER TRANSMISSION.

The hydro-electric power plant of the Perley Lowe Company at Peshtigo, Wis., has been completed and arrangements are being made for furnishing light and power to the cities of Peshtigo and Oconto. The waterpower is the first of several that were planned some time ago. The second one, at High Falls, will be finished next spring and power will be transmitted to Marinette and Menominee.

D. J. Albertson of Kalamazoo, Mich., is at the head of the Manistee Power Company, which has just been incorporated, and will succeed the Electric Land and Development Company which owns many miles of land along the Manistee River. The capital stock is $1,000,000. It is the purpose to establish large hydro-electric plants on the river and furnish electric current for power and light to Traverse City, Cadillac, Elk Rapids, Manistee and other towns in the northern part of the state.

A project was launched in Tacoma, Wash., recently by the Cascade Public Service Corporation, which, it is said, will result in the erection on the Nisqually River at La Grande of one of the largest electric power plants in Pierce County. The Cascade Public Service corporation is said to represent the Pacific Traction Company's interests and was formed for the purpose of erecting a power plant for the Pacific Traction Company's lines. Since the cars of the company have been in operation the power for them has been furnished by the Snoqualmie company, but so rapid has been the growth that the projected plant is an urgent necessity and plans for it were made long ago.

PUBLICATIONS.

Iwan Brothers of Peoria, Ill., have published a little booklet entitled "Easy Digging." In it is illustrated and thoroughly described the improved Iwan auger for all kinds of earth boring.

"A Dictionary of Electric Railway Material," edition of 1907, constituting a book of 170 pages, has been issued by the Street Railway Journal, published by the McGraw Publishing Company.

An interesting booklet being sent out with the compliments of Eugene Munsell & Co. and the Mica Insulator Company contains numerous illustrations and a good description of the Pennsylvania Railroad tunnels and terminals in New York city.

The Benjamin Electric Manufacturing Company of Chicago has published a supplementary bulletin containing additions and changes affecting catalogues B-17 and B-17A. This company manufactures the well-known wireless clusters and a large line of lighting specialties. A number of new devices are listed in the supplementary bulletin.

The Nernst Lamp Company of Pittsburg has just published an interesting and well-illustrated pamphlet entitled "Bank and Office Lighting by Electricity." It brings out very clearly the merits of the Nernst lamp, particularly for this class of lighting. It makes a strong plea for good illumination in offices where almost constant demand is made on the eyesight of the clerical force.

A booklet which should prove useful to everyone who sells electric motors or motor-driven machinery to the Navy Department has just been issued by the Cutler-Hammer Manufacturing Company of Milwaukee, maker of electric controlling devices. This company for many years has made a special study of Navy Department requirements, and in the booklet just issued full descriptions, illustrations, dimension diagrams and shipping weights are given on starting panels, speed-regulating panels, machine-tool controllers, resistances, circuit-breaker panels, etc. In the preface attention is called to the fact that navy specifications preclude in nearly all instances the use of ordinary controlling panels, and furthermore, that apparatus acceptable for use in navy yards will not always be acceptable if supplied for use on shipboard. The booklet includes several views of battleships equipped with Cutler-Hammer control.

Bulletins Nos. 106 and 107 from the Electric Storage Battery Company of Philadelphia treat, respectively, of the Chloride Accumulator for alternating-current regulation and the Chloride Accumulator as applied to the single-phase system of the Spokane and Inland Railway. These bulletins are of special interest to electric-railway men or operators of industrial plants where intermittent service is common.

Of considerable interest to street and interurban-railway men are Bulletins Nos. 8 and 9, published by the Gould Storage Battery Company of New York. The former embodies an interesting description of an interurban-railway distribution system, giving attention to the storage-battery plants on the Dayton and Western Railway. The latter treats of storage batteries on alternating-current systems, being a description of the plant of the Rutland Railway, Light and Power Company. The Gould company has also just published the third edition of "Facts," giving a detailed description of Gould plates.

Users of electric motors and generators will be interested in two well-illustrated bulletins just issued by the Electric Machinery Company of Minneapolis. Bulletin No. 77 goes into the construction and uses of the direct-current motors and generators made in the carefully organized shops of this company. Revolving-field alternating-current generators made by the company are illustrated in Bulletin No. 84. A list of 100 representative institutions that have been using the Electric Machinery Company's direct-current generators and motors and one, two and three-phase alternators are given in Bulletin No. 91. This company makes all sizes up to 1,000 horsepower.

The Trumbull Electric Manufacturing Company has just published the November issue of its "magazinette," Trumbull Cheer, in which it especially solicits the attention of the electrical trade. The primary object of this publication is to put forward the new lines of Trumbull material which are continually offered the trade and to re-emphasize other material already published. In this November issue appears an article on the recent rulings of the Underwriters covering switches for alternating-current work, also a detailed list of Trumbull's "A" line of switches. Panel boards and switchboards are also advertised. The whole tone of the little magazine, as the title indicates, is cheerful, numerous epigrammatical sayings being introduced with catchy verses and reflections on business and general conditions. It is printed throughout in two colors on heavy coated paper and illustrated with caricatures and half-tone cuts. Copies will be gladly sent upon application to all those interested in electrical developments.

The Forest Service of the United States Department of Agriculture, through Mr. Gifford Pinchot, forester, has published a valuable booklet of 42 pages on "The Use of the National Forests." Formerly the timber of the great mountain ranges in the West was destroyed recklessly by fire and cutting. This little volume describes the useful work done within the last decade in conserving this timber. The national forest reserves have in that period been carefully nurtured and protected as well as given over to legitimate use instead of being merely locked up and left to burn. Settlement, grazing and mining operations that do not conflict with the public use of these lands are encouraged, as they bring more people into the forests to protect them from fire. Timber is cut discriminately so as to keep the young trees growing and thus furnish a continuous supply. Besides preventing wholesale destruction of the timber these national forests, which now cover an area of 148,000,000 acres, produce a steady water supply for irrigation and power purposes.

Two recent bulletins to be distributed by the General Electric Company are of interest. In Bulletin No. 4538, 32 pages are given to a very complete description of the devices manufactured for the catenary system of overhead line construction. A great many new designs in frogs, crossings, hangers, etc., have been made necessary and numerous illustrations of separate parts as well as of complete installations are of immediate interest. Bulletin No. 4532 describes some recently perfected lines of direct-current motor-starting rheostats in capacities up to 50 horsepower and 550 volts. Type SA rheostats are made for one-minute duty, with no-voltage release, and are suitable for use with shunt, compound or series-wound motors. Type SO rheostats are similar to type SA, but have in addition to the no-voltage release attachment an overload coil in series with the motor armature. An improved type of resistance unit, known as the shunt, compound or series-wound motors. Type SO an enclosed unit made of low-temprature coefficient resistance wire wound on a strong tube. Types SA and SO rheostats have received the approval of the National Board of Fire Underwriters and comply with the service rules of the American Institute of Electrical Engineers, viz., one-minute starting duty once every four minutes for one hour.

The Ansonia Brass and Copper Company, 99 John Street, New York, issues a neat booklet on "Tobin Bronze." This celebrated alloy is much used in marine work, but it is also suitable for many mechanical purposes where a non-corrosive metal is required. It is noted for its high elastic limit, tensile strength, hardness and uniform texture. Much technical information about it is given in the booklet.

SOCIETIES AND SCHOOLS.

Meetings of the Electrical Section of the Canadian Society of Engineers will be held at the rooms of the society, 413 Dorchester Street West, Montreal, at 8 p. m. on November 7th and December 19th. R. A. Ross is president and A. A. Dion vice-president of the section.

The next meeting of the American Institute of Electrical Engineers will be held in the auditorium of the Engineers Building, 33 West Thirty-ninth Street, New York, on November 8th, at 8:15 p. m. Mr. Albert H. Armstrong of the General Electric Company of Schenectady will read a paper entitled "Comparative Performance of Steam and Electric Locomotives."

MISCELLANEOUS.

The electrical inspection department at Indianapolis, Ind., penalizes each risk found wanting in electrical equipment and applies the charges upon existing insurance policies until the suggested improvements are made.

An electrical inspection ordinance drawn by the Underwriters' Electrical Bureau has been submitted to the City Council of La Salle, Ill., where there is said to be urgent need for improvement. The interurban electric railway running through the city has a high-voltage transmission line for supplying current at distant points.

The London Times Engineering Supplement is informed that Brown, Boveri & Co. of Frankfort-on-the-Main, Germany, which is a branch of the company at Baden, Switzerland, is about to construct in its works at Mannheim a steam turbine of 24,000 horsepower. This will be the most powerful turbine ever produced. It is destined for the steel works and blast-furnace plant of Messrs. Krupp at Rheinhausen.

The charge d'affaires of France at Washington has furnished to the Bureau of Manufactures, through the Department of State, printed copies of the programme and announcement (in French) of the first International Congress of Refrigerating Industries, which will be held at Paris at the end of next year. In transmitting this literature the charge states that the congress is regarded as unusually important, and that his government will be pleased to have official delegates named for the congress and to have the circulars and programmes brought to the attention of academies, societies, and all learned bodies likely to be interested.

The exhibition to be held in Tokyo in 1912, according to the China Telegraph, is to be called the Grand Exhibition of Japan. It is to be held between April 1 and October 31, 1912, and is intended to demonstrate the growth of Japanese industry, civilization and resources. It is not only proposed to be the greatest fair ever held in Japan, but to give accommodation to the different exhibits of foreign countries. The expenditure, inclusive of 10,000,000 yen (1 yen = 49.8 cents), to be defrayed by the central government, will be an unprecedented amount, together with that to be expended by provincial government and new territories. In addition to ample facilities to be given to foreign exhibitions, the erecton of special halls by foreign countries is anticipated, and the required tracts of land are to be offered gratuitously.

TRADE NEWS.

The Northern Electrical Manufacturing Company of Madison, Wis., has established a district office at Pittsburg, Pa., in charge of C. A. Poe, formerly of C. A. Poe & Bro. The office is conveniently located at 618 Park Building.

Under recent amendments to the Belgian tariff cables of electrolytic copper wire covered with cotton exclusively required for dynamos and transformer coils are dutiable either at $2.31 per 100 kilograms, or at the option of the importer at 10 per cent. ad valorem.

The Electric Manufacturing Company of Traverse City, Mich., has been incorporated with a capital of $16,000 and proposes to manufacture a new lightning arrester invented by William Gifford. The company has been organized and machinery is now being installed in a building in Traverse City for the manufacture of the device. The officers of the company are: President, George G. Covell; vice-president, William Gifford; secretary, C. G. Sherwood; treasurer, H. B. Garner.

BUSINESS.

The International Telephone Manufacturing Company of Chicago is experiencing a constantly increasing demand for its four-party magneto-call local-battery telephones. These instruments are especially adapted, it is said, for four-party selective ringing lines where long-distance service is required, they being equipped with the well-known "International" loud-speaking transmitter and receiver.

The Willard Storage Battery Company, Cleveland, Ohio, has recently moved into a new factory, located on the corner of Marquette Road and Lakeside Avenue. The new building affords a large increase of floor space over the old factory and a correspondingly larger output will be possible. The new factory consists of one large three-story brick building, in addition to which there is a one-story frame building. The total floor space, including the frame building, is 400 by 200 feet. The power for the factory is generated by three Crocker-Wheeler generators operated by two Bruce-Meriam-Abbott gas engines and one steam engine. The ground floor is devoted to rolling, cutting, forming, lead-burning, assembling, etc. On the second floor are located the assembling department and offices. On the third floor are the carpentering and painting departments. The Willard Storage Battery Company will continue in the manufacture of storage batteries for all purposes.

During the last two and one half years 630 Westinghouse single-phase railway motors have been shipped to 18 different railway companies in America and Europe. These motors range from 40 to 250 nominal horsepower each and make a total of 79,380 nominal horsepower. There are now on order 310 Westinghouse single-phase railway motors for shipment to 11 different railway companies, totaling 34,135 nominal horsepower. This makes a total of 940 Westinghouse single-phase railway motors delivered to or on order for 25 different railway companies, and aggregating 113,515 nominal horsepower.

An acid-proof, alkali-proof, oilproof, air-drying insulating varnish that does not lose flexibility and dielectric strength with age is something that electrical manufacturers and repair men have greatly desired. Benolite air-drying varnish is declared to meet these requirements and to be replacing baking varnishes. It is said to be the only quick-drying insulating varnish made that does not lose its elasticity and toughness in service. It dries in from four to six hours at ordinary room temperature when applied to tape or cotton covering, and in about one hour when applied to a hard surface. After it has become thoroughly set it is not affected by strong solutions of acid or concentrated alkali. It is not softened by oil, hot or cold. The dielectric strength is reported to be high, two dips applied to 0.005 inch insulating cambric giving 1,000 volts for 0.001 inch. One unusual characteristic is the fact that the varnish is more flexible warm than cold, and yet it has no tendency to soften up or "lip." The Benolite Company also makes a baking varnish which is similar to the air-drying varnish except in time of drying and in elasticity. This varnish will dry in from six to eight hours at 100° C. (212° F.) and may be baked at this temperature without affecting the elasticity. It is recommended for high-voltage armature coils or for any other work where extreme elasticity is required. The two varnishes are composed of the same materials but in different proportions. They are made by the Benolite Company of Pittsburg, Pa., which will be glad to submit samples.

ILLUSTRATED ELECTRICAL PATENT RECORD.

Issued (United States Patent Office) October 22, 1907.

868,648. Semaphore Signal. Fred B. Corey, Schenectady, N. Y., assignor to the General Electric Company, Schenectady, N. Y. Application filed March 27, 1907.

A semaphore arm is driven toward clear position by an electric motor. The arm can automatically return to danger position, and in doing so the motor armature is short-circuited and the motor operated as a brake to stop the motion of the arm.

868,651. Insulated Metal Cross-tie. Alva C. Dinkey, Pittsburg, Pa. Application filed December 31, 1906.

A metallic cross tie has a rail-bearing plate insulated from the tie, a permanent fastening securing the plates to the tie, a rail clip and a separate independently removable clip fastening, for securing the rail clip to the insulated bearing plate.

868,664. Process of Making Rail-bonds. Albert B. Herrick, Ridgewood, N. J., assignor to the Electric Railway Improvement Company, Cleveland, Ohio. Application filed May 5, 1904.

This process consists in first winding upon an elliptical pattern a continuous band of the bonding material, then applying soldering material to diametrically opposite points of this laminated structure and finally cutting through these soldered places so as to make two similar bonds.

868,670. Electrolysis of Fused Alkaline Chlorides. Franz von Kügelgen and George O. Seward, Holcombs Rock, Va. Application filed June 13, 1905.

In this process there is electrolyzed a mixture of sodium chloride with sodium and calcium fluorides.

868,674. Electric Sign. Carl O. Lindstrom, Chicago, Ill. Application filed April 7, 1906.

A cylindrical casing with glass front contains an incandescent lamp. The casing has fastened to it an attachment plug of special design. An electric bell may be placed in the casing in series with the lamp.

868,686. Incubator. Alfons Musiol, Tabor, Austria-Hungary. Application filed May 10, 1907.

This incubator has a casing surrounding a metallic hatching box with a heating space between. An electrically operated thermostat regulates the heat.

868,693. Device to Prevent Tampering with or Theft of Motor Vehicles. Leon Ottinger, New York, N. Y. Application filed December 18, 1905.

The device consists of a latch mechanism for the bonnet or hood, an electric switch for the motor circuit and a hook for controlling both the switch and latch mechanism.

868,696. Self-winding Electric Clock. Arthur F. Poole, Wheeling, W. Va. Application filed January 24, 1906.

This clock has an electromagnet with a movable armature controlling the motion of a cam that has a roller bearing on its surface and operating the switch for the electromagnet. The motion of the armature is also transmitted to the clock weights.

868,704. Electric Knife Switch. Otto Rothenstein, Pittsburg, Pa. Application filed September 4, 1902.

This is a quick-break knife-blade switch. The operating lever is distinct from the blade and connected with it by a coiled spring. The blade is arranged so it can be reversed end for end and edge for edge.

868,711. Means for Controlling the Operations of Blast-furnace-charging Devices. Barton R. Shover, Youngstown, Ohio. Application filed January 12, 1906.

The system consists of hoists for hauling the charges to the furnace top and of various automatic devices used in charging the material into the furnace. Each device is operated by a separate motor. Each of these is controlled by an electromagnetic switch actuated by the motion of the different parts in such a way that the motors operate in a definite cycle.

868,712. Means for Controlling the Operations of Blast-furnace-charging Devices. Barton R. Shover, Youngstown, Ohio. Application filed July 17, 1906.

This patent covers a system almost identical with the preceding one.

868,718. Means for Operating Hydraulic-elevator Plants. Rudolph C. Smith, Yonkers, N. Y., assignor to the Otis Elevator Company, Jersey City, N. J. Application filed July 28, 1900.

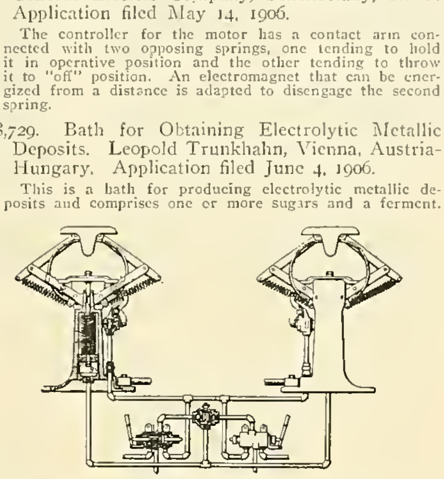
The high and low pressure receivers are supplied by electrically driven pumps. Pressure regulators control the switches for the motors and connect the latter in series or parallel.

868,723. Control of Motor-operated Doors. David W. Taylor, Washington, D. C., assignor to the General Electric Company, Schenectady, N. Y. Application filed May 14, 1906.

The controller for the motor has a contact arm connected with two opposing springs, one tending to hold it in operative position and the other tending to throw it to "off" position. An electromagnet that can be energized from a distance is adapted to disengage the second spring.

868,729. Bath for Obtaining Electrolytic Metallic Deposits. Leopold Trunkhahn, Vienna, Austria-Hungary. Application filed June 4, 1906.

This is a bath for producing electrolytic metallic deposits and comprises one or more sugars and a ferment.



NO. 868,889.—OPERATION OF PANTAGRAPH TROLLEYS.

868,737. Spark-plug. Frank J. Watt, Detroit, Mich., assignor of one-half to Roy E. Hardy, New York, N. Y. Application filed March 28, 1904.

One electrode is in the form of a screw-threaded metal bushing containing a porcelain plug. Through the center of this plug passes a long binding bolt, which forms the other electrode.

868,740. Electrical Piano-playing Attachment. Joseph Weber, Brooklyn, N. Y. Original application filed January 16, 1904. Divided and this application filed September 14, 1905.

This is an electrically operated playing attachment that is supported and hinged in such a way as to permit it to slide beneath the keyboard of the piano when not in use.

868,751. Electrical Connector. Frederick H. Ayer, Chicago Heights, Ill. Application filed February 23, 1907.

A bond wire or rod has the cross-sectional shape of a three-sided figure, each side of which is formed on an arc described from the intersection of the other two sides.

868,752. Variable Reactive Coil. Ralph E. Barker, Lynn, Mass., assignor to the General Electric Company, Schenectady, N. Y. Application filed January 23, 1907.

A variable reactive coil has a stationary winding and a laminated circular core having a central opening surrounding the winding and eccentric with respect to the periphery of the core. The core is pivotally mounted on an axis concentric with the central opening.

868,769. Process for the Recovery of Nickel from Ore. Charles H. Ehrenfeld and Jacob R. Grove, York, Pa. Application filed January 27, 1906.

This process consists in mixing the crushed ore with an aqueous solution of sulphuric acid and a salt of ammonia, placing this mixture in a porous jar containing an electrode, and then setting the jar as an anode into an electrolyte of the same composition as that in the jar, and which has a nickel plate as cathode.

868,780. Trolley-wheel Guard. Charles Harkness, Providence, R. I., assignor to the Harkness Trolley System Company. Application filed February 16, 1905.

Combined with a trolley wheel and the spindle on which the wheel is mounted are a pair of guard plates loosely mounted upon the spindle and rotary disk-shaped heads having convex inner faces mounted upon both ends of the plates.

868,781. Electric Switch. Chester S. Hill, Williamsport, Pa., assignor of one-half to George L. Campbell, Williamsport, Pa. Application filed July 16, 1906.

This switch is mounted in boxes between the main rails of sectional third-rail or surface-contact electric roads. These boxes contain pole pieces energized by an electromagnet on the car. Armatures attracted by the pole pieces move contacts that connect the continuous feeder with the sectional rail adjacent to the car.

868,795. Electrically Operated Vibrator. Willis I. Miller, Cleveland, Ohio. Application filed March 7, 1907.

A spherical casing contains an electric motor that has a weight eccentrically mounted on its shaft. An adjustable band around the casing has the applicator fastened to it.

868,798. Means for Obtaining Power from Flowing Water. Robert McLaughlin, Baltimore, Md. Application filed February 20, 1905.

A water-tight vessel that can be floated in the running stream is provided with a screw propeller on the outside. On the shaft of this propeller and inside the vessel is the armature of a dynamo, supplying current to the place desired through a flexible conducting cable.

868,806. Electric Motor. Oscar H. Pieper and Alphonse F. Pieper, Rochester, N. Y. Application filed November 25, 1905.

A motor controller consists of insulated contact plates supported on a sleeve on the motor armature shaft, a movable member normally connecting the plates and a regulating member. The motor circuit leads to the contact plates.

868,843. Metallic Cross-arm for Telegraph or Telephone Poles. Wellington S. Clay, Hutchinson, Minn. Application filed September 7, 1906.

This is a channel-shaped cross-arm. The clamping yoke is U-shaped, the round part extending around the pole and the ends being bolted to the web of the cross-arm. The arm and yoke have barbs engaging the pole.

868,864. Electric Controlling System. Ray P. Jackson, Wilkinsburg, Pa., assignor to the Westinghouse Electric and Manufacturing Company, Pittsburg, Pa. Application filed November 23, 1904.

This is a system for controlling the electrical energy supplied to a translating device and consists of an induction voltage regulator, provided with means for preventing further adjustment thereof when the current reaches a predetermined value, an overload circuit-breaker and reversing switch. These are all electromagnetically interlocked so as to prevent any excessive current or abnormal operation.

868,870. Automatic Light-switch. Henry E. King, Bunkie, La. Application filed February 23, 1907.

The switch consists of a stationary and a movable part. An alarm clock is arranged so that its vibrating hammer engages a bead on the movable contact part and causes it to close the circuit.

868,874. Electrically Operated Self-leveling Marine Table. Clarence W. Laskay, New York, N. Y. Application filed October 9, 1905.

The table rests on a supplementary deck supported by mechanical means upon the main deck. An electric motor operates the mechanical means for keeping the supplementary deck level. It is automatically started, stopped and reversed by variations in the level of the supplementary deck.

868,880. Sound Transmitter and Receiver. Arthur J. Mundy, Boston, Mass., assignor to the Submarine Signal Company, Waterville, Me. Application filed April 23, 1902.

A submerged electric sound transmitter has a shell adapted to receive, focus and transmit vibrations to a telephone transmitter placed in its interior. A compressible medium lies in the space between the shell and the inner transmitter.

868,888. Suspension Bracket. Earl H. Richardson, Ontario, Cal., assignor to the Pacific Electric Heating Company, Los Angeles, Cal. Application filed September 27, 1906.

This bracket is arranged to be fastened to an ironing board and supports a lamp and the flexible cord connected to the electric flat iron, a spring taking up the slack in the cord.

868,889. Trolley-operating valve. Robert H. Rogers, Schenectady, N. Y., assignor to the General Electric Company, Schenectady, N. Y. Application filed November 17, 1905.

This is a valve for controlling the pneumatic mechanism for raising and lowering pantagraph trolleys. It is a slide valve that can be operated manually and also pneumatically. (See cut on preceding page.)

868,890. Typewriting Machine. Joseph A. Ronchetti, New York, N. Y., assignor to the Underwood Typewriter Company, New York, N. Y. Application filed March 23, 1906.

This is a combination with a series of type-bar operating levers, of a series of solenoids, mechanical connections from the levers to the cores of the solenoids, a set of keys, and electrical connections from the keys to the solenoids, each solenoid having an iron plug in the end opposite to the core. (See cut.)

868,911. Electric-railway System. John L. Crouse, New York, N. Y., assignor to the Westinghouse Electric and Manufacturing Company, Pittsburg, Pa. Application filed December 29, 1904.

A system using both overhead trolley and third rail has an overload circuit-breaker in the lead coming from each source. Relay switches control the operation of these circuit-breakers in such a way that only one of these can be kept closed at one time, and this prevents getting current from both sources simultaneously.

869,027. Electric Railroad. William G. Spiegel, New York, N. Y. Application filed July 17, 1906.

This railroad system employs a sectionalized third rail, the sections of which are normally "dead" and insulated from each other. Switches are electrically operated by the car that connects successive sections of the third rail to the feeder cable.

869,031. Lightning Arrester. Clark I. Stocking, Hiawatha, Kan., assignor of one-half to Arthur J. Stevens, Hiawatha, Kan. Application filed January 3, 1907.

A tubular metallic casing is connected to ground. In its center is a conductor connected to the line. A perforated non-conducting tube is interposed between the casing and core.

869,058. Speed-changing Device. John G. Callan, Lynn, Mass., assignor to the General Electric Company, Schenectady, N. Y. Application filed June 6, 1904.

This device is an enclosed gear for a motor. A casing has a boss forming a bearing for the armature shaft. A pinion on the latter engages a gear on the inside of a rotating cylinder closed at one end and on the other end fitting up to the casing to which its shaft is attached.

869,060. Electric-line Fuse. Frank B. Cook, Chicago, Ill. Application filed October 8, 1906.

An enclosed fuse has a small bore for the fusible conductor. The terminal cap has an extended flattened portion for clamping to the line wire. The fusible conductor extends through the cap and is also clamped under a washer on the extended part of the cap.

869,186. Shunt-wound Self-excited Alternator. Marius C. A. Latour, Sèvres, France, assignor to the General Electric Company, Schenectady, N. Y. Original application filed July 9, 1901. Divided and this application filed August 8, 1903. Renewed February 27, 1907.

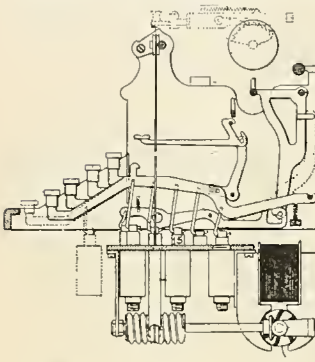
The field excitation for this type of machine is similar to the preceding one, except that the field and armature are in shunt.

869,187. Compounded Self-excited Alternator Marius C. A. Latour, Sèvres, France, assignor to the General Electric Company, Schenectady, N. Y. Original application filed July 9, 1901. Divided and this application filed August 8, 1903. Renewed February 27, 1907.

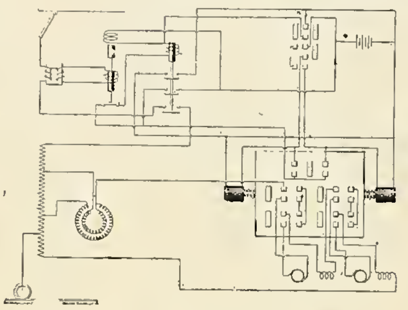
In this machine the field is likewise connected to a many-parted commutator, the brushes on which connect with compensating transformers that supply currents proportional to both the armature voltage and armature current.

869,196. Railway Signal. Robert D. Peters, Knox, Ind. Application filed July 25, 1905.

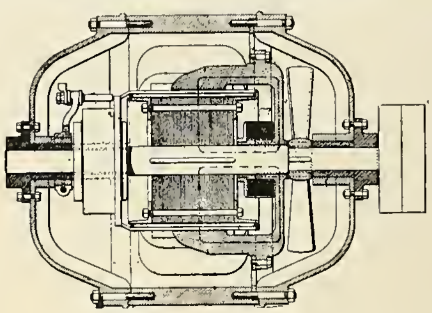
Two normally open circuits have each a coil for energizing a pair of pole pieces with a movable core arranged between them. The core carries a signal normally set at danger. An approaching train closes one circuit and operates the signal. If trains approach from both directions both circuits are closed and the signal remains at danger.



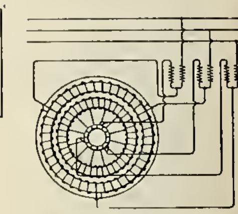
NO. 868,890.—ELECTRIC TYPEWRITER.



NO. 868,929.—ELECTRIC CONTROL SYSTEM.



NO. 869,102.—COMMUTATING-POLE DYNAMO.



NO. 869,185.—SELF-EXCITING ALTERNATOR.

868,929. Electric-control System. Ray P. Jackson, Wilkinsburg, Pa., assignor to the Westinghouse Electric and Manufacturing Company, Pittsburg, Pa. Application filed April 3, 1905.

The combination with a translating device and means for supplying energy, consists of a circuit-breaker, a reversing switch provided with operating magnets, a master switch for closing the circuit of either of the magnets and opening that of the other, and means for maintaining the circuit of the energized magnet until after the circuit-breaker opens. (See cut.)

868,933. Telephone Exchange. Frank A. Lundquist, Chicago, Ill. Application filed May 20, 1904.

Each selector switch of an automatic telephone exchange is provided with a non-interference magnet operated by a reduction of the resistance in its circuit. Means are controlled by the movement of each switching mechanism through interfering connections made by it for varying the resistance in the circuit of the associated magnet so as to break such interfering connections.

868,967. Automatic Tool-operating Device. Arthur Clemons and David W. Pelkey, Chicago, Ill., assignors of one-third to F. W. Ries, Chicago, Ill. Application filed October 9, 1906.

Two aligned solenoids are provided with a reciprocating armature which carries a tool. Means are actuated by the motion of the armature that alternately connect each solenoid to the circuit and thus alternately energize them.

868,968. Pole-changer. Walter H. Cotton, Chicago, Ill., assignor to the Adams & Westlake Company, Chicago, Ill. Application filed August 6, 1906.

This pole-changer consists of an oscillating switch, a reversible wheel with a recess on its periphery and an oscillating yoke engaging a stud on the switch and carrying a projecting finger that rides on the wheel.

869,012. Filament for Incandescent Lamps. Eugene McOuat and Henry W. F. Lorenz, Amsterdam, N. Y. Application filed June 29, 1904.

The filament is made by dipping a carbonized core into a caramel solution containing finely divided metallic light-emitting particles in mechanical suspension, whereby a coat is deposited on the core through which these particles are dispersed, and finally carbonizing this coat to render it and the particles integral with the core.

869,013. Incandescent Filament and Process. Eugene McOuat, New York, N. Y., and Henry W. F. Lorenz, Springfield, Ohio. Application filed December 6, 1905.

This process of making incandescent filaments consists in depositing a metal and silicon on the surface of a core and effecting the formation of a silicide by heat.

869,014. Electric Fire-alarm. John A. Obester, Passaic, N. J. Application filed April 25, 1907.

A main circuit containing an alarm has normally a gap bridged by a thermo-actuated circuit closer. A branch circuit is closed at the same time as the main circuit.

869,018. Clamp Insulator. George Pollock and William E. Werd, Deer Lodge, Mont., assignors of one-third to Sidney C. Houk, Deer Lodge, Mont. Application filed May 9, 1907.

A supporting block has an aperture into which fit the hooked ends of a pair of clamping members that engage the wire. A cap encircles the outer ends of these clamping parts and serves to increase their pressure on the wire.

869,067. Telephone System. William W. Dean, Chicago, Ill., assignor to the Kellogg Switchboard and Supply Company, Chicago, Ill. Application filed February 16, 1903.

The feature of this system is a relay in the cord circuit which connects a ringing source to the called line when connection is established with it. As soon as the called subscriber answers this ringing current is automatically cut off.

869,094. Method of Producing Sulphuric Acid. Isidor Kitsee, Philadelphia, Pa. Application filed July 21, 1906.

This method of producing sulphuric acid consists in bringing a continuous stream of sulphurous gas into contact with a body of air and subjecting the same in the presence of necessary moisture to the action of an electric current adapted to modify the chemical constituents of the gas to convert the same into sulphuric acid.

869,102. Dynamo-electric Machine. Mathias Pfatischer, Philadelphia, Pa., assignor to the Electro Dynamic Company, New York, N. Y. Original application filed July 23, 1906. Divided and this application filed July 5, 1907.

This patent covers a commutating pole construction particularly suited to shunt motors. The auxiliary poles are placed between the main poles and they are distinct from the main magnet yoke. They project longitudinally from a spider at one end of the armature on which is wound a single commutating pole winding in series with the armature winding. This makes all the commutating poles of one polarity and of a strength proportional to the armature current. (See cut.)

869,119. Telephone System. Harry G. Webster, Chicago, Ill., assignor to the Kellogg Switchboard and Supply Company, Chicago, Ill. Application filed December 13, 1902.

The line relays connected in each side of each telephone line control a signal. When connection is established with the line through a cord circuit one of the supervisory relays in the latter is connected as a shunt around one of the line relays and thus practically depriving it of current, the line signal is cut out.

869,125. Process of Smelting Ores. Henry Arden, San Diego, Cal. Application filed September 24, 1906.

This process of smelting ores consists in oxidizing a liquid hydrocarbon to produce a gaseous mixture containing carbon monoxide, superheating the gaseous mixture by electrically developed heat, commingling a hydrocarbon vapor therewith, and conveying the resulting mixture into contact with a heated body of ore.

869,163. Insulator. William J. Devine, Norwalk, Conn. Application filed July 23, 1907.

An insulating block has grooves along the lower side to fit against angular structures and transverse notches for holding the wires. The upper side has similar grooves and notches so that two of the blocks may be superimposed.

869,185. Self-exciting Alternating-current Dynamo. Marius Latour, Sèvres, France, assignor to the General Electric Company, Schenectady, N. Y. Application filed July 9, 1901.

A polyphase generator with distributed windings for armature and field has the latter winding connected at intervals to the segments of a commutator, the brushes on which connect the field and armature in series so as to produce a rotary self-excited field. (See cut.)

869,208. Electric Ignition of Explosives. Oliver J. Lodge and Alexander M. Lodge, Birmingham, England. Application filed April 10, 1903.

An induction coil has a spark gap in its secondary. The main spark gap is a spark plug in the explosion chamber of the engine. It is connected through condensers to the terminals of the secondary.

REISSUE.

12,704. Electro-pneumatic Channeler. Arthur H. Gibson, Easton, Pa., assignor to the Ingersoll-Sergeant Drill Company, New York, N. Y. Application filed August 3, 1907. Original No. 805,195, dated November 21, 1905. Reissue No. 12,602, dated January 29, 1907.

This machine consists of a truck, a channeler, a compressor and motor adjustably mounted on the truck whereby the channeler and compressor cylinders may be kept in close proximity to each other as the channeler is adjusted to different positions along the truck.

PATENTS THAT HAVE EXPIRED.

Following is a list of electrical patents (issued by the United States Patent Office) that expired October 28, 1907:

439,102. Electric Motor. C. S. Bradley, Yonkers, N. Y.
439,151. Dry Battery. W. L. F. Hellesen, Copenhagen, Denmark.
439,178. Method of Repairing Incandescent Electric Lamps. C. Pauthonier, Paris, France.
439,180. Electric Elevator. F. B. Perkins, Boston, Mass.
439,213. Electromagnetic Clutch. C. H. Veeder, Lynn, Mass.
439,237. Apparatus for Transferring Electric-car Batteries. F. G. Corning, New York, N. Y.
439,262. Electric Railway. L. Westerland, Atlanta, Ga.
439,295. Recording Signaling System. W. J. Fraser, Milwaukee, Wis.
439,301. Secondary Electric Battery. J. F. Mehren, Chicago, Ill.
439,345. Electric Locomotive. F. W. Dean, Cambridge, Mass.
439,363. Electric Lamp. A. Swan, Orange, N. J.
439,364. Incandescent Lamp Socket. A. Swan, Orange, N. J.
439,365. Incandescent Lamp Socket. A. Swan, Orange, N. J.
439,366. Incandescent Electric-lamp Socket. A. Swan, Orange, N. J.
439,367. Incandescent Electric-lamp Socket. A. Swan, Orange, N. J.
439,381. Electric Meter. Wm. H. Bristol, Hoboken, N. J.
439,389. Electric-lighting System. T. A. Edison, Menlo Park, N. J.
439,390. System of Electric Lighting. T. A. Edison, Menlo Park, N. J.
439,391. Junction Box for Electric Wires. T. A. Edison, Menlo Park, N. J.
439,392. Electric-lighting System. T. A. Edison, Menlo Park, N. J.
439,409. Railway-track Electrical Annunciator. J. W. Lattig, Easton, Pa.
439,416. Method of Making Storage-battery Plates. Wm. Morrison and L. Schmidt, Des Moines, Ia.
439,417. Automatic Regulator for Electric Currents. Wm. Morrison, Des Moines, Ia.
439,428. Electric Railway. C. Richter, Camden, N. J.
439,459. Synchronous Alternating-current Electric Motor. C. Zipernowsky, M. Derl and O. Blathy, Buda-Pesth, Austria-Hungary.
439,516. Porous Cup for Galvanic Batteries. C. A. Hussey, New York, N. Y.
439,577. Electric Motion Transmitter. M. W. Dewey, Syracuse, N. Y.
439,584. Electric-railway Motor Car. E. Wagemann, Little Rock, Ark.
439,594. Secondary Battery. W. B. Hollingshead, Bronxville, N. Y.
439,597. Conduit for Electric Railways. R. M. Hunter, Philadelphia, Pa.

WESTERN ELECTRICIAN

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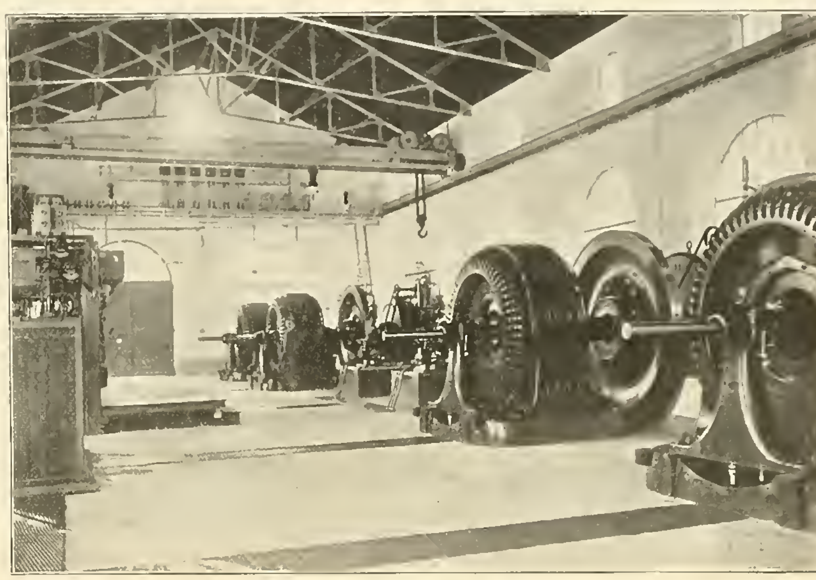
Hydro-electric Station of Pataras, on the Loup River, France.

By A. de Courcy.

One of the principal regions on the Continent where we find a great development of the use of hydraulic power is the district lying on the southern coast of France. Here the Alpine ranges approach very close to the Mediterranean coast, which allows of the erection of hydraulic plants for the supply of the principal coast towns, such as Nice, Cannes and Monte Carlo. The Western Electrician has already described several of the new plants which are now installed in this region and are interconnected by an extensive network of lines, the system being controlled by a large company having its headquarters at Paris, the "Energie Electrique." Recently this company has erected a turbine station on the Loup River in order to secure an additional supply of current, and the writer has obtained the present information about the new plant through the courtesy of Mr. Certonciny, one of the leading officials of the company.

PATARAS HYDRO-ELECTRIC STATION ON THE LOUP RIVER, FRANCE.



INTERIOR OF PATARAS POWER STATION.

The Loup River, which rises in the Hubac Mountain range and flows from west to east, then from northwest to southeast before emptying into the Mediterranean, near the town of Cagnes, is fed by a number of springs which are supplied by water falling as snow or rain upon a great stretch of high limestone plateaus. These plateaus rise abruptly to the north of Grasse at a mean altitude of 1,100 meters.

In relation to the character of the water flow, it is to be observed that low-water periods occur generally twice a year, one of these being quite regular in summer, and the other happens frequently in the winter season. The minimum flow does not go below 900 or 1,000 liters a second in times of low water, while the average flow is from 1,200 to 1,500 liters a second. From this stream a head of water of 270 meters can be obtained, using a canal of 3,850 meters length, leading from the dam. The turbine station is located at Pataras, near the railroad which leads from Nice to Grasse.

The hydraulic work, which I will mention briefly, consists in the first place of a dam, which is a simple masonry wall 30 meters in length, anchored in the two high banks of the river and resting upon a hard clay bed. On the right bank is established the main basin, lying just below the dam. It is lined with masonry and receives water from the main gate of the dam. A part of the water, equal to 1,000 liters a second, is taken from here into the canal, and the excess of water is sent into the river below the dam by a side canal. The main canal leading from the dam to the turbine house has a total length of 3,852 meters. For the first 700 meters it is laid in marl and tufa ground, and here were needed special precautions for drainage, so as to prevent any displacement in the future. This work was carried out very successfully. Most of the canal is laid in vaulted underground construction, divided into 14 tunnels, of which the longest measures 328 meters. The tunnel sections are separated by above-ground canal sections of short length. In the gorges the canal is covered with heavy flagstones in order to protect it from falling rock.

At the lower end of the flume is situated the reservoir of 6,500 cubic meters, which forms the basin for the penstocks and allows of storing up the water supply during the hours of light load. The basin is built on the mountain at a height of 270 meters above the valley upon a rock platform cut out of the limestone. It is about 120 meters long and nine meters wide, and the depth of water is more than six meters. A lateral chamber built in front of the basin serves as the starting point for the penstocks leading to the turbine house. Since the construction of the above reservoir it was found that it would be necessary to be able to cut it off from the station without stopping the running of the latter. To this end there was constructed, besides the end of the main flume, a small independent water chamber formed of a basin in armored cement containing 253 cubic meters. From the bottom of this chamber runs a penstock section of 0.72 meter diameter, which is joined to the principal penstock. The company is also designing a new basin of 6,000 to 8,000 cubic meters capacity, which is to be built beside the present one and will be joined to it by a conduit.

The penstock gives a head of 270 meters and is formed of a steel tube having 0.92 meter inside diameter. It has a total length of 538 meters and is built of steel varying from 4 to 20 millimeters in thickness. The present conduit is laid under difficult conditions upon the precipitous slope of limestone rock above, and loose rock at the lower part. It rests upon the ground or else upon masonry pillars. At the lower end the penstock is brought at a right angle so as to run parallel to the turbine house. From this portion are branched six tubulars, of which four are used for the main alternator wheels and two for the exciter sets. Each tubular is provided with a gate for shutting off the turbine.

The turbine house is built on the bank of the river and occupies a surface of 512 square meters. It comprises a main dynamo room 31 by 12 meters and an annex with machine shop and storeroom on the ground floor, and lodgings on the second floor. Each of the turbines sends the water into a separate masonry chamber, and the latter are connected to a main conduit which forms the tail-race, and from here the water is led to the river below the turbine house.

The station contains at present four main groups of 600 kilowatts each, one of which is used as a standby. Each of these units consists of a horizontal-shaft turbine of 1,000 horsepower, operating at 375 revolutions per minute and constructed for an output of 420 liters per second and a head of water of 235 meters. The wheels are direct-coupled to alternators of 600 kilowatts, which give three-phase current at 10,000 to 12,000 volts and 25 cycles. Each turbine carries a revolving wheel of the Escher-Wyss pattern, which works under the action of the water jet sent by a special distributor, the latter being submitted to the action of an automatic speed governor provided with a hydraulic motor. The motor is operated by water under pressure, coming from the fall itself. It acts directly upon the distributor by modifying the section of flow without throttling the water jet, so that the system keeps a high efficiency at all speeds.

The action of the governor has the effect of causing the simultaneous movement of the distributor and of the apparatus which regulates the pressure in the penstock, the latter being arranged so as to cause the opening of an outflow conduit in an equal proportion to the lessening of the section of flow, and, on the other hand, to close the same automatically without giving rise to hammering. This regulation can be made during the working of the apparatus and without any special attention.

Owing to the use of the regulators the differences of speed corresponding to the full load of 1,000 horsepower and no load do not exceed three per cent., and the momentary variation of speed for a sudden change of load does not reach four per cent. for a change of 50 per cent. of the load or eight per cent. for a sudden and complete discharge of the turbine or where all the load is thrown on at once. In all these cases the standard speed of the turbine is regained within 30 seconds. Two small groups of 60 horsepower each are used for the exciters, and they operate at 800 revolutions per minute, being of a construction analogous to the large machines.

The four alternators of 600 kilowatts are of the same type and a similar construction to the machines which are installed in the Plan du Var hydraulic plant, and I have already given a description of these alternators in preceding articles. (See Western Electrician of January 6 and March 10, 1906, pp. 13, 14 and 192.) Like the former, they are built by the French Thomson-Houston Company at its Paris works. The field circuit of these machines is excited at 60 volts by the small generators above mentioned. A regulator of the Thury pattern works upon the four field rheostats of the alternators, and keeps the voltage automatically constant at Nice.

In the plant is erected a switchboard, which comprises four panels for the alternators, one panel for the two exciters, one station panel and two line panels. Each of the high-tension panels is provided with a three-pole oil switch and three fuse blocks, which are specially designed for very high tensions. The alternator and line panels are provided with voltmeters and ammeters supplied by special transformers, so as to avoid the use of high tension on the front of the switchboard. On the station panel is mounted a registering ammeter for measuring the total current, as well as an induction meter.

One of the lines leaving the station passes to the transformer post which is located at Grasse and serves to supply the 10,000-volt network lying to the west of Nice. This line can be aided or replaced if need be by a line which is brought from the Siagne hydraulic plant. The second power line runs from the turbine station and, after traversing a series of section and distribution posts by which it distributes power along its course, is extended in underground cable as far as the Risso plant at Nice.

The present plant was designed and built by the Marseilles Construction Company, and the Thomson-Houston Company furnished the electrical outfit. The penstock is supplied by the Joya firm of Grenoble.

Recent "Wireless" Inventions.

On October 8th there were issued by the United States Patent Office a number of patents on apparatus for "wireless" communication that are of considerable interest in this field of activity. Three patents were granted to Lee De Forest on new types of coherer or receiving apparatus and two patents to the McCarty estate on transmitting apparatus in space telephony.

The recent inventions of Dr. De Forest are designed to produce an improved apparatus for receiving telegraph signals transmitted from a distant station by means of electrical waves. The inventor discovered that if two bodies adapted for use as electrodes or conductive members be electrically separated partially or wholly, after the manner common in analogous devices, the separation between them may be neutralized sufficiently to enable them to act as a detector of electrical oscillations if the intervening or surrounding gaseous medium be put into a condition of molecular and ionic activity, such, for instance, as would be caused by heating it in any manner, as by radiation, conduction, or by the combustion of gases in the space which surrounds the electrodes. Such condition of molecular and ionic activity causes what would otherwise be a non-sensitive device to become sensitive to the reception of electrical influences. He is thus enabled to employ as such sensitive member devices which would otherwise be of no value and which comprise electrodes separated by a gaseous medium.

This principle can be embodied in a variety of apparatus, only one form of which is shown in the accompanying illustration. In Fig. 1 the two electrodes (F) are slightly separated and are within the flame of an ordinary Bunsen burner (D). Under these conditions the electrodes may be adjusted so that there is normally no indication of a passing current from the local battery (B) given by the receiving instrument, such as the telephone (T). The electrical separation of the electrodes is, however, insufficient to prevent electrical oscillations, such as those intercepted by the antenna or receiving conductor (A), from passing across the gap. The influence of these oscillations upon the heated gas seems to vary the insulating quality of the gap,

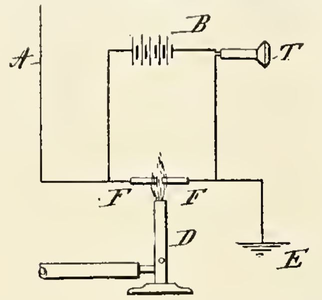


FIG. 1. DE FOREST WIRELESS RECEIVING APPARATUS.

so that, while the influence of the oscillations lasts the current of the local circuit may pass between the electrodes, thus affecting the indicating instrument therein to produce a signal. This may be due to ionization of the gases surrounding the electrodes which greatly increases their conductivity, this ionization being more or less accomplished or greatly facilitated in the present instance by their previous heating which has already put them in a condition of intense molecular activity.

The form of the electrodes and the method of heating and confining the active gas may be varied considerably in different forms of apparatus carrying out the principle of the invention. For instance, the electrodes may be in the form of parallel plates to give them a larger active surface. The gas may be confined in a sealed tube and electric heating resorted to. The action described may be effected by controlling the composition of the gases between and surrounding the electrodes or poles of the sensitive member. As an instance of this, the addition of sodium or salts of the halogen class in the flame increases the ionization and conductivity of the gases and increases the sensitiveness of the device.

The patents issued to Henry A. McCarty, administrator of Francis J. McCarty, deceased, cover a transmitter designed for space telephony. The accompanying diagram, Fig. 2, shows one form of this transmitting device. In this invention an induction coil is employed having a secondary winding (A) and two primary windings (2) and (3). The secondary coil is connected in the usual manner to

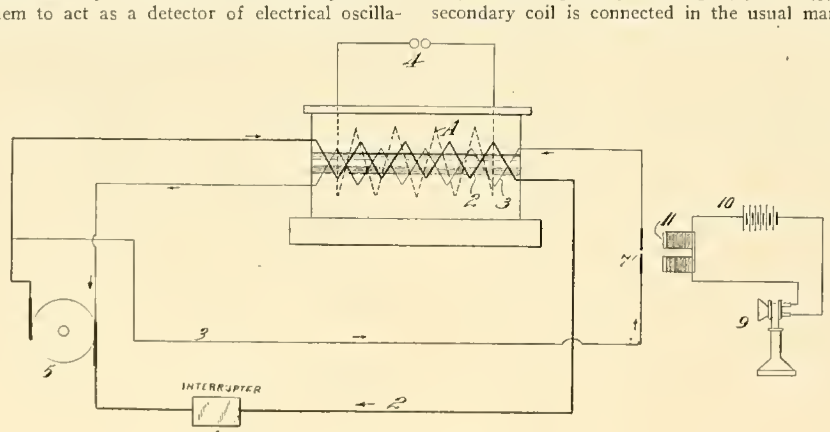


FIG 2. M'CARTY WIRELESS TRANSMITTING APPARATUS.

the two sides of a spark gap (4). At (5) is a suitable source of electrical energy, and one of the primary coils (2) is put in series with this source, and the current while flowing through this primary is continually varied by an interrupter as indicated at (6). The other primary (3) is connected in series with the same source of electrical energy, in such a manner that the current through this primary coil is made to flow in the opposite direction to the previously described current in the primary (2).

An arc light (7) is introduced in series in the primary (3), and the current flowing through this in series with the arc light being a continuous one, generates an unvaried magnetic field which, owing to its steadiness, neutralizes the variations of the magnetic field of the primary (2) which are caused by the interrupter (6), and consequently no discharge takes place at the spark gap (4).

In order to cause discharges which will approximate the variations in the human voice, the variations of the current in the circuit (3), which is in series with the arc light, are effected by means of a telephone transmitter (9) which is connected through batteries (10) to an electromagnet (11). This margnet is energized by the impulses created by the voice acting through the diaphragm of the transmitter and the magnet is placed in close proximity to the arc light. The lines of force thus generated through the magnet influence the arc so that the current flowing through the circuit (3) and the arc is varied in unison with the variations induced through the transmitter and its connections. The primary (3), which is in series with the arc light, is now also varied, and as the steadiness ot this current on which the neutralization of the magnetic field of the other primary depended is now varied similar vibrations will immediately occur in the magnetic field of the primary (2), and the discharges through the spark gap will be varied by the impulses of the human voice energizing the electromagnet, and through it producing variations in the arc light and in the circuit in which it is located.

An Almost Frictionless Electric Meter.

The chief source of inaccuracy in motor-type recording watt-hour meters is undoubtedly caused by friction in the bearings, between brushes and commutators and in the recording clockwork. If

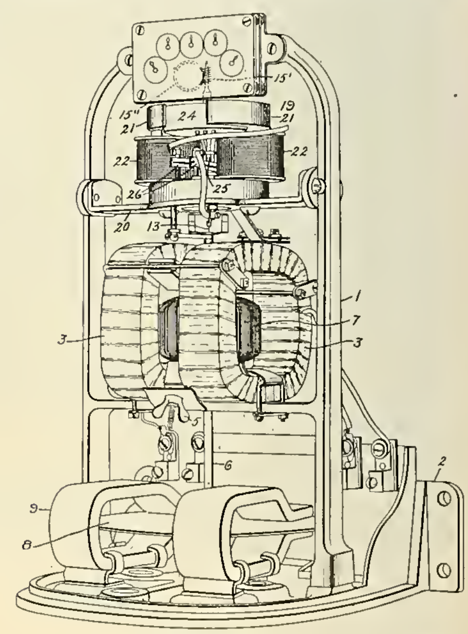


FIG. 1. PERSPECTIVE ELEVATION OF A MOTOR METER DESIGNED TO BE ALMOST FRICTIONLESS.

this friction varied in the same proportion as the load and therefore as the speed of the moving parts, it could readily be compensated for. Actually, however, it varies in an inverse manner, and therefore causes great errors for small loads. From time to time inventors have worked on the problem of reducing this friction. A recent ingenious improvement in this line is the invention of Albert G. Davis and Caryl D. Haskins of Schenectady, N. Y., which was patented on October 1st, and assigned to the General Electric Company.

In this type of meter an auxiliary motor is provided to furnish the requisite starting torque to overcome the initial friction and to supply additional torque from time to time when the moving system lags behind its proper speed of rotation. This motor is mounted above the main measuring motor and has a vertical shaft in line with but distinct from that of the main motor. The moving element of the latter is suspended by a fiber or wire from the upper shaft, thus doing away with bearing friction from the shaft of the main armature and damping disk. This connection between the two shafts is flexible, so that there is relative movement between them. However the upper shaft may intermittently lag or lead the lower one, its total movement will be equal to the total movement of the latter or measuring element, though the speed of the two elements at any given instant will usually be different. Moreover, as the auxiliary element moves proportionately to the measuring element, it is employed to drive a counting train or similar indicating mechanism. The commutator brushes may, if desired, be transferred to the auxiliary member, thus still further reducing the frictional forces tending to resist the movement of the measuring element.

The accompanying drawings illustrate the main features of the invention. Fig. 1 is a perspective elevation of the meter with the casing removed; Fig. 2 is a sectional elevation of the instrument; Fig. 3 is a diagram showing the arrangement of circuits, and Figs. 4 and 5 illustrate details of construction.

Referring to the construction shown in the diagrams, a meter of the well known Thomson recording wattmeter type is shown in connection with the new features. The meter, which is supported in framework (1) carried on the base (2), comprises main field coils (3), an auxiliary starting coil (4) adjustably clamped to the field coils by a thumbscrew (5), a vertical shaft (6) which carries an armature (7) turning in the magnetic field produced by the coils (3 and 4), and a damping or brake disk (8) turning between the poles of one or more fixed brake magnets (9). A commutator (10) for the armature (7) is located above it on the shaft (6), which is reduced in diameter to receive it. Brushes (11) co-operating with the commutator are secured to the framework in the ordinary manner.

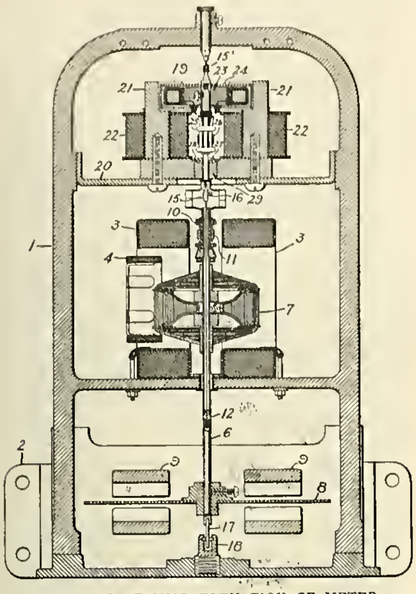


FIG. 2. SECTIONAL ELEVATION OF METER.

The shaft (6) is preferably formed in two sections connected together by a coupler member (12), as shown in Fig. 4. The coupler member is provided with a pair of threaded ends separated by a cylindrical collar. The threaded ends screw into threaded openings formed for the purpose in the adjacent ends of the two sections of shaft (6). The upper section of the shaft (6) and preferably the lower section of the shaft also are made tubular. A filament or wire (13) has its lower end detachably secured to a block (14) which fits in a socket formed for the purpose in the lower end of the coupler member (12). The upper end of the filament or wire (13) is secured to the lower end of a shaft (15) in line with its axis by means of a clamping screw (16) (see Fig. 2). The lower end of the shaft (6) is smaller in diameter than the body of the shaft. This result may be obtained by reducing the end of the shaft or, preferably, as shown, by axially inserting a hardened steel pin (17) in the lower end of the lower section of shaft (6). The pin (17) or the reduced portion of the shaft passes through an annular bearing, which may be formed out of diamond, sapphire or the like, and is carried by a support (18) detachably secured to the base (2). The upper end of the upper section of the shaft (6) may have its bore reduced to a diameter substantially equal to the diameter of the wire in order that the upper end of the shaft may be positioned by its engagement with the wire (13), but preferably the coupling member (12) is located somewhat above the center of gravity of the shaft (6) and parts carried by it, so that in the ordinary operation of the instrument the upper end of the shaft will not engage the filament or wire (13).

The shaft (15), from which the shaft (6) is supported, is the armature shaft of an electric motor (19) which constitutes the auxiliary element of the instrument. The motor (19) is carried by a cross-bar (20) secured to the side members of the frame (1). The field of this motor comprises a pair of pole pieces (21) energized by suitable magnetizing coils (22). The armature (23) of the motor (19), which is shown as of the Gramme ring type, is mounted in a casing (24) formed of some good conducting material, such as copper. The purpose of this conducting casing will be hereinafter explained. The shaft (15) carries a suitable commutator (25). Brushes (26) engage this commutator to supply current to the armature (23). The shaft (15) may be supported in any suitable step bearing. In the construction shown in Fig. 2 the shaft carries a disk (27) which rests against balls (28) mounted in a raceway formed for the purpose in a block (29) mounted in the yoke connecting the pole pieces (21). The upper end of the shaft (15) carries a worm (15') which drives a counting train (15"), shown in Fig. 1.

A pair of diametrically opposed arms (31) (see Fig. 5), are carried by a collar (32) adjustably secured to the lower end of the shaft (15). The arms (31) carry at their outer ends a pair of downwardly extending flexible contact members (33). A similar pair of flexible contact members (34) extend upwardly from arms (35) which project in opposite directions from a collar (36) mounted on and insulated from the upper end of the shaft (6). A flexible brush (32') bears against the collar (32) above the arms (31) and a similar brush (36') bears against the collar (36) below the arms (35). The flexible contact members (33 and 34) are made of conducting material; however, one side of each of the contacts carries a layer of insulating material, as shown in Fig. 5, so that a sufficient movement in one direction of one set of contacts with respect to the other will cause the conducting sides of the flexible contact members to engage, while upon a relative movement in the opposite direction of sufficient extent the non-conducting sides will engage.

The various circuits of the construction of this meter are shown in Fig. 5, in which lines (37 and 38) convey the electrical energy which is to be measured. The coils (3) are shown as connected in series in the line (38). A conductor (39) connects the line (38) to one brush of the meter armature (7). The other brush of the meter armature is connected to the line (37) through the starting coil (4) and a suitable resistance (40). A conductor (41) leads from the line (37) in series through the coils (22) to one of the brushes of the motor (19). The other brush of this motor is connected by a conductor (42) to the brush (32') which bears against the collar (32). A conductor (43), which includes a regulating resistance (44), is connected to the brush (36') bearing against the collar (36).

Assuming the initial position of the meter to be that in which the contacts (33 and 34) are separated, as indicated in Figs. 3 and 5, upon the passage of current through the coils (3 and 4) and through the coils of the armature (7), the latter will begin to rotate. The only frictional forces retarding the movement of the armature are those produced by the engagement of the brushes (11) with the commutator (10) and the brush (36') with the collar (36), together with the very insignificant friction between the pin (17) and the annular bearing (18). These forces are very small. When the armature (7) turns far enough, the contact members (33 and 34) will engage. This will cause current to flow through the windings of the series motor (19), the armature of which will immediately start to revolve. The motor (19) is so wound that the speed given to the shaft (15) is considerably greater than the speed of the shaft (6) under the normal load on the meter. As a result, as soon as the motor (19) is energized by the engagement between the contacts (33 and 34), its armature will move so as to separate these contacts, thus breaking the circuit through the motor (19). The conducting casing (24) co-operates with the pole pieces (21) to form a brake for limiting the speed of armature (23) and for immediately slowing it down when the motor is deenergized. After the separation of the contacts (33 and 34), if the load on the meter continues, the contact (34) will again approach the contacts (33) and after a slight interval will again engage contacts (33) to energize the motor (19). This operation, including the intermittent energization of the motor (19), is continued as long as the load remains upon the meter. Of course, it will be understood that the motion of the armature shaft is intermittent only with respect to the motion of the shaft (15), and that the shaft (6) will rotate uniformly with respect to the framework so long as the load on the meter does not change. If the wire or filament (13) is made of torsionless fiber the twisting of the filament will produce no effect on the constant of the meter. If, however, it is made out of some material such as piano wire, its resiliency may be relied upon to give the necessary starting torque to the armature (7), thus doing away with the necessity for an auxiliary coil (4). It has been found that to establish a working circuit through the motor (19) the contacts (33 and 34) must be pressed together with a certain amount of force. The torsion of the wire or filament (13)

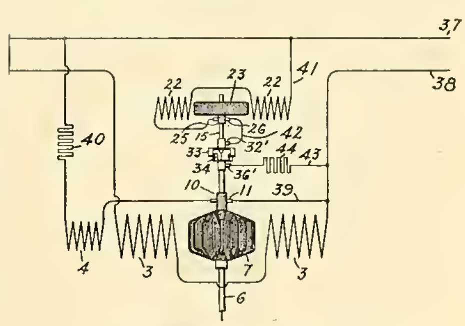


FIG. 3. ARRANGEMENT OF METER CIRCUITS.

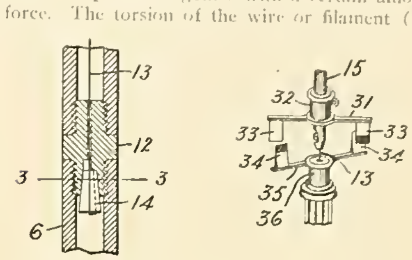


Fig. 4. Fig. 5.

DETAILS OF METER CONSTRUCTION.

may be adjusted to supply this force as well as to supply the starting torque.

The general principles of the construction of this meter can be carried out in a number of modified forms. The auxiliary motor may be changed from a series motor to one having an iron bar for rotor and a distributed field winding for the stator, the latter producing a revolving magnetic field, which drags the rotor around. The construction of the parts shown in Fig. 5 may also be modified considerably so as to get a more positive pressure between the contacts (33 and 34) and so as to prevent arcing between them.

The distinctive feature of the invention is that bearing friction in the main motor is practically eliminated and that the insignificant brush friction remaining is compensated by an auxiliary motor taking a slight current from the line only intermittently while energy is being used on the metered circuit. Moreover, the slight current this auxiliary motor takes is not indicated on the meter, and therefore the readings of the latter should correspond almost exactly with the actual energy consumed by the translating device, whether its load is large or small in comparison with the normal capacity of the meter.

Steam Power-transmission Plants Planned for Texas.

J. J. Henry and T. B. Burbridge of Denver, Colo., are said to be making progress with their preliminary plans for building a large electric power plant at Austin, Tex., for the purpose of supplying a large number of towns of Central Texas with light and power. They will use lignite for fuel and have secured options on extensive lignite fields near Austin. It is possible that $3,500,000 will be expended in installing the plant and in building the transmission lines. Some of these lines will be of unusual length. Mr. Henry installed the Consolidated Power and Light Company's plant at Deadwood, S. D., and the Northern Colorado Power Company's plant. He says that the latter plant is a parallel undertaking to what is contemplated in Texas. The Colorado plant is located on the lignite beds north of Denver. It supplies 25 cities and towns in Northern Colorado, besides supplying the power to the Colorado and Southern Railroad for its northern division.

Samuel Kahn of San Antonio is at the head of a company which is being organized to install a large electric power plant at the coal mines, 25 miles from Laredo. The power will be transmitted to Laredo and used also for operating irrigating plants in the valley of the Rio Grande.

Automatic Telegraphs in the United States.

By D. McNicol.

The recent telegraphers' strike, which has been general throughout the country, has again brought to public attention the question of the substitution of machine or automatically operated telegraphs in place of the manually operated system.

It has been frequently charged by government-ownership advocates and by inventors of automatic telegraph systems that the telegraph companies now in existence have discouraged the exploitation and adoption of mechanical telegraphs. It may be that some oversanguine inventors have been shown the shortcomings, from a practical viewpoint, of their inventions. But there is little reasonable argument in the statement that the telegraph companies have at any time looked unfavorably upon inventions which would actually improve the service or reduce its cost to them.

In the words of Mr. John Gavey, the eminent English telegraph engineer, most telegraph administrations have considered the ideal system to be a manual system, in which the messages are brought up to the instrument at the sending station and dispatched over the wires, while at the receiving station they are written off direct, packed in envelopes, and sent out without any intervening operations.

It has been stated by Mr. J. C. Barclay, assistant general manager of the Western Union Telegraph Company, that a successful printing telegraph system will never be developed outside of the telegraph office.

That this is true is generally believed by telegraph men actually engaged in the business and who have made a thorough study of the art of automatic telegraphs as developed by inventors, both in and out of the service.

In England the Wheatstone automatic telegraph is largely used. It consists of a tape-perforating machine by means of which telegrams are prepared for transmission, a transmitter which utilizes the perforated strip to transmit the telegram so prepared, and a receiver actuated by electrical pulsations set up by the transmitter, the dots and dashes of the letters being recorded on stiff paper tape. A speed of 200 words a minute is common practice in England, although theoretically the apparatus is capable of transmitting 600 words a minute over the comparatively short circuits in use there.

This system is also used to some extent in America. The fact that this system is not more widely used here, or, rather, the fact that it is losing ground, is evidence sufficient that it does not meet the requirements.

The most promising of the scores of automatic telegraphs invented and patented in this country are the Buckingham, Barclay, Rowland, Murray, Dean and Delaney systems.

The Rowland system, which is being given an extensive try-out by the Postal Telegraph Company, first between New York and Boston, and more recently between New York and Chicago, consists of a synchronous arrangement employing two direct-current motors. One motor drives the mechanism which produces an alternating telegraphic current of about one hundred complete periods per second. The second motor drives the commutator for synchronizing purposes. The use of the alternating current in the Rowland system furnishes great possibilities for long-distance transmission.

Figs. 1 and 2 are reproductions of photographs of Rowland equipment.

One feature of the Rowland system which recommends it to telegraph engineers is that it fits into the present method of handling telegraph business. Telegrams to be transmitted are distributed to the sending operators as in the familiar Morse method. At the receiving end telegrams are recorded upon the regulation telegraph forms ready for turning over to the delivery department.

The printing of the message is directly accomplished. That is, no perforated or otherwise prepared tape is used at either the sending or receiving end. At the receiving end the keys of a typewriter are controlled by the operation of a similar keyboard at the sending station.

The multiplex feature of the Rowland system, of course, necessitates modification in the working of the typewriter, as compared with the operation of an ordinary typewriter. The duration of the operation from the time a key is pressed at the sending station until the character is printed on the receiving blank at the distant station is less than one-fourth second.

On account of the distribution of the line to the different operators the keys are locked and unlocked automatically at intervals of one-fourth second. A sending operator may depress a key only when it is unlocked. The key, however, remains depressed until the letter has been correctly transmitted. After the expiration of one-fourth second the sender can depress another key, and the key previously depressed will automatically return to normal position. Those operations of the receiving typewriter which move the paper from line to line and which return the carriage to the beginning of a new line are controlled by the keys of the sending typewriter called the lining, backing and blanking keys.

At the sending station a tape recorder indicates to the sending operator the manner in which the telegram is being printed on the receiving blank at the distant station. In place of the bell signal, which is an attachment of the ordinary typewriter to indicate when the carriage has approached within a certain number of characters of the end of the written line, in the Rowland machine a red signal lamp automatically lights up. Depression of the backing key on the sending typewriter causes the carriage of the typewriter at the receiving station to return to the beginning of a new line. Whereupon the signal lamp is automatically extinguished.

The method of "feeding" receiving blanks to the receiving typewriter is that of having the form of the telegraph blank printed on long bands of paper about eight inches wide, the paper being carried around a roll and carried between a platen and a constantly revolving wheel. In actual practice the speed obtained is about forty words a minute. The evident advantages of the Rowland system are:

1. Direct method of operation.
2. Large carrying capacity per wire.
3. Large capacity per operator.
4. Message printed in page form ready for immediate delivery.
5. Small liability of error.
6. Ease of manipulation.
7. Printed record at sending station.

Another system of automatic telegraphy which is being given practical trial is that invented by Mr. Robert L. Dean of Kansas City, Mo. During the last five or six months this system has been in operation over a 320-mile circuit between Kansas City and St. Louis, Mo. The wire employed is also used for telephone purposes. Specially constructed Hammond typewriters are used for both sending and receiving. That is, the typewriter at the sending end is used to prepare the telegram for transmission. The messages are prepared at about fifty words a minute, after which the transmitter sends them over the line at a speed of about 400 words a minute. At the receiving end the letters forming the words of the message are printed in Gothic letters in page form, something similar to the old Bonelli chemical telegraph reproduction.

The Western Union Telegraph Company has adopted the Barclay page-printing system. In this arrangement the receiving apparatus connected with the main line consists of a differentially wound polarized relay, the local contact points of which control alternately two local circuits, which actuate magnets supplied with peculiarly constructed armature levers, through which circuits are made up to any desired key or letter magnet of the typewriter used for receiving. The periphery of the type-wheel bears all necessary letters and characters required in printing. The sending operator operates a typewriter transmitter. At the receiving end the telegrams are printed on regular telegraph forms, which are "fed" into the receiver as required. The entire operation of the typewriter is accomplished by means of relays and magnets in the local circuits. This feature to some extent eliminates the effects of line disturbances. The synchronizing of the home with the distant relay is not necessary. The Barclay system has for some time past been in successful operation between Buffalo and New York on Western Union lines.

Another system which for a number of years was used on the Buffalo-New York and New York-Chicago circuits of the Western Union is what is known as the Buckingham system. In this device unique arrangement of perforating apparatus for preparing the paper slip for transmission and the automatic printer located in the local receiving circuit are the distinguishing features. The slip is passed through an ordinary Wheatstone transmitter and sent to line. The message is received at the distant station by a Wheatstone relay, which controls a local circuit, containing electromagnets, which operate the type-wheel. This type-wheel is mounted upon a shaft so constructed that the wheel moves axially or circumferentially, or in both directions simultaneously. Four rows of type, rotating through half-revolutions in either direction, are employed in place of a large wheel, having the entire list of characters in a row on its periphery, and rotating all the way around. The axial movement brings any desired row of type into line with the printing pad, while the rotary movement shifts the type of a row into the printing position.

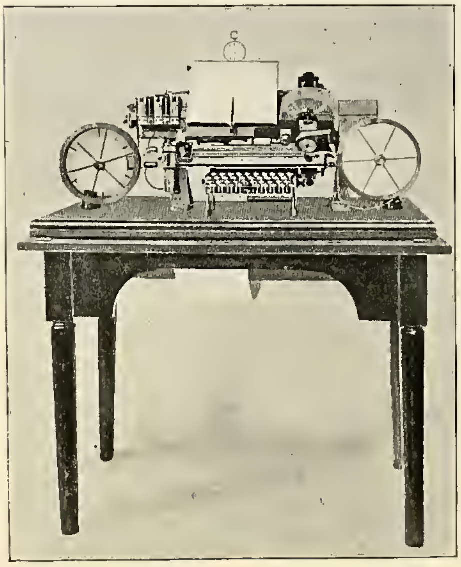


FIG. 1. ROWLAND DIRECT KEYBOARD TRANSMITTER, SHOWING HOME RECORDING TAPE.

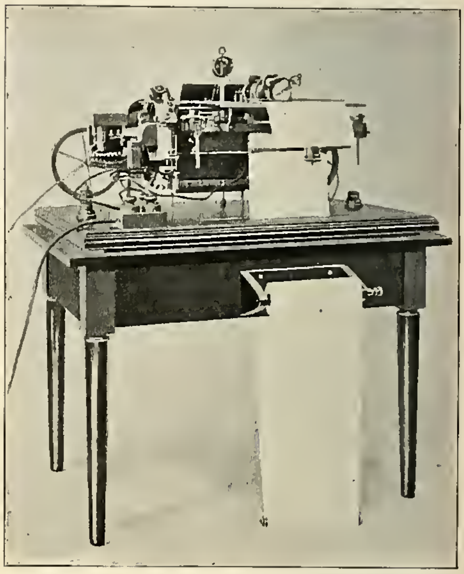


FIG 2. ROWLAND DIRECT-PRINTING RECEIVER.

The chief objection to the use of the Buckingham system is that a perforated strip is required for transmitting purposes. In this respect, and in the matter of greater number of characters which may be employed, the Barclay system is superior to the Buckingham. In the receiving apparatus of the Buckingham system the armature of a main-line polarized relay controls two local circuits. Rates of speed regularly obtained on the New York-Chicago circuit, working duplex, average one hundred messages an hour in each direction. The circuit is worked through ordinary Wheatstone repeaters at Buffalo. Figs. 3 and 4 show the Buckingham apparatus.

A system at one time tested by the Postal Company, and more recently installed on telegraph lines in Russia, and which is the invention of Mr. Donald Murray, consists of a group of machines at each end of a single telegraph wire. Perforating machines with typewriter keyboards prepare the telegrams for transmission in the form of punched paper tape, which is run through automatic transmitters at the receiving end. An electrical perforating machine controlled by the distant transmitter reproduces the signals of the transmitting tape. The received tape is then run through an automatic printer, which prints the telegram in page form, the latter operation being performed at a speed of 120 words a minute. For transmission on the same wire in the opposite direction a similar group of machines operated in reverse order is required. The operation of the printer at the receiving end is accomplished by means of an electric motor. Such functions as running the typewriter carriage back and turning up to a new line are automatically controlled by the perforations in the transmission tape.

It will be observed that in the Murray system perforated tape is used at both ends of the line. In the Buckingham system it is used at one end only, and in the Rowland system the tape is not used at either end, excepting the tape reproduction which is made at the transmitting end for the purposes of record and check.

From the standpoint of the telegraph engineer, who seeks the ideal, the use of tape has ever seemed an objection.

The Murray system is also used in Great Britain, Germany and in India. Mr. Murray has been engaged by the British Postoffice Department for a term of years to develop printing telegraphs to suit special local conditions.

FIG. 3. BUCKINGHAM RECEIVER.

In France the old Boudot system, invented 30 years ago, is still in use. The Boudot system is not to be compared in efficiency with the systems heretofore described, as it does not employ a typewriter keyboard for transmitting and does not print the messages in page form. Its chief advantage lies in the fact that it is capable of transmitting six telegrams simultaneously over one wire.

The French government has recently experimented with a system of telegraphy invented by Professor Mercadier, the director of the High School for Posts and Telegraphs in Paris. Professor Mercadier employs alternating current, which, by the application of tuning fork interrupters, are taken from direct-current sources for the transmission of telegraph signals in a multiplex system. It is asserted that 20 telegrams can be sent over a single wire simultaneously. One objection to the Mercadier arrangement is that its operation causes serious interference with neighboring telephone circuits.

A printing system has been invented by Mr. John Burry of New York, which, although it has not been given extensive trial, possesses some meritorious features, especially for short-distance distribution of press matter and stock quotations. The apparatus consists of a transmitter at a central station, from which, by the operation of a typewriter keyboard, electrical impulses are sent out in proper sequence and of proper polarity, over two-line wires, to any number of printing-telegraph receivers. Depression of a key of the transmitter causes electrical impulses to be sent through the circuit. These impulses act upon a series of magnets in each of the receiving instruments. The magnets furnish the energy for the automatic movements of the machines.

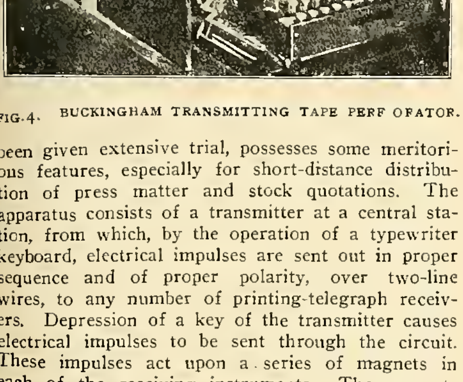


FIG. 4. BUCKINGHAM TRANSMITTING TAPE PERF OPATOR.

There are two or three other systems of automatic telegraphs which have distinctive advantages and also disadvantages, considered from the viewpoint of the requirements of a satisfactory system of automatic telegraphy. Such a system would make it practicable to handle large numbers of telegrams accurately and rapidly over long circuits, with a reasonable first cost, low cost of maintenance, reduction in cost of operation and ease of manipulation.

In a very ingenious system invented by Mr. P. B. Delaney of South Orange, N. J., line static is utilized in place of being eliminated. The system requires static capacity for its operation, and in cases where the line wire used does not furnish a sufficient quantity, condensers are employed. All signals, whether dashes or dots, are the result of two impulses of equal duration, positive or negative. The production of a dot or dash is determined by the time elapsing between two impulses.

Other systems of automatic telegraphy which might be mentioned are the Pollak-Virag, Weiny-Phillips and the Casper page-printing telegraph. The first named has been introduced on some European lines with fair success. Messages are prepared for transmission in a similar manner to that employed in the Buckingham system. There is a radical departure, however, in the method of receiving the message. The arriving electric impulses cause a thin metal strip resembling a telephone diaphragm to vibrate and thereby cause a small mirror attached thereto to move and throw a slender beam of light reflected from an incandescent lamp into a photographically sensitive strip of paper, which latter is unrolled by clockwork as signals arrive. Chemical development of this paper strip brings out a continuous dark line, with upward projections indicating dashes, and downward projections indicating dots of the code used.

This system was tried out on a circuit between New York and Chicago during the latter part of the year 1899, but the success obtained was not such that the application of the invention to the operation of American lines would be of any material advantage.

In the Weiny-Phillips system the work of the expert sending telegrapher consists of operating a local circuit by means of a regular Morse key. This local circuit includes a tape-preparing machine. The tape is then run through an automatic transmitter, and messages are so transmitted at about 100 words a minute over the main line to distant stations. The receiver consists of a relay and an embossing register which reproduces on the home tape signals corresponding to those of the transmitting tape. The receiver tape is then run through a local transmitter, the speed of which may be regulated to suit the ability of any available operator, the signals being locally reproduced on an ordinary Morse sounder in circuit with the local transmitter and may be copied on telegraph-receiving forms on an ordinary typewriter.

The complete story of printing telegraphs, if told, would be a long one and would show the life work of a host of brilliant minds. That there have been so many failures and so few successes in this line of endeavor seems solely attributable to the fact that inventors have failed to realize that a successful automatic telegraph system absolutely must print messages in page form, at high rates of speed and over long circuits.

Of the numerous systems so far developed the Rowland gives the most satisfactory results. This system, at least, embodies two of the three fundamental principles of the ideal machine, in that it produces a typewritten telegram and may be worked over comparatively long distances. In the matter of obtaining high speed the difficulty has ever been that the static charge which remains in the main line after each pulsation of current "tails" the signals to such an extent that the limit of speed is soon reached.

The employment of automatic telegraph systems is desirable or necessary only between large centers, but for such service there is a large field for the successful system, and the future of telegraphy in America will undoubtedly have much to do with automatic operation.

Chicago Bills Before the State Legislature.

The Chicago City Council this week sent a committee of five to Springfield to urge before the state Legislature the passage of the bill introduced into the Senate by S. A. Ettleson requiring that within three years all railroads in the city limits operate their trains by electricity instead of steam.

The Council also sent a communication to Springfield recommending to the Legislature that the required statute be passed giving Chicago the power to regulate the rates charged by public-utility corporations. A bill to this effect was introduced by Harry G. Hall.

Magnetic Clutch with Several Working Surfaces.

A French patent has been recently obtained by Ravenshaw, Middleton and Townsend for an improved form of electromagnetic clutch. This clutch is of the form in which the magnetizing action is secured by means of an iron disk having a coil of wire sunk flush with the surface, the disk attracting a second iron disk which is mounted on the other shaft which it is desired to couple to the first shaft. The present device differs from the ordinary form by the following construction: Instead of having a single element of the clutch mounted on the motor shaft and a single one placed on the driven shaft the new form has at least one other piece which can be disposed on either of these two shafts.

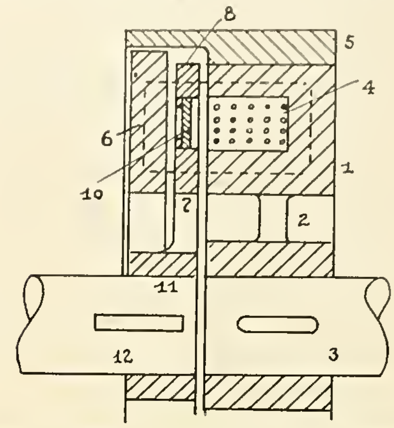


FIG. 1. MAGNETIC CLUTCH WITH SEVERAL WORKING SURFACES.

Fig. 1, a sectional view, shows the principal disk (1) of the clutch system, mounted by means of the spider (2) upon the motor shaft (3) and keyed in a fixed position on the latter shaft. This disk is magnetized by the coil (4), this being placed in a groove and sunk flush with the surface of the disk. On the outer part is a ring (5) made of non-magnetic material, which is fixed solidly upon the main disk. On the opposite side is placed a flat metal ring (6) of magnetic material. It is keyed to the cylinder (5), which projects upon this side by means of a long key, so that it can slide back and forth inside the latter and at the same time revolve with it, and is otherwise independent of the shaft.

Between these parts is a middle element which is made up of two concentric rings (7) and (8). These two rings are fixed upon an intermediate ring (10) of non-magnetic material. The inside ring (7) is fixed to the spider (11), which is keyed on the driven shaft but can slide upon it.

When a current is sent into the magnetizing coil the elements (6) and (7) are attracted to the right and press against the first disk. The magnetic circuit is therefore closed across the disks, as is shown by the dotted line, and the friction of the surfaces in contact oblige the shaft (12) to turn with the motor shaft according to the well-known action of such clutches. But in the present device, with a greater number of working surfaces, there is an increased tractive power.

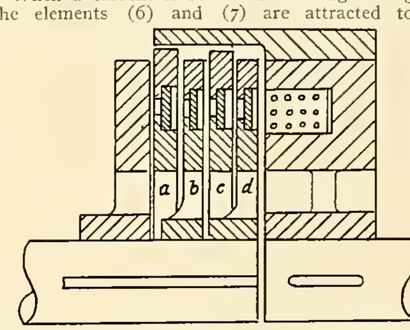


FIG. 2. MAGNETIC CLUTCH WITH SEVERAL WORKING SURFACES.

In Fig. 2 the number of working surfaces is still further increased by using a greater number of elements. This is done by introducing four middle pieces instead of one. Such pieces are indicated at (a) (b) (c) (d) and are each composed of a double magnetic ring separated by a non-magnetic ring so that the three rings form a fixed system. Two of these elements, (b) and (d), are connected with the shaft and are keyed to it so as to slide upon the shaft. The other two disks (a) and (c) are in like manner keyed to the outer cylinder and slide upon it. Here the outer piece on the left is not keyed to the latter cylinder as before shown, but is made to slide by the key upon the shaft. For the rest the construction is as in Fig. 1.

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DEPARTMENTS.

AUTOMATIC or machine telegraphy is destined to play an increasingly important part in electrical communication, and therefore Mr. McNicol's article on the use of this class of apparatus in the United States is of timely interest. Written from a practical telegrapher's viewpoint, the contribution, given elsewhere in this issue, will be useful to all interested in the art.

PROJECTS for power-transmission plants where electric power is generated by steam or possibly gas engines at coal mines are increasing in number. The idea is to transmit power derived from the coal over wires rather than the actual coal itself in railroad cars. Installations of this character are in operation in Nova Scotia and Colorado, and others are under consideration in Texas and elsewhere. Mr. Alex Dow, president of the Association of Edison Illuminating Companies, made a reference to this subject in his interesting consideration of the comparative value of waterpower and steam power in his recent annual address. The pit's-mouth plan is an old one, but seems to be receiving renewed attention at the present time.

IT'S A POOR RULE that doesn't work both ways. If a state commission be given the power to reduce the rates of a public-service corporation when such rates are deemed to be excessive, it should in like manner increase the rates if they prove to be unremunerative to a company which is efficiently managed. Usually the zeal of the commissions is in the line of reduction, but it is a pleasure to record at least one instance where, on application, the rates of an electric-light company were raised. The case came up in Wisconsin recently and was based on the application of the La Crosse Gas and Electric Company to the Railroad Commission of Wisconsin, to which the Legislature last winter intrusted the control of public-service corporations. As the result of local conditions the La Crosse company found itself burdened with rates which were below operating costs. It appealed to the commission for authority to increase its rates, and after due investigation the application was granted. The findings of the state body are given at some length elsewhere in this issue, and they will possess much interest for all central-station men.

IN A PAPER entitled "The Possibilities of Electrical Development," read before the Birmingham and District Electric Club, Mr. R. Borlase Matthews suggests the establishment in England of an association patterned after the Co-operative Electrical Development Association of the United States. Mr. Matthews thinks that the success of that association "should set British electrical manufacturers and central-station managers seriously thinking whether it would not be of great advantage to form a somewhat similar association in this country, not necessarily along the same lines as the American association, but modified to suit the needs and customs of an older civilization. The argument may be brought forward that the Americans are more progressive than ourselves, and also that they do not suffer from gas competition. This is not a fact, but only a general impression, which is true only of the larger cities, such as New York, Chicago, Philadelphia and Boston. It does not take a very long residence in places other than these larger cities before it is realized that there are many Americans who are far from progressive, and that gas competition is indeed a very serious factor in the older cities. In many parts of the States there is also the competition of cheap natural gas. The income per capita of the average American city is only a trifle higher than that of the average English town, and it is only within the last year or two that American central stations have realized that it is essential to sell electricity along very much the same modern business lines as they would sell any other commodity."

The Co-operative Electrical Development Association has indeed done good work in the United States, largely, it is but fair to say, through the personal efforts of Mr. J. Robert Crouse, who succeeded, almost by his own individual efforts, in arousing a great industry which was pretty much alive before. Primarily the work was undertaken to help the sale of incandescent lamps, but Mr. Crouse was so convincing in showing that the greater use of electricity was for the benefit of all, and his enthusiasm was so contagious, that in a few months he was in the forefront of a powerful "forward movement" in the electrical industry. So far from there being no gas competition in the United States, it is the fact that very alert and keen gas competition had not a little to do with starting the Co-operative movement. Great Britain will do well to follow the example, but someone with energy, patience, tact and enthusiasm must be found to be the propagandist of the movement as Mr. Crouse has been in the United States.

WIRING INSPECTION is carried out more carefully, thoroughly and scientifically today than ever before. The results are seen in the greatly improved quality of electrical construction and the decreased electrical fire hazard, although the latter was never so great as sensation-mongers would have the public believe. Much still remains to be done, however, and all electrical contractors should do their part—a very important part, of course—to the end that all new electrical construction at least may be up to the requirements of the National Electrical Code. Reputable contractors are willing to do this, but it is not so easy to keep up the standard, for high-class electrical construction costs money, and there are not wanting less scrupulous contractors who are willing to use inferior material and workmanship in order to cut the price on the job and get the contract. In England this individual is known as a "jerry wirer," and everywhere he is low in the estimation of electrical men. But in the last analysis customers who insist on the lowest prices are themselves to blame if the work they receive is not up to standard. In the electrical business, as in any other, good work and good goods command their price, and it doesn't need technical knowledge, but simply common sense, to recognize the fact. But, despite the vagaries of an occasional irresponsible contractor, it is a pleasure to be able to bear witness that the general tendency of electrical construction is distinctly toward better and more thorough work.

UNDER the heading "A Modern Instance" we print this week in the "Selling Electricity" department an instructive account of a ten-day campaign for new central-station business by a man whose name we are not permitted to divulge, but who has made an enviable record in marketing electric light and power. The scene of activities was a small Iowa town where the electric-supply company was not measuring up to its possibilities, as is the case in thousands of other towns and cities in the United States. The management did not know just what to do itself, but it did the next best thing and enlisted the services of one who did. The outsider spent ten days in the town, and as a result he convinced the local company not only of the feasibility but of the decided advantage of establishing a day circuit. Before he left he secured definite agreements for the placing of 25 motors, which will bring a return for current consumption of over $2,700 a year, to say nothing of the benefit to the lighting service and the opportunity of introducing electric fans, flatirons and other appliances which are used in the daytime. In this case the local people said that practically no power load could be obtained, but their adviser proved that they were in error by getting over $2,000 worth of power load promised in half a day's work. He also suggested rendering the bills monthly instead of quarterly, and induced several of the gasoline-light users to transfer to the electric service on promise of current being available in the daytime.

The story is an instructive one as showing the capabilities of the central-station business even in a small city at the hands of an earnest, thoughtful and energetic man. The lesson is not so much that outside talent should be secured to start the new-business campaign (although such a course is often advisable) as that local managers should study their conditions carefully and not be satisfied with the business that offers or the business in sight, but create business by anticipating electrical needs of which possible customers have little or no idea. The campaign of education is needed even more in the small town than in the large city, and the local manager should be the electrical schoolmaster of his community.

Bids for Winnipeg's $3,500,000 Power Plant.

Winnipeg, Man., November 2.—The financial depression which has prevailed all over the North American continent resulted in a heated argument in this city in relation to the construction of the $3,500,000 power plant to be built by the city at Lac du Bonnet. Mayor Ashdown advocated leaving construction until next year, owing to the condition of the money market and his failure to dispose of the power bonds during his recent trip to England. However, the people of Winnipeg want cheaper power at once, and in the Council the majority of the aldermen were in favor of immediate construction of the plant. It now seems certain work will commence as soon as the contracts have been awarded.

At a recent meeting of the power committee the following tenders were recommended to the Council for acceptance:

Telephone—J. Y. Hyland & Co., $24,839.93.

General works—Robinson, Pratt & Ryckman, including possible contingencies and variation in quantities, $862,000.

Generators, exciters and induction motors—Swedish General Electric Company, $145,000.

Low and high tension electrical equipment—Canadian Westinghouse Company, covering modifications agreed upon, $382,000.

Steel towers—Naylor Bros., $99,000.

Insulators—Lima Insulator Company, including estimated cost of inside insulators, $18,500.

Transmission cable—Northern Aluminum Company, $180,000.

Auxiliary appliances—Canadian Foundry Company, Allis-Chalmers-Bullock Company, Canadian Fairbanks Company, including estimated cost of oiling system, $35,000.

Repair shop equipments—Canadian Fairbanks Company, $6,715.

Total, $1,753,054.93.

The following tenders were also received but the power committee did not recommend their acceptance and it is likely new tenders will be called: Turbines, $200,000; terminal station, $93,600; protective appliances, $8,000; electric cranes, $18,980; turbine governors, $18,000; total, $338,580.

On the following items no tenders were received: Erection of line (estimated, $104,400); clearing of remainder of transmission line (estimated, $12,500); bridge (estimated, $15,000); total, $131,900.

The following contracts have been let and are now in progress: Tramway grades, etc., $125,000; bridge at Winnipeg River, $45,000; clearing portions of transmission line, $6,000; total, $176,000.

Under civic control the following works are being constructed: Construction, tracklaying and ballasting, $135,000; rolling stock purchased, $12,000; total, $147,000.

In addition to the above the following items must be added to the cost of the plant: Estimated loss of railway operation, $10,000; corduroy road, $35,000; engineering, $159,000; right-of-way and fencing, $104,000; total, $299,000. Making a grand total for the cost of the plant of $2,845,534.93 against an estimate dated April 25, 1906, of $2,929,625.

A bulk tender of $3,094,000 was received from the Anglo-Canadian Engineering Company, the company offering to take power debentures at 92 in payment for the work, but this offer is considered too low.

It is expected the tenders recommended for acceptance by the power committee will be signed at once and a start on the work made this fall so as to have the plant in operation at the earliest possible moment. R.

Drainage Canal Power Nearly Ready for Distribution in Chicago.

After December 1st the Sanitary District of Chicago will be ready to supply current for light and power to users in Chicago and the rest of the Sanitary District. In the large hydro-electric power plant on the Drainage Canal at Lockport, descriptions of which have been given in the Western Electrician, three units aggregating 12,000 kilowatts are being tested and the final adjustments made preparatory to furnishing power under contract by December 1st. The fourth unit is being completed, and eventually a total of eight units of similar size will be in operation, giving 32,000 kilowatts.

The city of Chicago will be among the first users of the new current, having contracted to take 7,000 kilowatts in December. The fine steel-tower transmission line of the Lockport plant, described in the Western Electrician of September 7th, has been completed and is ready to bring the current to the sub-station at Western Avenue and the canal. For some time the city electrical department has been busy installing the distributing system from the sub-station, and City Electrician Carroll is now preparing the city lighting plants for the Lockport power. One new transformer station has been built by the city, and in the existing street-lighting plants electric motors will take the place of the steam engines for driving the generators.

Preparations are being made by the Sanitary District to do the pumping for the North channel by screw pumps driven by slow speed 450-horsepower motors installed at Wilmette and taking current from the canal sub-station. Others who will use a considerable amount of the canal power are the West Park Board, the township of Cicero and the village of Morgan Park. Union Stock Yards firms are also preparing to use the current. The Sanitary District will receive $15 a horsepower for the current.

Power Development on the Desplaines River.

Plans of the Chicago Drainage Canal trustees have contemplated the construction later on of a second power plant near Joliet, four miles farther down the Desplaines River from the existing plant at Lockport, Ill., the plant to be similar to the Lockport installation as to dam and ship lock, the whole project being in line with the proposed deep waterway to the Mississippi, in furtherance of which $20,000,000 state aid is proposed.

These plans, however, seem to involve to some extent certain private waterpower rights along the Desplaines River, which rights have become more valuable by the increased flow of water resulting from the Drainage Canal. The Economy Light and Power Company of Joliet, Ill., has been doing some work on a waterpower dam in the Desplaines River near the confluence with the Kankakee River, where it is proposed to construct a power plant. This site is about 14 miles below Joliet or 18 miles below Lockport.

This plant and the proposed plant of the Sanitary District at Joliet have been the subject of some controversy. Coming, therefore, at this time, the Allen-Lantz bill in furtherance of the deep waterway project has taken on more interest. This bill, introduced in the present session of the state Legislature, declares the Desplaines and Illinois rivers to be navigable and orders the state authorities to proceed to remove all obstructions. This, of course, would affect the Economy plant. The bill in its natural course, if passed, would become a law on July 1, 1908, but an emergency clause was attached making the law effective immediately upon the passage of the bill.

The bill, with the emergency clause eliminated, passed the Senate last week and immediately some of the legislators and newspaper writers declared that the emergency clause was stricken out to give the private concern ample time to complete its plant before the bill became a law, provided, of course, the House concurred in the action of the Senate, which was not done.

So much has been written in the newspapers on the subject that Mr. Samuel Insull, president of the Economy Light and Power Company, issued the following statement, dated November 4th:

"There has been so much misrepresentation about the Economy Light and Power Company in connection with a contemplated deep waterway and with legislation by the adjourned session of the Illinois General Assembly that, departing from my usual policy of silence in relation to matters under my charge, I deem it proper to ask a little space now for a few words.

"I am president of the Economy Light and Power Company, and I think it will be appreciated that I probably know something about its action.

"In no way whatever has the Economy company sought or undertaken to influence legislation by the adjourned session of the Legislature. It has had nobody at Springfield to act for it, directly or indirectly, in the Legislature or out of it, in favor of any measure or against any measure. All statements to the contrary are unfounded and untrue, and I am afraid in many cases have been known to be untrue by the parties making them, who desire thereby to create an atmosphere hostile to the company.

"In the last few days much has been said in the newspapers about the action of the Senate upon the so-called 'navigability' bill in striking out the emergency clause, and this action seems to be in some way attributed to the Economy company. I want to say with all possible emphasis that neither I nor anybody else connected with the company, so far as I know, has in any way been instrumental in bringing about this action of the Senate, or had any advance information about it or know why it was taken.

"Further, let me say that the Economy company is not hostile to the deep waterway. All the company's plans have been executed with the knowledge and acquiescence of United States government engineers so as to harmonize with any future federal deepwater work. The company's present work at Morris was projected more than a year ago, and bonds were publicly sold to provide for it, and the work is now going on in an ordinary and usual way, and not with 'feverish haste.' The plans for the work were submitted to the secretary of war, who did not issue a permit therefor, solely because he was advised that the Desplaines River was not navigable in fact, and that he therefore had no jurisdiction in the premises, but he intimated that if the river were navigable and he had jurisdiction he would have been disposed to issue the permit.

"The Economy company is simply a property owner, owning land along the banks of a river and under a river which is not navigable, and, like other property owners, it is exercising its right to improve its property at its own expense. It does not expect that its property will be or can be taken away without compensation, and it has not tried to stand in the way and does not wish to stand in the way of the contemplated waterway."

To Increase Boiler Capacity During the Peak.

[From the Question Box of the American Street and Interurban Railway Engineering Associations.]

In a small or medium size plant, what is the best method of increasing boiler capacity during heavy peak load? Give details and results obtained.

Answers.

D. Thomson, De Kalb-Sycamore and Interurban Traction Company, De Kalb, Ill.: We think induced draft. Just about installing an outfit.

A. J. Kohler, Lynchburg (Va.) Traction and Light Company: Have been using the Parson system of furnaces in two plants to increase boiler capacity with very good results, obtaining 25 to 40 per cent. more steam from boilers than with hand fire. This system was installed to carry us over the peak load, otherwise we would have had to purchase more boiler capacity and have bought more land for boiler room. We have got as much as double rating from boiler with clean boiler and clean fires, the only requirement being that boiler be kept clean so as not to lose tubes.

Anonymous: Increase the grate area. The output of the boiler depends very largely upon the amount of coal that can be burned, which in turn, the draught being good, depends on the grate area. In power-station work it is therefore of no great importance to have a large grate area. While forcing a boiler in this way will necessarily give a high flue temperature, the losses thus caused are not great and only last for a comparatively short time.

George W. Knox, Green Bay (Wis.) Traction Company: Careful firing.

Alfred Green, Brooklyn, N. Y.: In a medium-size plant where No. 3 buckwheat coal, or a mixture of No. 3 buckwheat and soft coal are burned the capacity of the boilers can be considerably increased by increasing the percentage of soft coal in the mixture and still make very little smoke. With a mixture half and half of No. 3 buckwheat and soft coal at least 175 per cent. rating can be obtained with less than two inches of air under the grates.

H. R. Fothergill, Greenville Traction Company, Greenville, S. C.: By blowing superheated steam and air at bridge.

Electrical Exports for September.

Electrical exports from the United States in the month of September, 1907, show a decline in total value of $157,053 compared with September, 1906, the total values for the two months being, respectively, $1,247,368 and $1,404,421. Both classes of electrical exports—electrical appliances and electrical machinery—participated in the decline, as shown by the following figures: Electrical appliances, including telegraph and telephone instruments—September, 1907, $648,513; September, 1906, $677,821. Electrical machinery—September, 1907, $598,855; September, 1906, $726,600.

The following-named countries were the principal destinations of electrical exports from the United States in the month of September, 1907:

Electrical appliances — British North America, $121,544; Brazil, $97,358; Mexico, $65,152; Japan, $59,542; Cuba, $55,255; United Kingdom, $49,498; Argentina, $32,650; Germany, $31,519; Central American states and British Honduras, $24,187; Philippine Islands, $13,788; British Australasia, $11,793; Belgium, $9,704; France, $4,066; British Africa, $2,357; other South America, $35,103; other Europe, $15,481; other countries, $19,216.

Electrical Machinery—Mexico, $109,644; Japan, $101,647; United Kingdom, $83,704; British North America, $74,079; Brazil, $41,203; British Australasia, $39,780; Argentina, $17,345; Philippine Islands, $12,158; British East Indies, $11,509; Germany, $9,845; France, $9,128; Cuba, $9,098; Central American states and British Honduras, $5,293; British Africa, $2,919; other South America, $35,684; other Europe, $29,784; other Africa, $6,568; other countries, $3,103.

At the recent meeting of the International Waterways Commission at Toronto G. G. Foster, president of the St. Lawrence Power Company of Canada, made a proposition for the development of waterpower at Mille Roches, Ont., at a cost of $20,000,000, $5,000,000 of which is to be spent by the St. Lawrence company and $15,000,000 by the Long Sault Power Company, an American concern. Mr. Foster explained that this development would greatly improve navigation.

The Comparative Value of Waterpower.

In the course of his presidential address at the convention of the Association of Edison Illuminating Companies at Hot Springs, Va., on September 10, 1907, Alex Dow of Detroit had this to say on the present comparative value of waterpower:

"We have had for the last four or five years a tremendous development of the large waterpowers of the country and of their transmission systems. The wonderful Niagara development has in that period made its greatest advances. Other powers of the St. Lawrence basin and the powers in the upper Hudson River area have lengthened their radius of effective distribution in accordance with the increase of practicable transmission voltage. A great development is in progress on the Susquehanna, and the fall of the Chicago Drainage Canal is to be utilized on a scale which we would not long ago have called gigantic. These powers and many others of the same order are not in distant western mountains but are located within transmission distance of cities of the class which the members of this association serve with electricity. To many of us the question is now presented, and by some of us it has been answered—shall we or shall we not purchase electric energy transmitted from a distant waterpower, and if so, at what price?

"The question of a possible price involves immediate comparison with the cost of steam power. The cost of steam power has changed radically during the last few years—during these same years of which this great development of waterpower has taken place. In either case I speak of power in large blocks—thousands of horsepower. Such a large steam plant as is required for one of our representative cities can now be installed at less first cost and operated more economically as to labor and lubricants and fuel than ever before. The possibility has arrived of a steam electric plant costing complete, say, $75 a kilowatt, and operated under practical conditions with little labor and with a steam consumption of 16 to 18 pounds per net kilowatt-hour. On the other hand, these immense waterpowers, developed with comparatively low first cost per unit, can and do sell transmitted energy at prices which five years ago would have been startling or revolutionary. I do not refer to such exceptional instances as the sale by the Ontario Power Company to the provincial government of Ontario of 100,000 horsepower at a price said to be $10.40 per electrical horsepower at the powerhouse switchboard. I speak of prices ranging upward from that record figure.

"As compared to such steam power and for the annual load factors common in our business, is waterpower attractive? If so, at what price per kilowatt per annum? And if we can transmit water-generated current so cheaply, can we not transmit steam-produced current competitively from steam plants located at the coal mines? In these days of congested railroad traffic and high rates for haulage of fuel, is it still true that the railroad haulage of a carload of coal is the cheapest method of transmitting the potential energy of that fuel? I do not know, and after looking at comparative figures recently made by different capable men for different projects I dare not hazard a guess. The turn of the wheel has made this old question a new one, and I, concurring with the members who have called my attention to it, say that it requires a new study and a new elucidation."

Affairs of the Westinghouse Companies.

W. D. Uptegraff and William McConway, receivers for the Nernst Lamp Company, have issued a circular, in which they assure the clients of the Nernst Lamp Company and all others interested that there should be no occasion for apprehension because of the company's application for a receivership. "This action was deliberately and thoughtfully taken as a sensible and logical measure for conserving the interests of the customers, creditors and stockholders of a solvent institution which is doing a large and profitable trade. Prudence seemed to require this receivership by reason of the close relations which have subsisted between the Nernst company and the allied Westinghouse industries, for which receivers have been appointed, and there is strong ground for the belief that the embarrassment will be temporary. There has not been even a momentary pause in the operations of the company, and the personnel remains the same as heretofore. There will be no departure from the general policy that has hitherto obtained in the conduct of the business, and the receivers will, during their incumbency, spare no pains to foster and maintain the cordial relations that have always existed between the Nernst Lamp Company and its customers."

Theodore W. Siemon of Pittsburg and Drury W. Cooper of New Brunswick, N. J., were appointed receivers of the Westinghouse Lamp Company on October 25th. The receivers have authority to continue the business of the company, which is apparently in a satisfactory condition. The assets appear to be far greater than the liabilities, and it is believed that this embarrassment, caused by the present financial conditions and the inability of the company to make collections, will be only temporary.

The treasury department of the Westinghouse Electric and Manufacturing Company, formerly located in New York, has been moved to East Pittsburg. This change of location, it was stated by officials of the company, is due to the fact that the receivers lately appointed wish to have every branch of the business within easy reach.

Pacific Gas and Electric Company Has a Good Year.

Some interesting figures, based upon the recent operations of the Pacific Gas and Electric Company, which have come out through interested financial sources, are furnished by the San Francisco correspondent of the Western Electrician. The combined income account of all properties owned and controlled by this company, including the California Gas and Electric Corporation, the San Francisco Gas and Electric Company, and properties directly operated for the year ended June 30, 1907, is as follows:

Gross earnings from all sources, $12,164,399; operating expenses, maintenance, taxes, etc., $7,016,507; net income available for bond interest, $5,147,892; interest and sinking funds of subsidiary corporations, $2,497,414; surplus available for interest and sinking funds of Pacific Gas and Electric Company, $2,650,478; bond interest and sinking funds of Pacific Gas and Electric Company, $1,010,673; balance, $1,639,805; preferred stock dividends accrued, $600,000; balance, $1,039,805.

The California Gas and Electric Corporation reports as follows for the year ended June 30, 1907: Gross earnings, $7,186,133; operating expenses, maintenance, taxes, etc., $4,062,920; net earnings from operations, $3,123,213; other income, $232,482; total net income available for interest, $3,355,695; interest, $1,724,619; balance, $1,631,076; sinking funds, $150,000; surplus, $1,481,076.

These figures have not yet been officially issued as an annual report, but are believed to show the most favorable features of the year's events with the largest electric power corporation on the Pacific Coast. About 1,500 miles of electric transmission lines are operated by this concern in the state of California.

Austrian Railroad Electrification.

Mr. C. L. de Muralt of New York, consulting engineer, returned last week from a flying trip to Europe, where he made an examination of the Arlberg Tunnel under the Tyrolean Alps, which is shortly to be electrified. Mr. Muralt has been appointed consulting engineer to the state railways of Austria, and the work to be done under his supervision will probably be the longest stretch of steam railroad electrified in either Europe or the United States, there being about 140 miles, exclusive of the tunnel. The tunnel is on the main line from Paris to Vienna and is seven miles long, with steep grades from each mouth to the middle. When the plans developed by Mr. Muralt are carried out the speeds of the trains passing over this line will have been increased 25 per cent. and the capacity of the road 50 per cent. To accomplish this result three-phase alternating-current locomotives will be used capable of developing 3,000 horsepower.

The electric locomotives designed for the Arlberg tunnel will be particularly adapted to this service, as when coasting down the grade out of the tunnel they will generate and return to the system about 60 per cent. of the energy used to pull the train up the grade into the tunnel. Mr. Muralt, who has recently been appointed professor of electrical engineering at the University of Michigan, has been granted a leave of absence from the university in order that he may supervise this work.

The Traveling Motorman.

The Northern Electric Company, realizing the growth of its interurban and local electric-railway system in the Sacramento Valley, California, and the need of systematic training of its platform men, has established a new office—that of traveling motorman—and W. W. Nelson, formerly motorman and conductor on the local and interurban service, has been appointed to the position, the work of which is now being organized. New men will be instructed for a week in the manipulation of the car by a regular motorman. They will then be placed in charge of the master-mechanic in the shops for a week. If able to pass the examination thereafter in the office of the traveling motorman the men will then be placed in charge of the trainmaster.

Nominations for "Mechanicals" for 1908.

A committee of which Prof. R. H. Fernald of Washington University, St. Louis, was chairman, has nominated for the 1908 officers of the American Society of Mechanical Engineers the following-named gentlemen: For president, M. L. Holman, St. Louis, Mo.; for vice-presidents, L. P. Breckenridge of Urbana, Ill., Fred. J. Miller of New York, N. Y., and Arthur West of Pittsburg, Pa.; for managers, William L. Abbott of Chicago, Alexander C. Humphreys of New York and Henry G. Stott of New York; for treasurer, William H. Wiley, New York. The vice-presidents holding over in 1908 are Alex Dow of Detroit, P. W. Gates of Chicago and J. W. Lieb, Jr., of New York.

General Electric Managers Report a Good Outlook.

The first session of the annual meeting of the managers of the General Electric Company was held on October 28th at the main office of the company in Schenectady. Owing to the national interest taken in the business affairs of the industrial world the principal topic during the first session was a discussion of the general situation in the electrical field. Vice-president J. R. Lovejoy has not entirely recovered from his recent illness, and Vice-president B. E. Sunny of Chicago presided.

The satisfactory condition of the company's business was indicated by a statement that orders received during the current year to the date of meeting exceeded those of the corresponding period of last year by fully 15 per cent. The volume of orders and prospective demand for supplies and for the various lines of smaller electrical devices which the company manufactures are very satisfactory.

Dr. Thomas Addison, manager of the Pacific Coast territory, reported a recent order for a Curtis steam-turbine generator of unusual size. This machine, which will be one of the largest power producers ever built for electrical purposes, will have a normal capacity of 20,000 horsepower.

Generally encouraging sentiment regarding the business outlook prevailed among the company's managers. The company's foreign business continues to show gratifying increases.

Among those in attendance were C. A. Coffin, president; E. W. Rice, Jr., vice-president; Hinsdill Parsons, vice-president; B. E. Sunny, vice-president, Chicago; Anson W. Burchard, assistant to president; M. F. Westover, secretary; H. W. Darling, treasurer; Edward Clark, general auditor; J. R. McKee, manager power and mining department; W. J. Clark, manager foreign department; C. D. Haskins, manager lighting department; J. G. Barry, manager railway department; D. R. Bullen, manager supply department; G. E. Emmons, manager Schenectady works; W. C. Fish, manager Lynn works; George F. Morrison, manager Harrison works; Thomas Addison, Pacific Coast manager; E. D. Mullen, manager Philadelphia office; C. B. Davis, manager Boston office; General Irving Hale, manager Denver office; T. Beran, manager New York office; A. F. Giles, manager Atlanta office; J. B. Pevear, manager Cincinnati office; E. E. Gilbert, turbine sales manager; P. D. Wagoner, transformer sales manager; A. D. Page, manager incandescent lamp sales; W. L. R. Emmett, engineer lighting department; D. B. Rushmore, engineer power and mining department; M. P. Rice, publication bureau; F. H. Gale, in charge of advertising.

Increase in Elevated-railway Traffic.

The traffic during the month of October on the three largest elevated railways of Chicago shows larger totals for each road than those for any previous month. The number of passengers carried by the three roads in question last month as compared with the corresponding month last year are:

	Oct., '07.	Oct., '06.	Increase.
Metropolitan	4,869,470	4,422,792	446,678
South Side	3,926,755	2,900,902	1,025,853
Northwestern	3,372,976	2,738,675	634,301
Totals	12,169,201	10,062,369	2,106,832

The daily averages for these months and the percentage increase are:

	Oct., '07.	Oct., '06.	Percent.
Metropolitan	157,080	142,671	10.10
South Side	126,670	93,577	35.36
Northwestern	108,806	88,344	23.16

The Metropolitan is operating about the same mileage as last year, the South Side has opened two extensions and the Northwestern one. The detail figures, however, show that the increase on the two latter roads is due nearly as much to increase on the main lines as to the opening of the new branches.

Topics to be Discussed by the Western Society of Engineers.

The Western Society of Engineers, Chicago, announces a series of interesting topics for its meetings this season. Papers and addresses are expected from the following: Prof. J. C. Thorp, "Recent Developments in Steam Turbines;" Mr. W. C. Robinson, "Fire Protection of Fireproof Buildings;" Mr. G. B. Springer, "The Tunnels Under the Chicago River for Electric Cables;" Mr. W. E. Symons, "The Passing of the Steam Locomotive;" Mr. J. D. Ihlder, "Electric Elevators for High Buildings;" Mr. E. B. Ellicott, "The Hydro-electric Development of the Sanitary District, Chicago."

The electrical topics will be presented before the Electrical Section of the society, which usually meets on the second Friday of each month. On November 8th Mr. H. V. Allen is scheduled to read a paper prepared by Mr. W. D'A. Ryan on "Color Values of Artificial Illuminants."

ELEMENTS OF ELECTRICAL ENGINEERING.

By Geo. R. Metcalfe.

XLI.—Electric Railways.

Bonding.

It was explained in a previous chapter that the current for operating electric cars passes from the generators at the power house to the overhead system and trolley wire, thence through the car, and returns to the power house by means of the railway tracks. It is obvious, therefore, that the tracks considered as an electric circuit carry the same current as the overhead wires, and they should therefore have as little electrical resistance as possible.

In case of the welded tracks described in the preceding chapter, a continuous metallic circuit exists over the whole road, but in most cases rails are laid in 30-foot lengths, and in rare cases, 60-foot lengths, so that the track circuit is broken at the end of each rail length.

As the joints are connected by fish-plates, it would appear at first sight that there would be very little resistance at the joints, and it takes but a very short time until the surfaces at the joints are coated with rust, which is an excellent nonconductor of electricity, and as soon as rust is formed a high resistance is introduced at every joint.

To overcome this, rail bonds are used. These consist of short lengths of copper wire which run across each joint and whose ends are securely fastened to each of the rail ends at the joint. There are a large variety of bonds in use. Among the earlier ones used were pieces of iron wire about 18 inches long, each end of which contained a small rivet of about one-quarter-inch diameter. A quarter-inch hole was bored near the end of each rail, and the rivets on the bond were inserted in these holes and headed up with a hammer. These bonds, however, soon proved inadequate, and copper was substituted for iron. Since then the size of bonds has steadily increased, and the manner of applying them has been improved.

The conductivity of copper is about ten times that of the steel from which the rails are made, and in order to make the conductivity of the joint equal to the conductivity of the unbroken rail the bond must have about one-tenth the sectional area of the rail. One form of bond commonly used consists of two large copper rivets connected by strands of flexible copper. These are made short enough to be placed under the fish-plates, and should preferably be headed into the rail by hydraulic press. Placing the bonds under the fish-plates tends to keep them securely in place, and it also prevents their being stolen, which is a trouble that has been frequently met with since the bonds have been made large enough so that the copper in them is of considerable value.

In order that the bonding may be efficient, it is necessary that the heads of the bonds must fit absolutely tight in the rail holes, and the two surfaces of contact must be thoroughly cleaned, so there is no opportunity for oxidation between them. The ductility of copper makes it possible to secure a very intimate union between the two metals, but it is very difficult to keep this electrical contact good if there is much motion at the joints.

Another type of bond largely in use is one having a hole in the end of the rivet head which projects through the hole in the rail; a steel pin is driven into the hole, which has the effect of expanding the metal of the bond tight into the hole in the rail.

The so-called plastic rail bond is an entirely different type of bond, which depends for its connection to the rail upon a plastic alloy of mercury and other metals. The main portion of the copper bond is made in various forms, and the place on the rail where the bond is applied is made perfectly clean and is amalgamated with mercury compound. The surface of contact between the bond and rail is covered with the plastic alloy, and the two are pressed together, and in some cases held in contact by a spring. An absolutely firm contact like that required for the riveted bonds is not necessary for the plastic bond, as the plastic alloy maintains good conductivity between the rail and the bond, even when some slight motion occurs between them.

In addition to the bonds between joints, bonds should always be used to connect the rails at either side of special work, such as frogs, crossings, etc., and cross-bonds should be placed at frequent intervals between the two rails of a single-track road, and between the two tracks of a double-track road.

Where the railway traffic is very dense, the conductivity of all tracks bonded together is not sufficient, and in this case ground wires are used, which are wires running parallel with the tracks and which are connected to the bonds of the track at frequent intervals. The object of bonding is to form all the tracks and ground wires, if they are used, into a single electrical conductor whose different parts are so frequently cross-connected that the breaking of a few bonds, which is always liable to occur, will not permit a high resistance to be introduced in the track circuit between the power house and the car, no matter what the location of the latter on the track.

In the case of welded rails no bonds are necessary at the joints, but cross-bonds should be used to avoid the break in the circuit which might be occasionally introduced on account of broken rails. These rails should also be bonded around special work.

In order that the bonding shall remain effective, it is necessary that the work be done with the utmost care. The holes in the rail should be reamed out thoroughly clean at the time the bond is to be applied, and the head of the bond should present a thoroughly clean metallic surface. If the riveted type of bond does not make an absolutely solid contact with the metal of the rail, but permits air or moisture to creep in between the two surfaces of contact, a coating of scale, which is non-conducting, will be formed between the two surfaces, and the utility of the bond will be entirely destroyed.

On some roads, where there are a number of branches, and where the traffic is very heavy, what are known as track feeders are sometimes necessary. This is particularly the case when only a few of the tracks go near the power house. The track feeders are led from the generators to various points in the track, as may be necessary, and may consist of copper wire or in some cases worn-out rails, which are thoroughly bonded together and carried underground to the point where they are connected to the track system.

Overhead System.

As has already been explained, the power for nearly all direct-current electric railways of any considerable length is generated as alternating current at a high voltage, which depends upon the distance to which the power is transmitted. The voltage on some long lines runs from 15,000 to 30,000 volts, and even higher. This high voltage is then led into rotary-converter sub-stations located 10 to 15 miles apart, where it is converted into direct current of from 500 to 650 volts for use on the car.

The high-voltage distribution is, of course, entirely distinct and separate from the 500-volt distribution, and the two are frequently carried on separate pole lines.

The low-tension distribution starts at each sub-station, and on most interurban roads the 500-volt current from the rotary converters is fed directly into the trolley wire. As all the sub-stations feed into the same trolley wire, the sub-stations are all connected in parallel on the 500-volt circuit. In city systems, however, where cars are running constantly under close headway, the trolley wire is entirely too small to carry all the current required between the different sub-stations, and in this case overhead feeders are carried out from the sub-stations along the line of the road, and these feeders are tapped into the trolley wire at frequent intervals.

The two types of overhead construction most commonly used are the span-wire and the bracket construction. The center-pole or double-bracket construction is also used, but only to a limited extent. In most city streets span work is used, which consists of a row of poles on either side of the track with a wire stretched across the track between each pair of poles. These span wires support the trolley wires over the tracks, which are suspended from the span wires by suitable insulators. In order to increase the insulation between the trolley wire and the ground, strain insulators are generally inserted near each end of the span wire near where it is fastened to the pole.

Trolley wires are rolled in different cross-sections. Sometimes a round wire is used, although what is known as a grooved section is preferable. The trolley wire is fastened by means of an ear with tapering edges, which fits closely around the trolley wire and is soldered securely to it. This ear does not form a complete sleeve around the trolley wire, but leaves the lower side of the wire exposed so as to form a smooth path for the trolley wheel. The grooved trolley wire has a cross section somewhat resembling a figure 8, and the supporting ear is clamped around the upper part of this section, leaving the lower part of this section perfectly smooth for the passage of the trolley wheel.

Bracket construction is considerably more economical than span work and is almost always used on suburban and interurban work, and, in fact, in any locality where the line of poles can be placed sufficiently close to the track. This consists of a single line of poles placed near the track, with brackets extending from the pole over the track for supporting the trolley wire. This construction is obviously adapted to single-track lines only, except in a few special cases, in which double-bracket construction has been used. The latter consists of a line of poles set midway between the tracks of a double-track system, with brackets extending from each side of the pole over each track.

It is necessary to have a certain amount of flexibility in the overhead work, and it has been found that where the trolley-wire insulators were fastened directly to the brackets they were very liable to be broken by the passing trolley wheels. In order to secure flexibility at the point of suspension a short length of wire is generally suspended from the bracket arm, and the insulator is fastened to this wire. In other cases the bracket arm itself is hinged near its support on the pole and arranged so that it has more or less motion in a vertical plane and is free to move up and down when the trolley passes under it.

[*To be continued.*]

Note.—This series of articles, intended to survey, briefly, the whole field of applied electricity for light, power and heat; was begun in the Western Electrician of February 2, 1907.

QUESTIONS AND ANSWERS.

Charging Storage Batteries.

J. W. A., New Iberia, La.: I am much interested in charging storage batteries, particularly automobile batteries. I wish to know what connections are necessary to be used on a 220-volt circuit and on a 125-volt circuit, which is my exciter voltage. I intend to use the latter circuit at night, and during the summer I will use 220 volts from my day circuit. I would also like to know what would be the proper price to ask for this work.

Answers.

Storage batteries can be charged only on a direct-current circuit. There are usually 36, 40 or 44 cells in an automobile battery. For charging they are placed in series and connected in series with a suitable rheostat across the charging circuit, which should be preferably not over 110 volts to avoid wasting too much energy in the rheostat. The voltage of each cell at beginning of charge is a trifle over 2.0 and during the charge this rises to about 2.6 volts on closed circuit at the end. Therefore 40 cells require a little over 80 volts at the start and about 104 volts at the end. The rheostat takes up the remaining drop.

The rheostat should be adjustable and of sufficient resistance to keep the current below the normal value. It must of course be of sufficient current capacity to carry continuously for five hours or more the normal charging current, which, depending on the size of the cell, may be from 16 to 50 amperes.

Find out from the owner or maker of the batteries what is the normal charging rate for each battery and also what directions were furnished as to the duration of charging. Be sure to have the positive terminal of the batteries connected to the positive side of the charging circuit and to connect an ammeter in series with the battery to determine when the current is properly adjusted by the rheostat. Toward the end of charge it is well to reduce the current to about one-half the normal rate to prevent excessive gasing of the batteries.

It is not desirable to charge single-battery sets on a 220-volt circuit, as more than half the energy would be wasted in the rheostat, which would have to be extra large. If the inquirer can arrange to charge two batteries of the same size at the same time he can connect them in series with a rheostat to the 220-volt line with good results. Do not attempt to do this with batteries differing widely in size, as the larger one would not be sufficiently charged and the smaller one probably overcharged.

All the above refers to batteries for electric vehicles. Storage batteries for ignition on gasoline cars are best charged by being placed in series with incandescent lamps, figuring one-half ampere for each 16-candlepower lamp on 110 volts. If the charging current rate is greater, put a correspondingly greater number of lamps in parallel and this set in series with the battery to be charged.

The proper price to be asked for this service will depend on local conditions largely. Calculate, roughly at least, the number of kilowatt-hours used in charging and figure a rather low rate if the conditions warrant it. A flat rate is not equitable, as obviously a large battery will require more charging than a small one.

A Central-station Equipment for Testing Integrating Wattmeters.

By W. R. Pinckard and H. W. Young.

It is quite generally recognized that integrating wattmeters can only be maintained in an accurate and efficient condition by comparing them at certain intervals with known standards, and it is obvious that the standards for this purpose should be highly accurate. To avoid a multiplicity of instruments, these standards should have a wide

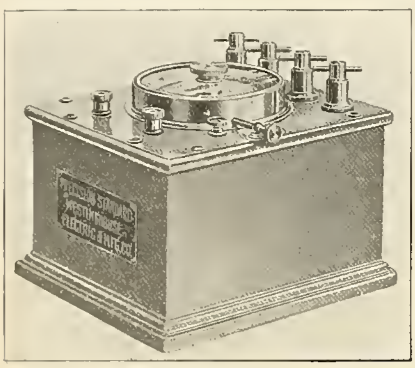


FIG. 1. PRIMARY STANDARD SINGLE-PHASE INTEGRATING WATTMETER.

operating range, which may be obtained primarily by a long scale, and where possible the range should be further increased by combining several current and potential capacities in one meter. To combine laboratory accuracy with the speed necessary in commercial work, two sets of standards should be provided, which may be designated as "primary" standard or "precision" meters for extreme accuracy, and "secondary" or working standards for use directly with the service meters.

A complete equipment of primary and secondary standards consists of the meters shown in Figs. 1, 2 and 3. If necessary, the indicating secondary standard can be omitted and the rotating standard alone used.

Checking of Secondary Standards.—All secondary

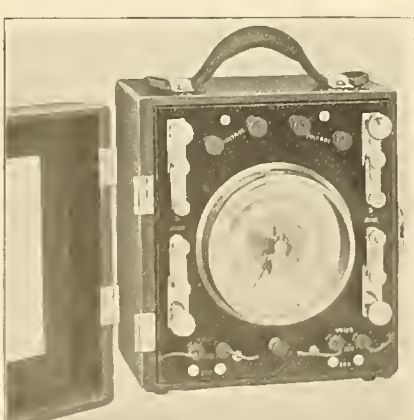


FIG. 2. SECONDARY STANDARD SINGLE OR POLYPHASE INDICATING WATTMETER.

standards should be frequently checked with the primary standards, the frequency of such checking varying largely with local conditions. As a rule, however, it is advisable to check the secondary standards at least once a month, especially when such standards consist of indicating meters, owing to the fact that all portable indicating meters are more or less delicate, and the rough usage attendant to commercial testing is liable to change the calibration materially.

To compare the calibration of a standard indicating wattmeter with the "precision" meter or primary standard, it should be connected into the circuit, as shown in Fig. 4, having the current coils of the meters in series and the shunt coils in multiple with each other. Care should be taken to have the shunt coil of each meter connected to the same point or source of potential to avoid the possibility of one meter measuring the shunt loss of the other.

Testing Load.—The load for the test can readily be obtained by a bank of incandescent lamps so

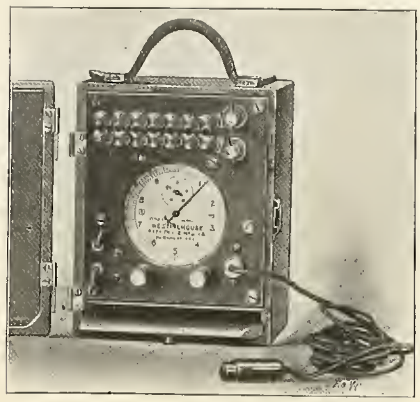


FIG. 3. SECONDARY STANDARD SINGLE-PHASE PORTABLE INTEGRATING WATTMETER.

arranged that any value from zero to full-load current may be easily and quickly obtained. The load should be taken from a source of supply having as little voltage variation as possible, on account of the effect of rapid fluctuations on the reading of indicating meters, it being somewhat difficult to secure accurate readings on a circuit having a badly fluctuating voltage.

A convenient arrangement of load is shown in Fig. 5, and consists of a bank of lamps of different candlepower ranging from four to 100 candlepower, these lamps being arranged in connection with single-pole, single-throw switches so that the smaller sizes may be thrown in circuit individually and the larger sizes in groups. The arrangement shown may, of course, be varied to suit local conditions.

In circuit with a portion of the lamp bank is placed an adjustable resistance or rheostat for use in obtaining exact current values and also to assist in maintaining a constant load. A water rheostat is very convenient for this class of work, as the load can be varied quickly and with perfect uni-

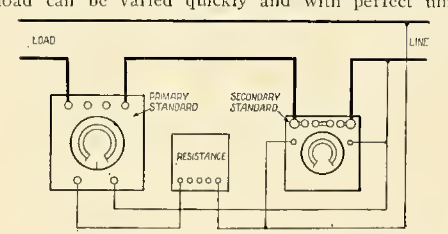


FIG. 4. CONNECTIONS FOR CHECKING SECONDARY STANDARD WITH PRIMARY STANDARD.

formity. The resistance of the water rheostat can be readily changed to almost any value by changing the strength of the solution.

Having made connections as above, it is now only necessary to take the readings on the portable meter at convenient points and to compare these readings with the true values as given on the "precision" meter. It is considered good practice to check the portable meter at each of the marked points on the scale, simply estimating the error of the intermediate points, thus showing the error very closely at all points of the scale.

Checking Calibration of Rotating Standard.—If the portable rotating standard meter is used as a secondary standard, it should be checked with a "precision" wattmeter from time to time, and for this purpose should be connected in the same manner as the indicating standard shown in Fig. 4. To make a comparison of the rotating standard with the "precision" meter it should, by means of the plugs on the terminal board, be connected for a capacity of five amperes and placed in series with the five-ampere coil of the "precision" meter.

Light-load Test.—The load should now be maintained at approximately 20 watts, and the pointer revolutions of the rotating standard timed by a stop-watch. Having obtained the time consumed in making a certain number of pointer revolutions, the watts should be computed by the formula $W = \frac{R}{T} K$, where W = watts, R = the number of pointer revolutions, T = the time in seconds as taken by the stop-watch, and K = the volt-ampere rating of the meter coils used multiplied by 2.4.

Full-load Test.—The meter may be tested on other loads, ranging from the light load to full load of 500 watts, but as the calibration curve of the rotating standard from light load to full load is practically a straight line, it is unnecessary to take readings at other points than light and full load unless extreme accuracy is required. If this is desired, readings may be taken at several intermediate points, from which readings a curve may be plotted giving the exact calibration of the meter at all points.

Selection of Precision Meter Capacity.—In comparing secondary standards with "precision" meters care should be taken to select the windings of the "precision" meter having a capacity nearest that of the meter under test, in order that it may be used at the highest possible part of the scale. This rule also applies to the comparison of service meters with secondary standards. The "precision" meter best adapted for the above purpose and the one commonly used for this class of service has three current capacities of five, 20 and 100 amperes, respectively, and may be furnished with resistances suitable for use on any voltage up to 2,000 volts.

Testing Service Meters.—For the testing of service meters, either the "portable indicating" meters may be employed in conjunction with a stop watch and the reading computed by the use of a calibrating formula or the meter may be compared with a "rotating" standard watt-hour meter. To use either of these methods the standard should be connected in circuit with the service meter, as shown in the diagrams usually accompanying each meter.

Where meters operating from series and voltage transformers are to be tested it will usually be

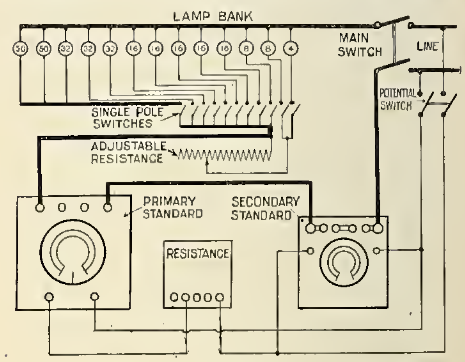


FIG. 5. METHOD OF OBTAINING LOAD FOR TESTING METERS.

found advisable to test them as five-ampere, 100-volt meters without using the transformers. If such meters are to be tested under the running load, the standard may be connected in circuit with the meter under test, using the five-ampere, 100-volt coils of the standard.

Testing Service Meters with Standard Indicating Meters.—To conduct a test with the indicating meter it will be necessary to hold the load as constant as possible, and while noting the reading of the standard, count the revolutions of the disk of the meter under test, taking the time by means of a stop watch. To eliminate personal errors, several readings of at least one minute each should be taken and averaged. To compare the reading of the meter with the standard it is necessary to use a formula pertaining to the particular meter under test.

Use of Stop Watch.—When employing the indicating wattmeter method it should be remembered that the stop watch is not infallible, and should be frequently checked by comparing it with the second hand of a good clock. For this purpose a clock in which the pendulum beats seconds or half seconds should be used, starting the watch with a certain beat of the pendulum and having allowed the watch to run several minutes to eliminate personal errors, it should be stopped on the same beat of the pendulum on which it was started. A little

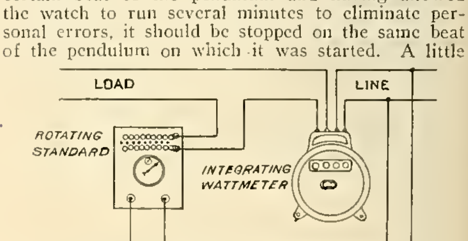


FIG. 6. CONNECTIONS FOR CHECKING SERVICE METER WITH PORTABLE STANDARD INTEGRATING WATTMETER.

practice will enable the operator to check the watch within 0.1 of a second without difficulty.

Testing Service Meters with Rotating Standard.—If the rotating standard is used for testing single-phase service meters the operation is much simplified, as the use of the formula and stop watch can be eliminated. To conduct a test by this method the standard should be connected as shown in Fig. 6, and the connection plugs so arranged that the capacity of the standard will be the same as that of the meter under test. The proper connections having been made, the load should be adjusted to the desired value and a direct comparison made of the number of revolutions of the meter under test with the number of revolutions shown on the counter of the standard. In common with the indicating-standard method, readings should be taken for at least one minute to eliminate personal errors. The percentage of error in the meter under test may be found directly by dividing the number of revolutions of the service meter by the revolutions of the standard—that is, if the meter under test makes 10 revolutions while the standard meter shows 10.4 revolutions, the ratio would be 0.96, showing the meter under test to be four per cent. slow.

[Note. The above paragraph regarding rotating standards applies only when the meter under test has the same full-load speed as the standard, namely, 25 revolutions per minute.]

In order that the rotating standard illustrated herein may be conveniently employed in testing meters in which the full-load speed is other than 25 revolutions per minute, the following table has been prepared as applying to Westinghouse, General Electric and Fort Wayne meters. By the use of this table any one of the three makes can easily be tested with the one rotating standard:

on inductive circuits the necessary inductive load can be secured in one of several ways.

For obtaining the inductive load from a single phase circuit a set of two or more five-ampere reactive coils, such as are used in the multiple alternating current arc lamp, will be found convenient. The coils can be arranged to give almost any current value when used on a 110-volt circuit up to their capacity by means of series parallel connections. The taps which are brought out at numerous points are useful in obtaining close adjustment of current value.

Fig. 7 illustrates a method of connection for use in testing meters on inductive loads, the power factor of which can be directly determined by a power factor meter or by the use of an ammeter, voltmeter and wattmeter connected in circuit as indicated.

Method of Testing Service Meter for Inductive load Accuracy.—To conduct this test the service meter should be loaded to its full current capacity,

CALIBRATION DATA FOR STANDARD PORTABLE INTEGRATING WATTMETERS.

Make	Service Meter: Amperes Capacity	Service Meter: Revolutions, Heavy Load	Service Meter: Revolutions, Light Load	Standard Meter Ampere Capacity	Revolutions of Westinghouse Portable Integrating Wattmeter For 94 Per Cent to 106 Per Cent Registration of Service Meter: 94 Per Cent	95 Per Cent	96 Per Cent	97 Per Cent	98 Per Cent	99 Per Cent	100 Per Cent	101 Per Cent	102 Per Cent	103 Per Cent	104 Per Cent	105 Per Cent	106 Per Cent
*Westinghouse Types B and C	5 10 20 40	25 25 25 25	... ...	5 10 20 40	26.5	26.25	26.00	25.75	25.5	25.25	25.	24.75	24.50	24.25	24.00	23.75	23.50
	5 10 20 40	.. ..	1.0 1.0 1.0 1.0	5 10 20 40	1.06	1.05	1.04	1.03	1.02	1.01	1.	.99	.98	.97	.96	.95	.94
	80 80	15 ..	... 1.0	40 40	31.8 2.12	31.5 2.1	31.2 2.08	30.9 2.06	30.6 2.04	30.3 2.02	30. 2.	29.7 1.98	29.4 1.96	29.1 1.94	28.8 1.92	28.5 1.90	28.2 1.88
General Electric Type I	3 3	30 ..	... 2.0	5 5	19.08 1.27	18.90 1.26	18.72 1.25	18.54 1.23	18.36 1.22	18.18 1.21	18. 1.2	17.82 1.19	17.64 1.18	17.46 1.16	17.28 1.15	17.10 1.14	16.92 1.13
	5 10	30 30	... ...	5 10	28.62	28.35	28.08	27.81	27.54	27.27	27.	26.73	26.46	26.19	25.92	25.65	25.38
	5 10	.. ..	2.0 2.0	5 10	1.91	1.89	1.87	1.85	1.84	1.81	1.8	1.78	1.76	1.75	1.73	1.71	1.69
	15 15	30 ..	... 2.0	20 20	23.85 1.59	23.62 1.57	23.4 1.56	23.17 1.54	22.95 1.53	22.72 1.51	22.5 1.5	22.05 1.48	21.83 1.47	21.6 1.45	21.38 1.44	21.15 1.42	20.93 1.41
	25 50	30 30	... ...	20 40	35.72	35.38	35.05	34.71	34.37	34.04	33.7	33.36	33.03	32.69	32.35	32.02	31.68
	25 50	.. ..	2.0 2.0	20 40	2.38	2.36	2.34	2.32	2.29	2.27	2.25	2.23	2.2	2.18	2.15	2.13	2.11
Fort Wayne Type K	5 10 40	30 30 30	... ...	5 10 40	23.85	23.62	23.4	23.17	22.95	22.72	22.5	22.27	22.05	21.82	21.6	21.37	21.15
	5 10 40	.. .. ..	2.0 2.0 2.0	5 10 40	1.59	1.57	1.56	1.54	1.53	1.51	1.5	1.48	1.47	1.45	1.44	1.42	1.41
	25 50	30 30	... ...	20 40	23.85	23 62	23.4	23.17	22.95	22.72	22.5	22.27	22 05	21.82	21.6	21.37	21.15
	25 50	. .	2.0 2.0	20 40	1.59	1.57	1.56	1.54	1.53	1.51	1.5	1.48	1.47	1.45	1.44	1.42	1.41

It is recommended that test be made at approximately 100 per cent and 4 per cent of full load if these loads are within the range of standard meter.
Load service meter so as to give revolutions stated in table in approximately one minute time.
Where possible, the capacity of coils used should be the same for both service and standard meters.
*Westinghouse Round Pattern and type "A" meters make fifty revolutions per minute at full load.

In explanation of the use of this table the following examples are given:

(1) If it is desired to test a Westinghouse service meter by using the rotating standard the two meters should be connected in series and loaded so as to give one revolution of the disk in approximately one minute's time for a light-load test, and for full load 25 revolutions of the disk in the same time. The number of revolutions made for these two loads by the standard—if the service meter is correct—would be 1 and 25, respectively. If the number of revolutions made by the standard is 1.03, the service meter is three per cent. slow at light load. If the number of revolutions of the standard is 0.97, the service meter is three per cent. fast at light load. From this example it will be seen that the accuracy can be determined for any speed within six per cent. fast or slow, reading same directly from the table without any calculation whatever.

(2) If it is desired to test a five-ampere General Electric meter the load can be adjusted to give, say, two revolutions at light load and 30 revolutions of the disk at heavy load in approximately one minute's time. If the meter is correct the standard will show 1.8 and 27 revolutions, respectively. If the standard shows 1.85, the service meter is three per cent. slow at light load. If the standard shows 1.75 the service meter is three per cent. fast at light load.

(3) If it is desired to test a five-ampere Fort Wayne meter the load can be adjusted to the same value as with the General Electric meter. If the meter is correct the standard will show 1.5 and 22.53 revolutions, respectively. If the standard shows 1.54, the service meter is three per cent. slow at light load. If the standard shows 1.45, the service meter is three per cent. fast at light load.

Fig. 6 illustrates the proper connections for testing a two-wire meter in accordance with the table. If it is desired to test three-wire meters the standard should be connected into the circuit with one side of the meter under test, the other side of the circuit being left open. When the test is conducted in this manner the rotating standard pointer will revolve twice as fast as the disk of the meter under test, which has but one-half of its current winding in use during the test. To effect a direct comparison the number of revolutions made by the meter being tested should be multiplied by two.

Testing Meters for Accuracy on Inductive Loads.—When it is desired to test meters for accuracy as indicated by the ammeter. The lamp load and inductive load should be so adjusted as to give a reading on the wattmeter equal to one-half of the volt-ampere readings, as shown by the reading of the ammeter multiplied by the voltage of the circuit. If a standard indicating wattmeter is used the watt value is at once apparent. If the rotating standard integrating meter is used, however, the approximate watt value may be obtained by noting the speed of the pointer, which should rotate one-

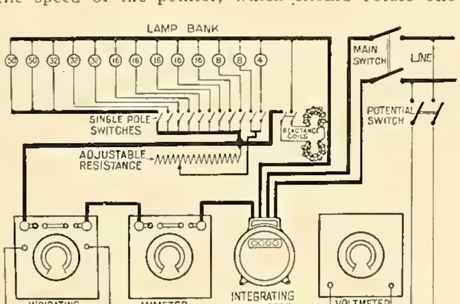


FIG. 7. METHOD OF OBTAINING INDUCTIVE LOAD FROM SINGLE-PHASE CIRCUIT.

half as fast as it would if the same volt-amperes were applied at unity power factor. The full-load speed of the rotating standard operating at the current and voltage marked upon the dial is 12½ revolutions per minute at a power factor of 50 per cent. It is necessary to take comparative readings the same as in the ordinary test of meters.

[Note.—It should be noted that in making tests at 50 per cent. power factor, extreme accuracy of current value as shown on the ammeter is not important, owing to the fact that the integrating meter error on inductive loads is due to a phase displacement within the meter, and this angle of displacement is the same at all values of power factor. It is evident from this that if the meter is adjusted at any point of power-factor curve and made correct it will be correct at all points of the curve. The value of 50 per cent. power factor is taken as a convenient value to obtain, it being only necessary so to adjust the load that the wattmeter readings are halved while the volt-ampere readings are kept at full-load value.]

Speedy Delivery of Steam Turbines.

The illustrations show the generator and steam ends of one of the two 1,500-kilowatt Allis-Chalmers steam turbine units recently sold to the Scranton (Pa.) plant of the American Gas and Electric Company, whose properties include public service utilities in many states. This turbine won a substantial bonus for its builder for delivery fully a

The upper picture shows the generator end and the lower one the steam end.

A 1,500-KILOWATT STEAM TURBINE ON ITS WAY TO SCRANTON, PA.

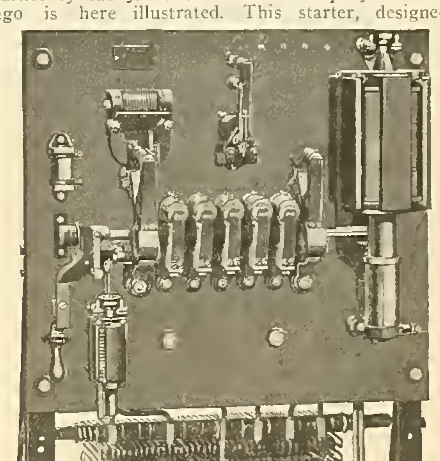
month in advance of the date specified in the contract.

The two units for the plant each comprise a steam turbine and an alternator of 1,500-kilowatt normal capacity at 1,800 revolutions per minute, three-phase, 60-cycle, 4,000 volts. The conditions under which they operate are 150 pounds steam pressure at the throttle and 28 inches vacuum.

In addition to the Scranton turbines, Allis-Chalmers machines have been installed in the Canton (Ohio) and Madison (Wis.) plants of the American Gas and Electric Company, one of which, that at Canton, has been operating continuously for several months.

New Combination Motor Starter.

The new type EH combination starter, for automatic or hand operation, recently placed on the market by the J. L. Schureman Company of Chicago is here illustrated. This starter, designed



NEW COMBINATION MOTOR STARTER.

chiefly for the control of motor-driven fire pumps, was described in the Western Electrician of October 5th, but was incorrectly illustrated in that issue. As here shown, the type EH starter is mounted in panel form so that all wiring is accessible from the back of the controller. The resistance is ordinarily made of cast-iron grids and is mounted at the base of the panel and to the rear. An overload device especially valuable in hand starting makes the apparatus "fool proof."

SELLING ELECTRICITY.

Under this heading will appear, from time to time, articles, suggestions and examples which will be of assistance in the constant effort to increase the existing demand for electric current and to create new demands.

A Modern Instance.

The possibilities that are overlooked by electric-lighting companies, both large and small, were strikingly illustrated by the results of a recent ten-day campaign by a modern "new-business emissary" in a small Iowa city. The town is the county seat, with a population of something less than 3,000, and is a typical rural town of the prairie country.

The electric company has until recently been dominated by a slow, non-progressive management, with the accompanying results of poor service and the entrance of competition—in this case gasoline lighting.

The plant was operated from dusk to midnight, and but for a very favorable street-lighting and waterworks pumping contract the returns would not have sustained even that limited service.

Early in 1907 a new management came into control, and being progressive business men, but unacquainted with electric-lighting work, they sought the advice of one of the number of live new-business agents that is being developed by the Co-operative Electrical Development Association.

This missionary reached the city on a Saturday night after lighting time and was at once struck by the number of gasoline lights in use. The presence of these lamps proved beyond a doubt that something was radically wrong with the electric service. The time until Monday was devoted to learning the situation from the viewpoint of the consumer. The complaints were various, as usual, but in the main they narrowed down to three things: Inability to accommodate themselves to the company's arbitrary hours of service, lack of attention on the part of the company's employes in making repairs on the customers' premises, and excessive bills.

The last accusation could not be understood by the agent at first, as none of the customers seemed to be overlighted and the rates were only 10 cents per kilowatt-hour. This point was, however, made plain when the agent sought the management to learn its side of the story.

The officers of the company said that they operated the same as they always had, from dusk until midnight, and until 11 o'clock on Sundays; that gasoline and gas lighting (fed with gas from gasoline-gas machines) was cutting their business to pieces; that their earnings for three years had shown a steady and discouraging decline; that the town was supporting two gasoline-machine agents, who were very active, and that the returns from their commercial customers were so small that they only read their meters and rendered bills every three months.

This last admission explained why the customers thought that their bills were so big, for it is one of the traits of the human family to consider only the size of the bill that they are called upon to pay. In this case the customer was comparing his three-month bill with the one of some friend in another city which was only for one month and only considering the size of each. Naturally the discrepancy was extreme.

When the agent suggested that a day service and monthly bills would no doubt go a long way toward rectifying lighting troubles, the management declared that, aside from three or four small motors, no power load could be obtained in the territory, and that the increase in lighting could not be expected to pay for the increased cost of operating such a service. But the agent had been looking around a bit himself, and had other ideas on the subject.

As the company was pumping the town's water and compelled to operate the pumps (they were belted from the generator jack shaft) two hours every forenoon and afternoon, and carry full steam pressure all the time, it was evident that a complete day service would not be excessively expensive.

It was figured out that the minimum extra cost of such a service would be $1,500 and the maximum cost $2,000 a year, and the company agreed that in case the agent could secure enough new business to pay this added cost, it would start the new service at once.

With this guaranty the agent secured in the first half day over $2,000 worth of power load, the first contract closed being for 25 horsepower to be used continuously 10 hours every day, with a minimum bill of $100 a month. Within 10 days from the time the agent arrived in the city he had secured definite agreements for the placing of 25 motors aggregating over 100 horsepower and assuring returns of over $2,700 a year, besides transferring six gasoline-lighting services to electricity.

If the proper advantage is taken of the new service in pushing fans, flatirons and other electrical conveniences, as well as in driving out the gasoline men, the company should be able to add at least $4,000 to its income the first year of its new service, and at a cost of less than $2,000, or at a profit of $2,000 in cash and an invaluable profit in the increased good-will from the community which it serves.

La Crosse Central Station Gets State Authority to Increase Its Rates.

Numerous instances have arisen where private consumers or municipal authorities have appealed to state commissions for relief from alleged excessive rates or other burdens imposed by public-service corporations. But La Crosse, Wis., affords the unusual spectacle of a central station getting permission to increase its rates for equitable reasons. The method of procedure and the findings of the Railroad Commission of Wisconsin, to which application was made by the La Crosse Gas and Electric Company, have been compiled in a booklet by Mr. C. H. Williams, manager of the company, and some extracts will be of general interest.

In the petition of the company for authority to increase rates it is set forth, among other things, that under the provisions of the laws of Wisconsin, it is unlawful for any public utility doing business within the state of Wisconsin to demand, collect or receive a greater compensation for any service than the charge fixed by it on the lowest schedule of rates for the same service on the first day of April, 1907.

On the first day of April, 1907, the company was doing business in competition with another company likewise engaged in the production of electricity, and, to meet the competition of said company, the petitioner was compelled to reduce its schedule to a point below the cost of production; therefore it had become necessary for the petitioning company to increase its rates of charge for electricity.

In reviewing the case the commission says that there are many important differences between public-service corporations and ordinary commercial enterprises. The former usually require a much larger investment in plant, equipment and other fixed property, which in turn means heavy annual charges for interest, repairs and maintenance. The conditions which surround the former are also of such character that the services which they render can usually be furnished at a much lower cost by one plant than by two or more in the same locality. The differences between them are not even limited to the facts named and to other facts of a similar character, but extend to the principles of competition. In most of the ordinary commercial undertakings the expense can usually be stopped whenever competition has reduced prices below a profitable level. But this cannot be done in the case of public-service corporations. The investment in the corporations cannot be withdrawn or often converted into other purposes. The interest and the maintenance charged go on at about the same rate whether the plant is in operation or not. Hence it often happens that it is better for the owners that such plants should be kept in operation even if they fail to earn more than the actual operating expenses. Duplications of such plants is a waste of capital whenever the services can be adequately furnished by one plant only. It necessarily means that interest and maintenance must be earned on a much greater, if not twice as great, an investment and that the actual cost of operation is likely to be relatively higher. Competition in this service therefore usually means a bitter struggle and low prices, until one of the contestants is forced out of the field, when the rates are raised to the old level, if not above it, or to a combination or understanding of some sort between them, which also ultimately results in higher rates. In this way it often happens that the means which were thought to be the preventive of onerous conditions become the very agents through which such conditions are imposed. In fact, active and continuous competition between public-utility corporations furnishing the same service to same locality seems to be out of the question. This has been shown by experience. Such competition is also contrary to the very nature of things. Two distinct and separate corporations are not likely to remain separate very long after it becomes clear that the services rendered by both can be more cheaply and more effectively furnished by only one of them.

The original company organized for the supply of gas for illuminating purposes in La Crosse was the La Crosse Gas Company, which was merged into the La Crosse Gas and Electric Company in November, 1901. The second lighting company organized in La Crosse was the La Crosse Brush Electric Light and Power Company, incorporated in October, 1881, shortly after the first patents were issued to Mr. Brush on his arc-lighting system. It was incorporated with the La Crosse Gas and Electric Company in 1901. The third lighting company to be organized in La Crosse was the Edison Light and Power Company, incorporated in February, 1887, shortly after Mr. Edison had perfected his incandescent lamp and low-voltage dynamo, and the company began at once the general furnishing of electricity for lighting and power for the first time throughout the city. Shortly after this organization the Brush company ceased to make any attempt at furnishing light for commercial purposes and relied exclusively upon its street-lighting business for its existence.

The above three companies were operated independently and maintained separate plants and offices until 1897, when a certain group of capitalists who had been largely interested in the Gas Light company in the past, obtained a controlling interest in the stock of all of the companies, and from that time on until the organization of the Gas and Electric Company in 1901, the three companies were managed from the same office, although retaining their individual corporate existence. In November, 1901, Mr. George MacMillan and his associates purchased from the then holders of the capital stock of the three companies in existence all of the property of these corporations and incorporated the La Crosse Gas and Electric Company, the capital stock of this company being $600,000.

After several years of effort, the city has not only failed to secure permanent competition in the electric-lighting business, but it has been the means of causing more fixed capital to become invested in such plants than is really warranted by the demand for such lighting in La Crosse. In other words, the lighting business in that city has been brought to a condition where it has to bear more in the way of fixed charges annually than would have been the case had the city adopted a wiser course of regulation than that which for services of this character can be had through competition.

Among the most important features that are involved in this case, says the commission, are those which relate to the earnings and the operating expenses of the company, for it is upon these facts largely that the adequacy or inadequacy of the rates must be determined. Detailed statements of both the gross earnings and the operating expenses for the last 5½ years were therefore required of the companies and furnished. These statements for the electric-light and heating plant have been closely examined and tested, and are believed to be substantially correct. The facts contained in them have been summarized in the following table:

Gross Earnings and Operating Expenses.— Electric and Heating.

	1902.	1903.	1904.	1905.	1906.	1907 (6 mos.)
Electric current, sales	$ 42,873.34	$ 46,275.50	$ 84,561.55	$ 87,853.12	$ 69,375.63	$ 35,934.19
Heating and sundries	14,488.52	19,077.08	21,627.40	26,936.56	30,891.59	19,326.33
Total earnings	57,361.86	65,362.58	106,188.95	114,789.68	100,267.32	55,260.52
Operating expenses	39,557.38	53,009.16	71,196.03	80,251.15	94,587.16	53,509.98
Net earnings	17,804.48	12,343.42	34,992.92	34,438.53	6,680.16	1,750.54
Kilowatt-hours sold	565,070.00	748,269.00	1,366,961.00	1,492,802.00	1,705,118.00	919,285.00
Current sales per kilowatt-hour	.07580	.06184	.06186	.05875	.04068	.03908
Heating sales per kilowatt-hour	.02560	.02550	.01582	.01801	.01812	.02113
Total earnings per kilowatt-hour	.10140	.08734	.07768	.07674	.05880	.06021
Total operating expenses per kw.-hour	.07000	.07080	.05210	.05358	.05546	.05820
Net earnings per kilowatt-hour	.03140	.01650	.02560	.02316	.00334	.00201

The net earnings are the items which in this case throw the most light upon the situation of the plant in question in so far as its rates and expenses are concerned. The net earnings may be said to consist of the balance between the gross earnings and expenses as shown in the table. It is the amount out of which depreciation of the plant, interest on the bonds and dividends on the stock should be met. In order to ascertain more definitely what the net earnings in this case amount to when applied to these purposes, the commission found it necessary to capitalize them upon some given basis.

The commission sums up in part as follows:

During the past two years the net earnings are not even large enough to meet ordinary depreciation charges, much less any interest upon the investment, and as long as the rates charged for current remain as low as at present there is but little hope that the net earnings will increase. The situation, then, is about this: Under the present rates the earnings derived from the business are not sufficient to meet the operating expenses and full maintenance of the plant. If this should be permitted to go on indefinitely a situation might easily develop under which the plant would become incapacitated to furnish the city with the necessary amount of lighting. In view of these facts, and also in view of the fact that the present rates are much lower than the rates charged by any other plant operated under similar conditions that we have been able to find, it appears to us that it is in line with public policy that the rates now charged by the petitioner for electric current should be raised to a more remunerative basis, and it is our determination that this change should be made.

Since electric current cannot be stored, the capacity of the plants must be equal to the greatest demand that may be made upon them. Their capacity must, in fact, be entirely out of proportion to the average demand for current. The demand for current is much greater in the evening than during the rest of the day. It is also greater in the winter than in the summer. But experience shows that the average demand is seldom equal to more than 30 per cent. of the capacity of the plants. The total capacity, for instance, of the petitioner's plant is about 10,960,000 kilowatt-hours, and the kilowatt-hours sold amounted to only 1,705,118 in 1906. Still the capacity of the plant could not have been greatly reduced, for the records show that during the winter months it was employed almost up to the full capacity. Nor can it stop operating when the demand is light. It must constantly stand ready to supply current whenever the lights happen to be turned on. These facts also tend to increase the difference in the cost per kilowatt-hour as between the long and the short-hour users, or between those who with a given installation consume a large and those who consume a small amount of electric current.

For the year 1906, for instance, the operating expenses, rentals and taxes amounted to $94,587. When interest and depreciation at the rate of 10 per cent. on $450,000 (estimated cost of constructing the electric plant) is added, the total cost foots up to about $139,587. When these items are separated between fixed and variable expenses upon what have been termed as usual methods the amount for the two classes will be about $90,732 for the fixed and $48,855 for the variable. The fixed expenses will then constitute about 65 per cent. of the total.

When the fixed expenses are prorated upon the total kilowatt-hour capacity of the plant, which was 10,950,000, and the variable expenses are prorated upon the actual kilowatt-hours sold, or upon 1,706,118, the cost per kilowatt-hour for the consumer who consumes current or who uses his lights 24 hours daily will be found as follows:

Fixed expenses ....0.83 cent per kilowatt-hour
Variable expenses .....2.87 cents per kilowatt-hour
Total ....3.60 cents per kilowatt-hour

When the fixed expenses are prorated upon about 4.17 per cent. of the total capacity, or upon about 456,250 kilowatt-hours, and sold as above, the cost per kilowatt-hour for the consumer who uses lights only one hour per day will be found. It is approximately as follows:

Fixed expenses ....19.90 cents per kilowatt-hour
Variable expenses .....2.87 cents per kilowatt-hour
Total ....22.77 cents per kilowatt-hour

If the expenses are separated between fixed and variable on the other basis outlined above, that is, if rental, depreciation, interest and certain other items are divided between both the fixed and variable expenses, instead of being classed as fixed expenses entirely, the results will be somewhat different from those already presented. In that case the cost per kilowatt-hour would probably be close to 5.50 cents for those who used the current 24 hours daily and not far from 15.50 cents for those who used the lights about one hour per day.

A closer examination of the "maximum-demand" system reveals the fact that under this method of fixing rates due importance is given to the element of cost. If the customer who uses his lights one hour a day only, pays a higher rate than the one who uses his lights three hours a day, it is because the cost is greater in the former case. This is certainly true if the methods are strictly adhered to, the rates carefully computed and the expenses properly classified. The rates so determined are based upon facts rather than upon mere arbitrary ideas.

There are also other systems of charging in use. The first in order of these systems, or the flat rate, is practically out of the question for general application, and is not used to any considerable extent. The remaining systems are unscientific and seem to be rapidly going out of use.

The petitioners in this case prepared a tentative schedule which they regarded as fair for the present and which was submitted to this commission for examination. This schedule was said to have been based upon the "readiness-to-serve" system. It provides for a service charge of $1.80 per year each 16-candlepower lamp for one-third of the installation connected. It further provides for a meter rate of 7½ cents per kilowatt-hour for a consumption per installation equivalent to 60 hours or less per month; for a meter rate of six cents per kilowatt-hour for a consumption equivalent to more than 60 hours per month, and for a meter rate of five cents per kilowatt-hour for the "patrolled service" or for signs and other installations with fixed hours of use.

For "power rates" the submitted schedule provides a service charge of $27 per horsepower of demand, and in addition to this for meter rates of five cents per kilowatt-hour for less than five hours' use per day; of three cents per kilowatt-hour for daily use of over five hours, but not exceeding 10 hours, and of two cents per kilowatt hour for a use of over 10 hours per day per horsepower demanded.

Under the proposed schedule the short hour customers, who comprise mostly the residence district, will contribute relatively less to the revenues of the company when measured by the cost than the long-hour customers. This is an inequality, however, that it is difficult to adjust so long as the present ordinance remains in effect. It is, of course, possible that it may be obviated by radical improvements in the methods of operation or production, but the chances for this are rather remote.

Some of the rates for power, as given in the schedule, may appear to be lower than warranted by the cost in these cases. It is true that these rates were quite low, but it is not clear that they are unprofitable. Upon an examination of the facts it will be found that there is a great deal to be said in favor of comparatively low rates for power. The maintenance charges for distribution of power current are lower than for lighting. The consumption of current, both as to maximum demand and hours used, is also much greater in the former case, and this materially reduces the cost per unit. Power current is produced during that part of the day when little or no other current is used, or while the plant is simply holding itself in readiness to supply such demand for lighting as may be made upon it. There may also be sharp competition between the electric plants on one hand and steam and gasoline plants on the other. For these and other reasons it is customary everywhere to grant much lower rates for power than for lighting.

It further appears that the proposed rates are somewhat lower than those charged in other cities both in and outside of this state. The comparisons we have made upon this point are quite extensive. They embrace at least 20 cities in Wisconsin and fully as many in other states. These facts are of considerable importance not only to the petitioners but to the people who are served by this company.

It appears to us that the rates submitted by the petitioner fairly meet the situation, and that they are just and reasonable. It has been determined, therefore, that these rates shall be put into effect, subject, however, to such revision as may be found necessary when the plants in question have been appraised of for other reasons.

It is therefore ordered that the petitioner in this case, the La Crosse Gas and Electric Company, in lieu of the rates it now charges for electric current for lighting and power shall substitute the following maximum rates:

LIGHTING RATES.

The service charge on all lighting and installations shall be $1.80 per year per 16-candlepower lamp or equivalent demand, on one-third of connected installation, or when one-third of the connected installation is considered to be in the demand.

The meter rate for a consumption equivalent to 60 hours or less per month per each installation shall be 7½ cents per kilowatt-hour.

The meter rate for a consumption equivalent to more than 60 hours per kilowatt-month per each installation shall be six cents per kilowatt-hour.

The meter rate for "patrolled service" or for signs and other installations with fixed hours of use shall be five cents per kilowatt-hour.

POWER RATES.

The service charge shall be $27 per year per horsepower demanded.

The meter rate for less than five hours per day per horsepower demanded shall be five cents per kilowatt-hour.

The meter rate for over five hours but not exceeding 10 hours per day per horsepower demanded shall be three cents per kilowatt-hour.

The meter rate for 10 hours per day for horsepower demanded shall be two cents per kilowatt-hour.

Electric Power for the "Shower of Gold."

The Lluvia de Oro Gold Mining Company has purchased through L. L. Nunn of Provo, Utah, the machinery for a complete power plant to be operated in connection with its mines in the Sierra Madre Mountains near El Fuerte, Mexico. It is to consist of a 500-kilowatt Allis-Chalmers steam turbine, direct connected to one of the same company's 60-cycle, three-phase, 600-volt alternators. There has also been built by Allis-Chalmers Company, to be installed with the turbo-generator unit, a Tomlinson type B barometric condenser and an 8 by 16 by 20-inch vacuum pump. The water for the condensing system will be brought by gravity to a cold well, near the condenser, at a height to be forced into the condenser by atmospheric pressure.

The complete equipment, which was shipped soon after the placing of the order, will be installed in a substantially constructed stone power house. The fact that the plant has been designed by Mr. Nunn, who is one of the best known constructing and consulting engineers in the country, insures its being a model one in every respect. As all of this apparatus will have to be carried along a difficult road over the mountains, after being taken by boat from Guaymas to Topelodampo, and thence by rail a part of the distance, the transportation of it will be quite a problem. Lluvia de Oro means "Shower of Gold," and the mine has had a romantic history.

Self-welding Wire Joint.

Frank B. Cook of 235 West Lake Street, Chicago, who is well known in the telephone and electrical field, says that he has succeeded in perfecting a "wire joint" for splicing both iron and copper wires which is mechanically and electrically perfect. The construction of the sleeve or joint is in itself a simple matter, but its success is declared to be due to the peculiar design and the care used in its manufacture.

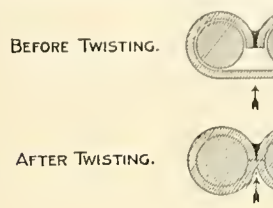


Fig. 1.

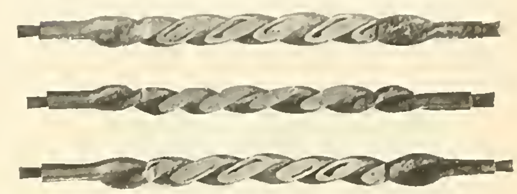


Fig. 2.

SELF-WELDING WIRE JOINT.

Referring to Fig. 1, it will be noted that one side is flat and the other is formed to fit the wires. In twisting, the flat side is drawn up into the recess between the wires and meets the upper or formed side, stretching the metal around the wires so tight as to completely close up any space and make a perfect cold weld between the metal in the joint and the wire. It is only necessary to use the ordinary splicing tools, and the mere act of twisting the joint makes a connection that is air and moisture proof—the ideal electrical splice.

The early method of making a splice was to twist the wires together and solder the joint. After a time this method was replaced to a certain extent by inserting the wire in a double-tube sleeve and twisting the sleeve and wires together. This latter method gave moderate satisfaction in splicing copper wires, but in splicing iron wire many of the large users decided to return to the old manner of twisting and soldering, even though more expensive than the sleeve, their reason being that they could not depend upon the joint made with the new sleeve. Moisture penetrated, setting up corrosion, causing high resistance, and the joint thus made was weak. Having all these faults in mind, Mr. Cook so constructed his sleeve as to retain the strength and other desirable features of the twisted and soldered splice and produce a sleeve with maximum strength and efficiency, combined with minimum labor in application. A comparison of this joint with other types is shown by Fig. 2, in which the top illustration is a Cook No. 10 joint with one No. 10 and one No. 12 wire, and the next two are other No. 10 joints made up under the same conditions. This illustration is a reproduction of a photograph which has not not been retouched. The upper portion of each sleeve or joint was filed away to show the interior of the joint. This illustration also shows that the Cook sleeve may be used as a combination joint with success, which feature is of considerable value, as it means less variety of sizes in stock for the consumer.

The strength of the Cook joint has been demonstrated, but some facts may be of interest. The joint is positively stronger than the wire. It will stand several twists in addition to the 3½ twists used in common practice without fracturing, and, in fact, it can almost be tied into a knot.

Mr. Cook also announces that the Western Union Telegraph Company has adopted his joint after exhaustive tests, and incidentally exhibits an initial order for 500,000; also a recent order for the Australian government and one from Japan, demonstrating that the Cook joint is used on telegraph, electric-light and power circuits with satisfaction, as well as in telephone construction.

The Great Gas-engine Electrical Plant at Gary.

At the steel mills of the Indiana Steel Company at Gary, Ind., now under construction, gas power is to be used exclusively. The entire electric power-generating equipment of this plant is being supplied by the Allis-Chalmers Company. The portion now under contract consists of 17 Allis-Chalmers gas engines rated at 4,000 horsepower each. Fifteen of these are direct connected to Allis-Chalmers 25-cycle three-phase alternators, which will operate in parallel and supply current to more distant portions of the mill; two are direct-current generators supplying current for portions of the plant immediately adjacent to the power house. There will also be eight blowing engines with the same size gas cylinders as the electrical units for the same plant, making 25 engines, or a total of 100,000 horsepower, which the Allis-Chalmers Company is supplying for this power house alone.

It will require approximately 1,000 carloads to complete the shipment of these engines.

The electrical power house, in which will be installed the 17 electrical units, is 1,000 feet long and 105 feet wide. Switchboards are arranged in the gallery located at such height that all of the units and the signals of the engine attendants may be readily observed by the operators at the switchboard. It will be one of the largest power houses in the world, and the electrical generating station at this plant alone will be double the size of any previous gas-engine installation either at home or abroad.

An Artistic Lighting Fixture.

The accompanying cut illustrates one of the handsome rock-crystal electric ceiling chandeliers that are being imported into the United States by R. E. Rickenbaugh of Grand Rapids, Mich. Mr. Rickenbaugh is introducing also rock-crystal drop and wall lights, portable lamps, shades, globes, cut and iridescent crystal prisms. Mr. Rickenbaugh's relation with the foreign manufacturer of this line of chandeliers and other fixtures is of a purely representative nature. He has effected the same connection as though a house in the United States should employ a sales manager to devote himself to the selling of its line. His compensation comes from the German manufacturer, and this permits his naming German prices. Mr. Rickenbaugh was graduated from Heidelberg University in 1888, served two years as deputy in the Probate Court at Toledo, O., was assistant cashier in one of Toledo's savings banks for 10 years and for seven years was engaged in the manufacture of furniture in Grand Rapids.

AN ARTISTIC LIGHTING FIXTURE.

Telephone News from the Northwest.

The Zenith Telephone Company of Duluth, Minn., announces a requirement to pay in advance for a full quarter hereafter, but will give 30 days before the 50-cent penalty is added.

The matter of a reduction of telephone rates may be an issue at the spring election in St. Paul, along with other demands upon public-service corporations.

The Wisconsin Telephone Company has completed rebuilding the local exchange at Eau Claire, Wis., installing cable work in place of open wires, with many other changes.

G. W. Johnson of Minneapolis has been made district manager for the Tri-State Telephone Company at Pine City, Minn.

The Rice Lake and Northwestern Telephone Company has completed a line some 60 miles in length in Northwestern Wisconsin.

The Hancock County Rural Telephone Company has been absorbed by the Western Electric Telephone Company of Britt, Iowa.

The Independent telephone interests of Western Iowa have formed a company to enter the long-distance field. It is capitalized at $3,000,000, with C. G. Cockrell of Sioux City president, and C. H. Smith of Council Bluffs, manager.

Canadian Telephone Notes.

The telephone system at Fernie, B. C., has been connected with the system at Cranbrook, a distance of 30 miles. The rate between the two towns is 50 cents for five minutes, with a half rate for every succeeding five minutes.

At Tisdale, Saskatchewan, the Tisdale Telephone Company is being organized to build a telephone system to New Osgoode settlement, a distance of 18 miles.

The Independent Telephone Company of Canada, a concern recently organized with a capital of $5,000,000, is said to be making good progress. Already the company has secured contracts to install systems in Edmonton, Alberta, and Brantford and Lindsay, Ontario. At the last-named place there will be 1,200 telephones at the initial installation, but the ultimate capacity of the plant will be 10,000 lines. The company owns the Lorimer automatic patents for Canada and has an exchange working successfully at Peterboro, Ontario.

On November 1st the Bell Telephone Company ceased to do business in the territory covered by the system of the Dunnville Consolidated Telephone Company of Dunnville, Ontario. The Consolidated company has purchased the poles, wires and all the outside plant of the Bell company in this territory, except that which is reserved for the long-distance service. The Bell company agrees to maintain no local exchange in this territory during the term of the agreement, which is for 10 years. R.

Indiana Telephone Items.

In Richmond the Home Telephone Company has dispensed with the services of 28 girls, the automatic system being now in use. Only a few girls, to take care of the long-distance business, are required. The new system is working very satisfactorily and the company is receiving praise for the adoption of the automatic system.

H. D. Foote, district superintendent of the Central Union Telephone Company at South Bend, has resigned his position to enter other business. Mr. Foote has held several positions with the Central Union Company and was at one time manager of the Mishawaka exchange.

Officials of the Independent Telephone companies of Davies, Pike, Gibson, Knox and Sullivan counties held a meeting in Vincennes during the last week for the purpose of adjusting and making uniform rates for local toll-line service. In the past each company has made its own rates and kept all charges collected. In the future the charge will be divided on a mileage basis.

The report of the Delaware and Madison Counties Telephone Company, which operates exchanges in Muncie, Anderson, Elwood and Alexandria, for the first nine months of the present year, is gratifying to the stockholders. The income for the nine months ended September 30th was $69,772.59. The operating expenses were $37,543.88, leaving a net income of $32,282.69. Of this amount $14,261.19 was applied on stock dividends.

The public press of Indiana has contained frequent references to events said to indicate a secret understanding for a future merger or consolidation of the opposing telephone interests in this state. Charles S. Norton, secretary of the New Long-distance Telephone Company, says that a merger or consolidation of the telephone interests of the state is impossible under present conditions. S.

GENERAL TELEPHONE NEWS

Something of a stir was created in Richmond, Va., a few days ago by the announcement that Alderman Bennett would offer a resolution providing for the appointment of a special committee to investigate the advisability of revoking the charter of the Southern Bell Telephone Company in Richmond on account of alleged insufficient service.

The recent assessment of local telephone companies in the state of South Carolina showed that there are 45 such companies, the largest, valued at $30,000, being the Piedmont Telephone Company, with headquarters at Gastonia, N. C. The total assessed value ascertained by the railroad board of assessors is near a total of $200,000. There are nine companies having $5,000 valuation or more.

The Chicago City Council at its regular meeting on Monday night rejected by a vote of 42 to 27 the resolution to make a thorough investigation into the ability of the Illinois Tunnel Company to furnish the entire city with automatic telephone service and by unanimous vote agreed to meet on Wednesday forenoon of this week to take up the Chicago Telephone Company ordinance. It was expected that at this meeting some definite action would be taken on the telephone franchise question.

It is reported that the plant of the Independent Telephone Company of Omaha, Neb., is now nearly completed. Service will be given on December 1st. By the terms of its franchise the company is required to give free service until 3,000 telephones are in use. This number of subscribers will be connected by the first of the year, but it is the intention of the company to make no charge for telephones until February 1st, when its 5,000 or 6,000 subscribers will all have had a full month's trial use of the automatic telephones. The system comprises two exchange buildings, with present capacity for 6,000 telephones and ultimate capacity for 20,000, 122 miles of underground system and extensive aerial construction.

CORRESPONDENCE.

Continental Europe.

Paris, October 22.—Upon the Eiffel tower has been mounted an apparatus which resembles a huge electric sign, and it serves to show the time, giving the hour and minute. Thus the Parisians can see the time during the night from a great distance. The change is made every minute by means of a revolving drum which is operated by a clockwork device. The figures which show the hour are made up as usual by incandescent lamps.

Some time ago the Paris Subway Company made a move in the direction of giving better ventilation for the tunnel, and to this end it adopted the system of shafts connecting the tunnel with the surface of the ground. In the shaft is placed a fan of large size, driven by an electric motor. At the same time in different places the tunnel is connected with the outer air by large openings. As this method gave quite an improvement in the ventilation it was decided to continue it upon other parts of the tunnel in the different sections of the road, and this is now being carried on. Regarding the new north-south line of the subway, the Clignancourt-Orleans section, I may mention that the first part of the line, from the first-mentioned station to the Chatelet at the Seine, will no doubt be opened for traffic at the end of the year, or at least early next year.

There is a project for a new electric line in Hungary. A Budapest company is undertaking to erect a mineral water establishment at Kocs and intends to connect this locality with the railroad by an electric road which will be about 12 miles long. The terminus of the electric line will be at the Tatatovaras station lying on the Hungarian state railroad and a good passenger traffic is expected. Freight trains will be run upon the line during the night.

At a recent meeting of the Academy of Sciences at Paris a communication was read from the director of the public hygiene department asking the advice of the academy upon the question of forbidding the use of X-rays in therapeutics to persons who are not professional physicians. Some time ago this matter was brought up before the Academy of Medicine, but it has not yet been decided. The Academy of Sciences has appointed a committee to consider the question.

Mr. De Lapparent showed those present some small crystals of carbon which have the appearance of the diamond and which were obtained by the physicist, Aristide Charette, by decomposing bisulphide of carbon. The action is carried out in the presence of certain metals, especially iron, and under the action of an electric current for several days. A continuous current of very low intensity is used.

In the Ain department of France there are several hydro-electric projects on foot. The report of the chief engineer of the department to the General Council relates to three separate projects. One of these is proposed by the Lyons Public Works Company and consists in erecting a dam upon the Ain River and a reservoir which will lie 115 meters above the level of the Rhone. In this way the proposed electric station will receive 12,000 horsepower at least. The project will cost $5,000,000, not counting the machines in the turbine plant. It is also proposed to build a plant which will supply a part of the Ain, Rhone and Loire departments. This station will also be placed on the Ain River at Mallon. On the same stream a third project calls for a turbine plant of 4,000 horsepower which will be used for a network of lines supplying the towns of Macon, Bourg and Villefranche and the surrounding region. The head of water in this case will be 12 meters.

It is stated on good authority that the War Department of Japan has recently ordered a number of portable radio-telegraphy stations from the Berlin Wireless Company, and it appears that Japan is convinced that its own system will not be a success, and therefore decided to adopt the German system in the future. In France the Toulon arsenal on the Mediterranean recently received orders from the War Department to proceed with a series of soundings for installing a radio-telegraphic post which is to communicate with all the islands on the coast. This station will be located at the Mourillon arsenal. A. DE C.

Great Britain.

London, October 26.—Mr. Sydney Buxton, the postmaster-general, has appointed a committee which includes the accountant-general to the postoffice, the accountant-general to the Board of Education, and the president of the Institute of Chartered Accountants in England and Wales to consider the various accounts and returns in connection with the telegraph and telephone services and to report in what manner these accounts and returns can be modified or supplemented so as to show more clearly the financial result of each service. At present there is a heavy annual loss upon the telegraph service, but it is frequently stated that the telephone service is in a much better financial position. It has been suggested that the increase in the telephone rates has been decided upon in order to help meet the deficit upon the telegraph service, but this has been officially denied. Unless the accounts of the two services are published distinct from one another, it will be difficult to see where the line of demarcation is.

A further indication of what is in the minds of the directors of some of our leading electrical manufacturing companies is afforded by a speech at the annual general meeting of Messrs. Ferranti. This firm, it may be remembered, is an old-established one which, at one time, made all classes of electrical machinery and also steam engines. From various causes it did not do well and a reconstruction took place, after which only switchboards, meters and instruments were manufactured. Last year a profit of over $10,000 was made, but there is a somewhat heavy deficit to wipe off from previous years and there is still a debit balance of some $25,000. The chairman stated at the annual meeting last week that the present keen competition, which was due in a large measure to foreign firms, would, unless the laws of the country were changed, result either in many firms stopping business or else in an amalgamation of large interests which would, incidentally, put an end to the useless expenditure of maintaining independent staffs and also check foreign competition. The speech in question rather indicated that that particular chairman would welcome an amalgamation. The rumor keeps cropping up in Lancashire electrical engineering circles that such an amalgamation is not impossible in the very near future.

The opening of the Marconi transatlantic wireless telegraph service has been recorded with great flourish by the daily press, but it is significant that the technical press is very wary in accepting the fact that a few messages have been sent across in a too enthusiastic spirit.

An extraordinary suicide took place at the Kingston electricity works, which are very close to London, last week. A carpenter who had been, but was not at the time, employed at the works paid a visit to the station and asked which were the most dangerous parts of the machinery and switchboard. The man in charge quite naturally thought the individual in question was about to carry out some work and wished to avoid danger and therefore gave him the necessary information. A few moments after the man deliberately caught hold of the 2,000-volt terminals, and when the current was switched off he was found to be dead. The evidence at the inquest showed the act to be quite intentional.

Since May of this year, when the electric ambulance system in the city of London was inaugurated, the vehicle has been called out nearly 450 times, and the increased rapidity in dealing with cases was commented upon at a recent meeting of the City of London Corporation.

Sir Alexander Kennedy has prepared an interesting report upon the question of depreciation, at the request of the Edinburgh Corporation. The Act of Parliament governing electrical undertakings stipulates that a fund not exceeding 10 per cent. of the capital expenditure shall be set aside for the purpose of depreciation. Edinburgh is almost the one fortunate municipality in the kingdom which has arrived at this happy state, but the worthy council is still in doubt as to whether the undertaking is on a sufficiently stable footing financially. In the flourishing circumstances of Edinburgh, Sir Alexander Kennedy recommends that an additional fund of 5 per cent. should be set aside for renewals in view of the uncertainty as to the life of certain portions of the machinery.

The first combined gas and electricity works in England have just been opened at Ascot. The undertaking is a very small affair, the generating plant consisting of two 70-horsepower gas engines and two 110-ampere dynamos. It will be interesting to watch how the company will be able to sell electricity alongside of gas with the comparatively high prices which have been fixed.

The experimental scheme of street lighting in the city by means of flame arc lamps suspended by wires from rosettes on either side of the streets was demonstrated this evening with most satisfactory results. This is the first opportunity the electric-lighting companies have had of showing what they are capable of accomplishing with modern lamps. The other arc lamps in the city are 15 years old, with a basket-pattern lantern insisted upon by the gentleman who was engineer to the city corporation at the time. Now the electric-lighting companies are reproached for having put up a type of lamp which they were compelled to. The new scheme of lighting is to be continued throughout the winter. G.

Dominion of Canada.

Ottawa, November 2.—Kerry & Chace, engineers, of Toronto, have been engaged to take charge of the work of developing power at Silver Falls for the city of Port Arthur, Ont. Estimates will be prepared for a present capacity of about 6,000 horsepower, and for an ultimate capacity of 30,000 horsepower. The head of water at the falls is about 300 feet, and power will be transmitted 25 miles. The Hydro-electric Power Commission's estimate, last spring, of the cost of developing 6,840 horsepower at Port Arthur was $619,700.

The Power, Light and Heat Company of Sherbrooke, Que., will lay the offer of that city for the company's plant before its shareholders at a meeting to be held in January next. The city offer $85 cash for each $100 share, or $95 in city bonds for each such share. The local shareholders in the company are in favor of the acceptance of the city's offer. The city was about to call for tenders for the development of the necessary power, but, owing to the condition of the money market, it was felt that it would pay the city to increase its offer to the company, rather than to try and raise money for development purposes.

It has been officially announced that the estimate of the Hydro-electric Power Commission, for distribution plants in the city of London, Ont., is $100,000. This represents the whole of the debenture issue necessary on the part of the city to obtain Niagara power. The commission will build the transmission line, construct the transformer stations, buy the right-of-way, and do everything necessary to bring the power to the city. London's estimate of power cost is not to exceed $23 per horsepower, and it is likely the charge will be less than that sum. In 30 years, or less, the transmission line, station and right-of-way will be paid for, when they will become the property of the municipalities. W.

Winnipeg, Man., November 2.—The Board of Trade of Saltcoats, Sask., is taking up the question of a municipal telephone system. Figures have been obtained from several telephone supply firms. A. B. Lauder, Saltcoats, Sask., may be addressed.

A scale of charges has been fixed for the municipal electric-lighting plant at Strathcona, Alberta. Up to 100 kilowatts the charge will be 14 cents per kilowatt-hour; up to 200 kilowatts, 12 cents; 300 kilowatts, 10 cents; 400 kilowatts, 8 cents; 500 kilowatts, 6 cents, and up to 600 kilowatts, 5 cents. It was also decided that a landlord will be responsible to the town for all electric light consumed on his premises, and that if the bill is not paid within 30 days the light will be cut off. The charge for reconnecting will be $1. Posting of bills on the electric-light poles is prohibited.

The city of Port Arthur, Ontario, has let the contract for a 30,000-horsepower development at Dog Lake to Smith, Kerry & Chance, Confederation Life Building, Toronto. The wheels to be used will be the Pelton impulse type. The work will cost in the neighborhood of $800,000.

A local syndicate has been formed at Vancouver, B. C., to develop 250,000 horsepower on the Chekamus River, 48 miles from Vancouver. The British Columbia Power and Electric Company is the name of the organization, and it is understood the concern has obtained all the necessary capital for the work. At the canyon where the site for the electric power plant has been selected there is a drop of 520 feet in 600 feet. The river is fed from glaciers and mountain streams and there is sufficient water in the river to develop fully 250,000 horsepower at all seasons of the year.

The radio-telegraph station at Shotbolt's Hill, Victoria, has been completed, and announcement was made that it would be opened during the first week in November. The Department of Marine and Fisheries, Ottawa, will have charge of the operation of the station, and has appointed E. J. Haughton of the Canadian Pacific Railroad Telegraph Company as officer in charge. This is the first station to be completed of the chain which the Dominion government is establishing on the Pacific Coast.

Doubling the capacity of the municipal power plant at Edmonton, Alberta, is one of the questions being discussed by the civic commissioners, and it is expected that tenders for the work will be called shortly, as the city has been successful in disposing of its debentures. A proposal has been made to run the machinery of this plant with a gas producer. Mayor Griesbach or City Electrician Ormsby may be addressed. R.

New York.

New York City, November 2.—Announcement was made by the president of the Trust Company of America that the New York, New Haven and Hartford Railroad Company had purchased the rights and property of the New York, Westchester and Boston Railroad and the New York and Portchester Railroad. All the shore-line transportation between the Connecticut line and New York city now passes into the hands of the New York, New Haven and Hartford. The Millbrook Company, which recently merged the two above properties, is a holding corporation that owns all of the stock of the New York and Portchester and a large proportion of the stock of the New York, Westchester and Boston. These have under them several associated companies, and the combination as a whole owns extremely large charter rights, giving substantially exclusive power to build high-class and standard electric roads between Harlem and the Connecticut line. In the Bronx, a large amount of money has already been spent for the purchase of realty for one of the lines, and the ultimate plan contemplates a large number of four-track standard electric lines connecting with the New York subway systems. Northward, the proposed system will extend to New Rochelle, Westchester, Mount Vernon and White Plains. It will connect with the Harlem and Portchester, which is also owned by the New York, New Haven and Hartford, at West Farms, and with the New York subway at One hundred and seventy seventh Street, New York city.

George S. Rice, chief engineer to the Public Service Commission, has tendered his resignation, to take effect December 1st. At that time he will become assistant engineer. The commission has appointed Henry B. Seaman of Brooklyn to succeed Mr. Rice. It is understood that a general reorganization of the engineering forces has been effected. Mr. Seaman is a native of this city and was graduated from Swarthmore College in 1881. He has held responsible engineering positions with the Erie, Pennsylvania, and New York, New Haven and Hartford, and has been a consulting engineer for the bridge department of the city. He was also in charge of the engineering work for the sub-contractors on the Fourth Avenue section of the subway. Mr. Seaman will have supervision over the entire engineering work coming under the supervision of the Utilities Board.

Following the announcement last week that the United States Navy Department had purchased a large number of the wireless-telephone sets, to be immediately installed, comes the announcement, through a special cable dispatch to the New York Herald, that the British Admiralty has made all arrangements for installing wireless telephones in most of the vessels of the fleet and that the work is being carried out by the Radio Telegraph Company. It is also stated that these sets are useful up to 30 miles, which, if true, exceeds that accomplished by the United States experimenters. At present the most general method of communication of signals is by the use of flags, consequently in stormy and foggy weather the wireless telephone will be of great service.

Judge Fawcett of Brooklyn has fined the Traction Development Company, which supplies the Brooklyn Rapid Transit Company through its station at Kent Avenue with power for its trolley lines, for maintaining a nuisance. It is claimed that the dense clouds of smoke and cinders which arise from the stacks of this large station settle on the surrounding property, and the sheriff has been ordered to act. The company, however, obtained a stay from the Supreme Court pending argument on a motion for a certificate of reasonable doubt. Experts testified at the hearing that the nuisance could be abated by the use of economizers, fans and other devices, but the "B. R. T." has made no effort to install any preventive apparatus.

The Nassau Light and Power Company of Roslyn, N. Y., has applied to the Public Service Commission for permission to issue $532,000 in capital stock and $1,000,000 in bonds and also for authority to purchase the capital stock of the Oyster Bay Light and Power Company. E. H. S.

Ohio.

Toledo, November 2.—A movement is on foot toward the organization of a company to erect an electric railway from Defiance to Fort Wayne, Ind., via the old Wabash Canal, running a branch to Paulding, and eventually on to Cincinnati. The project is being promoted by K. V. Haymaker of Defiance.

The George F. Grove Electric Company of Dayton was incorporated this week by George F. Grove, F. A. Carson, A. L. Grove, William H. Ware and Aldera Carson. The authorized capital stock is $15,000.

Robbers at Marion, Ohio, stole the building and contents of Pearl Sells, an electrical supply man. The building, which was located in the heart of the city, was torn down in the night, loaded on wagons and hauled away.

Over 100 delegates representing the Independent telephone companies of 13 counties will meet in convention at Newark, Ohio, on November 21st. An extensive programme will be carried out and a banquet spread in the evening.

William M. Lawrence has accepted the position of manager of the local telephone company at Norwalk, Ohio, to succeed H. R. Sykes, resigned.

The Ohio Electric Railway Company, operating one of the largest systems in the world, was formally organized this week by the election of the following-named officers: President, W. Kelsey Schoepf; vice-president, Norman McD. Crawford; secretary-treasurer, F. A. Healy. The foregoing, with D. G. Edwards, J. B. Foraker, Jr., Dana Stevens, J. Levering Jones and Hugh J. McGowan, form the directorate of the company. H. L. S.

Michigan.

Detroit, November 2.—J. W. Martin, who asked for a telephone franchise in Flint, has been requested to be present at a meeting of the ordinance committee to explain his plans. The Improvement League passed a resolution stating that Flint does not need a third telephone company and requesting that the franchise be refused.

The Houghton County Electric Light Company has made a proposal to install 100 new lights at Laurium and to operate them for $2,600 per annum.

A meeting of the Michigan Independent Telephone Association was held at Howell October 23d, and plans were made for improvements in several exchanges. With the inauguration of the service of the Home Telephone Company of Detroit, the Independent long-distance service of the state will be much improved.

The Home Telephone Company of Detroit has made a second request for a franchise in Mount Clemens, the first having been refused.

The contract for installing wiring and motors for the new Grand Trunk shops has been awarded to the Central Electric Light Company of Battle Creek.

An agreement has been reached at Trenton with the Detroit Edison Company for the sale of the electric-light and water plant, but the Council wants a boiler and pump installed in the new plant, to use in case of an accident to the transmission line. The village will furnish and erect this extra machinery, except the intake pipe.

A. C. Sekell has asked for a franchise for the Grand Rapids, Hastings and Battle Creek Interurban Railway at Middleville. He says that the right-of-way for the entire distance has been secured.

The Packard Motor Car Company has taken out a permit for a new power-house building in Detroit, the cost of which is given as $28,000.

The bid of the Toledo Electric Company for supplying 90 arc lamps for $3,104 was accepted by the Board of Works of Wyandotte on Wednesday. A turbine generator will probably be installed.

The telephone service at Hancock, which was interrupted in September by an electrical storm, is being resumed.

The ordinance committee of the Grand Rapids City Council has reported against granting a franchise to P. T. Cook for a street railway.

Electric lights will be provided for Aplin Beach, Bay City, next summer. The beach will be lighted by arc lamps, and service will also be available for lighting the cottages.

The street-lighting service at Grosse Pointe Farms, Detroit, was begun this week. It is a series incandescent system with tungsten lamps and ornamental posts, two lamps per post. The results are very satisfactory. D.

Texas.

Austin, November 2.—The financial stringency has as yet had no appreciable effect upon the various electric-railway enterprises that are on foot in this state. Construction work is in progress on several new lines in the northern part of the state, and plans are maturing for building roads in other parts of the state. Considerable progress has been made in the grading work of the two interurban electric lines that are building between Fort Worth and Mineral Wells. There have been rumors that these two projects would consolidate and that but one road would be built. Strong denial is made of this report by the promoters of the two lines. One of the roads is surveyed by way of Weatherford and the other has fixed its route by way of Springtown. Each line will be about 45 miles long.

The Dallas Interurban Electric Railway Company will soon be ready to push the construction of its interurban electric line between Dallas and Terrell, according to the statement of President D. E. Waggoner. The company is also arranging to build a line between Dallas and Waxahachie. Each road will be about 30 miles long. The road to Terrell will run through the towns of Mesquite and Forney.

Citizens of Greenville, Bonham and Wolfe City have taken steps to organize a company to build an electric railway between Greenville and Bonham, by way of Wolfe City. The distance is about 35 miles. D. W. Sweeney of Bonham is one of those interested.

Walter Goodenough of Boston, Mass., representing the Stone-Webster syndicate, recently made an investigation of the project of building an interurban electric railway between Austin and Lockhart, a distance of about 30 miles. Thomas Moore of Elizabeth, N. J., has been actively promoting the building of this road for some time. The survey has been made and the right-of-way for most of the distance obtained. The city of Austin has also granted a franchise for the proposed road.

It is announced by H. M. Griffin, president of the Denton Interurban Railway and Power Company, that the finances for the construction of the proposed interurban electric line between Fort Worth and Denton have been arranged. The same company owns and operates the electric street-railway system in the town of Denton, embracing seven miles of track.

Charles Smith of San Antonio is promoting the building of an electric railway between New Braunfels and Seguin, a distance of 15 miles. Water-power rights on the Guadalupe River have been secured for operating the proposed power plant. Indiana men are said to be interested with Mr. Smith in the project. W. D. H.

Illinois.

Peoria, November 2.—The Bureau County Light and Power Company has been incorporated with a capital of $50,000, with the principal office in Princeton, to manufacture and sell electricity. Incorporators are R. R. Priestly, C. F. Sturtevant and B. C. Lindley.

The seven telephone companies in Greenview are considering a plan for the consolidation of the systems into one company at an early date.

The directors of the Mattoon-Hillsboro Traction Company have received an offer believed to come from the Illinois Traction Company for the financial backing of the proposed line.

Mayor Shaffer, City Electrician Hill, Chief of Police Eckhart and two members of the finance committee of the city of Rock Island were visitors to this city this week to see the new underground work which the Peoria Gas and Electric Company is installing in the business part of the city.

The Peoria Railway Company is installing another electric switch at the busiest downtown corner. One switch is already installed and has given good satisfaction for some time.

The Peoria Terminal Railway did not receive the franchise from the City Council at the meeting this week. The franchise asked for is a valuable one, and both the Peoria Railway Company and the Terminal company are asking for the street, as it is the only available one on which interurbans can get into the city from the south.

Thirty-one indictments were returned by the Coles County grand jury against the employes and officials of the Central Illinois Traction Company as a result of its investigation of the recent wreck on the road in which 18 persons were killed and 75 were injured.

The café service of the Illinois Traction Company was abandoned this week. The move was made necessary, as the service has been carried on at much trouble and no profit for the company. One reason why the service has not proven a paying one is that many passengers are carried who do not travel a great distance, and many of those who travel are residents of the smaller towns and come with their lunch or have their meals before starting. The service was quite popular with the patrons of the road on the trip between Springfield and St. Louis, but as this trade was in the minority it was not a financial success to the company.

Several members of the North St. Louis Business Men's Association were visitors to the city of Springfield this week. They were there to make a study of the benefit of the interurbans, and came and returned on a special car of the Illinois Traction Company.

Judge Shirley of the Sangamon County Circuit Court dissolved the injunction restraining the Jacksonville Railway and Light Company from Crossing the tracks of the steam road on East Street in the city of Jacksonville. This terminates a long and costly fight, and now the company can extend the tracks and save its franchise. V. N.

Northwestern States.

Minneapolis, November 2.—Thomas R. Brown has resigned as secretary of the Northwestern Interurban Railway Company, and Fred Hebert succeeds him. The company is making preparations to start work on the proposed interurban from Fargo, N. D., to Detroit, Minn. The company has incorporated with $1,500,000 capital.

Work has been started on the new electric-light plant at Gary, S. D.

The financial matters for the construction of an interurban line from Des Moines to Winterset and Creston, Iowa, have been arranged.

Hamilton Brown is promoting a trolley line from Marshalltown, Iowa, to Melbourne. Fifty thousand dollars has been subscribed at the former city and a three per cent. tax voted.

Work is progressing rapidly on the Twin City and Lake Superior Electric Arrow line, and the company has announced that it will have its trains running from Minneapolis to Sunrise, Minn., before the end of the year.

The Independent Light and Power Company of Davenport, Iowa, has let the contract to the J. C. Settle Construction Company of St. Louis for the erection of a new plant.

F. G. Barrows and Vernon Wright of Fergus Falls, who are building a power plant near that city, propose to put in electric lights at Campbell, Minn. R.

Pacific Slope.

San Francisco, October 30.—An ordinance was introduced last week before the Board of Supervisors providing for the gradual placing underground of all overhead wires in districts designated as Underground Districts A, B and C throughout the city. The ordinance prohibits the erection of poles and requires the removal of all existing poles in two years in District A, in four years in District B and in six years in District C. The ordinance applies to trolley-feeder wires as to all others, and violations are punishable by a fine of between $200 and $500 for every day that poles or wires are left standing after the time for their removal has expired.

The work of the Fresno Traction Company at No. 2 power plant is going on rapidly and the capacity will be increased from 2,500 horsepower to 12,500 horsepower. Generating machinery will be installed as fast as the demand for power arises. Double-tracking of the Recreation Park line at Fresno, Cal., will commence as soon as the rails arrive.

The Northern Electric Company is now in possession of its franchise for a freight line through Sacramento, Cal., and is rushing its construction work there.

It has been rumored that W. F. Herrin, Harriman's representative in California, is in charge of the Huntington electric lines in Southern California, including the Pacific Electric, Interurban and Los Angeles railway companies, on account of the illness of Mr. Huntington. H. E. Huntington, Jr., says that his father has not relinquished any part of his trolley interests in this state and that Harriman has less than half interest in the southern electric lines.

The Wells-Fargo Express Company is to handle packages over the interurban lines of the Central California Traction Company in the neighborhood of Stockton, Cal., extending as far as Lodi.

E. M. Downer of Pinole, Cal., has put in an application to the supervisors of Alameda County requesting a franchise to erect an electric power plant and to run the necessary wires anywhere in the county. He is now president of an electric-lighting company at Pinole, but on account of his connection with the Southern Pacific Railroad it is thought that he is acting in the interests of the railroad company.

It has been announced that the government forest service has granted the Southern Pacific Railroad a permit to construct a power house and conduits in the Cascade National Forest in Oregon.

The Lytle Power Company of San Bernardino, Cal., and the Home Gas and Electric Company of Redlands, Cal., have signed a contract which provides for a power line connecting the two plants, by means of which each plant will supplement the other. The work of extending the present system to all parts of the residence section of San Bernardino will be taken up as soon as the line is completed.

The city of Pasadena, Cal., has taken steps to hold a bond election to secure between $194,000 and $250,000 for the erection of a municipal electric-lighting plant.

The American River Electric Company has had considerable difficulty of late in keeping up its supply of power, as the water in the river has been very low. The new steam-turbine auxiliary plant is now being put into commission in Stockton, Cal.

L. C. Brand of Glendale, Cal., has asked that city to pay him $21,000 for his entire electric-light and power system, as a large expenditure would be necessary in order to give the service demanded.

The city of San Jose, Cal., is taking the necessary steps toward a bond election for the construction of an electric-lighting plant.

The trustees of Calistoga, Cal., have awarded an electric-light, heat and power franchise to Henry Brown, who represents a new electric transmission company.

The Consolidated Gas and Electric Company of San Diego, Cal., has cut rates on its electric current and proposes to double the capacity of its plant, the work of which will be carried out at once. The additional equipment and machinery is already under contract.

The Stanislaus Electric Power Company, which has its new hydro-electric plant on the Stanislaus River near Vallecito, Cal., more than half completed and has about two-thirds of the equipment delivered, has discharged most of its laborers for the winter. The local officials admit that the financial difficulties of the Knickerbocker Trust Company of New York have tied up a portion of their ready money, but their engineering force has agreed to remain on the ground a month longer. A.

PERSONAL.

Edward Caldwell has been appointed chairman of the library committee of the American Institute of Electrical Engineers and has assumed the duties of the position.

Mr. D. H. Howard of the advertising department of the Commonwealth Edison Company of Chicago was confined to his home by illness last week, but is now reported as improving in health.

F. W. Coen of Cleveland, Ohio, has been elected to the position of general manager of the Lake Shore Electric Railway Company to fill the place made vacant by the death of F. J. Stout.

Charles W. Burkett, for four years chief engineer of the Wisconsin Telephone Company, will, it is said, become chief engineer of the Pacific States Telephone and Telegraph Company, with headquarters at San Francisco.

The death is reported, in New York, of James K. Tillotson, formerly of Fond du Lac, Wis. Mr. Tillotson was a pioneer in the construction of interurban roads and was well known throughout Wisconsin. He built the Oshkosh-Neenah and the Neenah-Appleton lines and also established the Oshkosh system of electric railways and laid out Electric Park in that city. He built the Toledo, Maumee and Perrysburg line in Ohio, one of the first of a network of interurbans in that state. As a relaxation from his work he turned to literature and was the author of several melodramas. His death was due to a nervous breakdown.

W. S. Whiting, incorporator and formerly president of the Brown-Corliss engine shop, located at Corliss, Wis., was found a few days ago lying beside the Chicago, Milwaukee and St. Paul tracks at that place with both legs cut off. It was not thought that he could live. How the accident occurred is not known.

Mr. Edward E. Scribner has recently joined the sales force of the Holophane Company. His work will be among architects whose interest in the Holophane system of illumination has grown to such proportions as to warrant the company in detailing a special representative to serve them. Mr. Scribner's headquarters will be in New York city.

D. G. Edwards has resigned his position as vice-president in charge of the traffic department of the Terre Haute, Indianapolis and Eastern Traction Company, a position which he has held for the last year and a half. Mr. Edwards will remain with the syndicate in an advisory capacity in the traffic department, dividing his time between Indiana and Ohio.

Mr. J. L. Adams, district manager at Springfield, Ohio, of the Schoepf syndicate of electric railways, has resigned his position. His duties will be performed for the present by W. A. Gibbs, manager of the eastern division, with headquarters at Newark. There are four divisions in the Schoepf system, the other two being in charge of F. J. J. Sloat at Dayton and F. T. Hepburn at Lima.

Mr. Richard T. Laffin, vice-president and general manager of the Manila Electric Railroad and Light Company, has resigned, having completed the task of establishing the operating organization of the property. The management is now assumed by Mr. C. B. Graves, who has been Mr. Laffin's right-hand man since the property was placed in operation three years ago, officiating as manager of the lighting and power department.

Mr. H. H. Bratt has been chosen to fill the newly created office of general manager of the Union Electric, Telephone and Telegraph Company of Rock Island, Ill. Formerly the affairs of the company in Rock Island, Davenport and Moline were directed from Harrisburg, Pa. Mr. Bratt was formerly superintendent of the properties. He will have charge of extensions and improvements, including the automatic telephone exchange.

Fletcher N. Durbin has resigned the assistant superintendency of the Indianapolis Traction and Terminal Company in order to accept the position of general manager of the Evansville and Southern Indiana Traction Company and the Evansville city lines. Mr. Durbin will succeed R. L. Smith, who has become general manager of the local street-car lines in Louisville, Ky. Mr. Durbin has been connected in one capacity and another with the Indianapolis lines for the last five years.

D. L. Benson, for a number of years past on the construction and operating staff of H. M. Byllesby & Co. of Chicago, died at the Lake Geneva Sanitarium, Lake Geneva, Wis., after a lingering illness, on Monday evening, November 4th, at the age of 40 years. Mr. Benson was well known in the electric-light, street-railway and gas fields of the Middle West, having been prominently connected with the construction of utility plants at Shelby, Ohio, Muskogee, I. T., Oklahoma City, Okla., Ottumwa, Iowa, and other points. Mr. Benson was a man of marked executive capacity and stood deservedly high in his chosen field. He is survived by a widow and a daughter.

ELECTRIC LIGHTING.

The Magnolia (Ark.) Ice and Light Company will rebuild its electric-light plant soon.

The Green Forest (Ark.) Canning Company is about to put in an electric-light plant.

Central City, Neb., has granted a 20-year light franchise to the Central City Electric Light Company.

The local electric-light company at North Platte, Neb., is about to put in $10,000 worth of improvements.

Charles Lauve of Franklin, La., has secured a franchise to operate an electric-light plant in Eunice, La.

Armour, S. D., has entered into a contract with the Wagner, Lake Shore and Armour Traction Company for electric lights.

L. S. Jenkins of Omaha and others have secured an electric-light franchise in Central City, Neb., and will put in a $15,000 plant.

Merchants and citizens of Hamilton, Ohio, were indignant a few days ago because of the failure of the municipal lighting plant to furnish light on a Saturday and Sunday night following the bursting of a valve in the plant. The Board of Public Service was censured for not being able to restore commercial and street lights on account of the lack of facilities in the plant.

The Citizens' Electric Light and Power Company of Oklahoma City has been incorporated with a capital stock of $50,000 by W. E. Grigsby and others.

The present contract for lighting the streets and public buildings of Lafayette, Ind., is about to expire. The Board of Public Works is advertising for bids on lighting the city for a period of 10 years.

As one of its expedients to increase the sale of current, the Commonwealth Edison Company of Chicago offers to its consumers a new colonial portable lamp. The lamp is furnished on seven days' free trial and at a low cost.

The West Side Business Men's Association of Chicago is arranging to install 350 additional arc lamps on Halsted, Van Buren, Twelfth, Fourteenth and Eighteenth streets, 75 per cent. of the cost of lighting to be borne by the merchants.

The stockholders of the Hartford (Conn.) Electric Light Company at a special meeting held recently unanimously voted to accept the act passed by the Connecticut Legislature authorizing it to increase its capital stock to $5,000,000.

ELECTRIC RAILWAYS.

The Milwaukee-Northern Electric Railway has began regular service between Milwaukee and Cedarburg and is about to begin regular service between Milwaukee and Port Washington. The company hopes to reach Sheboygan by June 1st. Cars now leave Milwaukee every hour from 7 in the morning to 9 at night. A theater car will leave the station at 11:25 p. m.

O. P. Robinson and associates of Little Rock and Pine Bluff, Ark., say that work on the construction of the proposed electric railway in which they are interested to connect the two cities is about to be begun by the Little Rock-Pine Bluff Interurban Railway Company. Another group of men say that the proposed Little Rock-Hot Springs electric railway will be built soon.

The new bondholders' plan of reorganization of the Chicago Union Traction Company has received its final signatures of trustees for bondholders and is to be made public. In substance the plan is similar to that devised by L. C. Krauthoff and G. W. Wickersham for the Chicago Railways Company, but interest rates on new bonds are made higher and control of the new management is given to the bondholders' representatives.

A dispatch from Appleton, Wis., says that John M. Seaman of Sheboygan is at the head of a company which will soon begin the construction of a gasoline-electric railway for freight and express transportation, to extend from Fond du Lac, Wis., around the east shore of Lake Winnebago to Appleton, touching eight towns. Mr. Seaman is quoted as saying: "We will have no power plant and no trolley wires to construct, as we will operate our cars by electricity generated by a gasoline engine on each car. This will be much cheaper than the trolley system. We will have them in operation within a year from now."

POWER TRANSMISSION.

Electric power from the Aroostock Falls Power Company of Aroostock, Me., is now available. The machinery at the company's big plant worked most satisfactorily at the start. The current will be ready for distribution at Presque Isle about the middle of November.

Work is in progress on a new power house of 12,000 horsepower which the Northwestern Elevated Railway Company of Chicago is building on Chicago Avenue, Evanston, near Calvary Cemetery. It will be an artistic building, 62 by 74 feet, 33 feet high. The power house will have two rotary converters taking current from the Commonwealth Edison Company.

The Idaho Consolidated Power Company, with a capital of $2,000,000, has absorbed the American Falls Power, Light and Water Company, the Pocatello Electric Light and Power Company and the Blackfoot Power and Water Company. James H. Brady of Pocatello, Idaho, retains the presidency of the Consolidated company. The plans include the development of the Consolidated's ownership of 50,000 horsepower at American Falls and transmission of electrical energy to the surrounding towns. Twenty-five hundred horsepower is now being generated at American Falls.

The difficulties of the Knickerbocker Trust Company of New York city are said to be the cause of 300 men being suspended from work at the McCall's Ferry (Pa.) power dam now in course of construction. It will be necessary to keep at work a sufficient number of men to put the construction in such shape as to prevent the ice gorges and freshets from destroying it. It is thought when the financial flurry has blown over the men will resume work. It is understood that the company is under contract with a number of cities and towns, especially Baltimore, to supply them with electric power in 1908.

The Mamon Power Company of New Orleans, La., has been organized with a capital of $20,000 to erect and operate power plants of all kinds. Charles D. Hill is president, John Clegg, vice-president, and Phillip S. Gidiere, secretary.

A dispatch from Lewiston, Idaho, says that the Harriman interests had investigated waterways in the upper Clearwater country and have located eight waterpower sites where it is proposed to install power plants to generate electricity to operate the trains over the mountain. The men engaged in this feature of the work in Idaho are said to have pretended to be placer miners seeking "pay dirt" on the low bars of the upper Clearwater tributaries. They secured guides and packers and have spent the summer in following the many streams that might be used in the development of the power system.

Detroit (Mich.) papers say that the purpose of the Edison Illuminating Company of Detroit to purchase the electric-light and water plants in the town of Trenton is part of a plan to establish an extensive cross-country electric-lighting and power system and a large waterworks plant. The report says that the company intends to build transmission lines from the plant of the Washtenaw Light and Power Company of Ypsilanti, furnishing electricity to many of the smaller towns along the route, and establish a large waterworks plant to supply water to the country for some distance around the village and also to supply Grosse Isle.

The Black Hills Traction Company will build another power plant to meet the requests of customers to be supplied with electricity. The company just recently completed a waterpower plant at Spearfish, S. D., which will generate 1,200 horsepower. So many mining companies and firms have contracted for the use of the electricity that the company is now figuring on plans for the erection of a new and larger plant, which will be built at Beulah, Wyo., west of Belle Fourche, some time this winter. This second plant will insure sufficient power for the operation of the proposed trolley line between Deadwood and Spearfish, which, it is said, may afford the Northwestern Railroad an opportunity to tap this section of the country.

PUBLICATIONS.

The Peirce Specialty Company of Chicago and Elkhart, Ind., has recently issued a new catalogue descriptive of its various specialties for outside construction work. The catalogue is fully illustrated and it contains valuable information for construction men. It will be mailed on request.

The Automatic Time Stamp Company, 160 Congress Street, Boston, Mass., is sending out its new booklet describing the timeometer or computing automatic time stamp for use on telephone toll-line switchboards. The timeometer is exciting much interest at the present time among telephone engineers and traffic managers.

Bulletin No. 8, just published by the General Storage Battery Company of New York, tells of "A Storage Battery in a Large Steel Works." It is an illustrated description of the battery installation of the Cambria Steel Company. Since this installation the Steel company has ordered another larger equipment of Bijur high-duty batteries.

The air-brake department of the Allis-Chalmers Company has recently published two bulletins of interest. Bulletin No. 1514 illustrates and describes the type J "OB" pneumatic governor for air-brake equipment. This governor is simple in design, and in an exhaustive test it was put through 284,000 continuous operations, breaking a current of 35 to 40 amperes at 600 volts without any attention during the test. Bulletin No. 1515 relates to the type J emergency valve for straight air-brake equipments.

SOCIETIES AND SCHOOLS.

At a recent meeting of members and associates of the American Institute of Electrical Engineers in Cleveland, Ohio, the Cleveland section of the Institute was organized with the following-named officers: Chairman, Prof. H. B. Dates, Case School; secretary, F. M. Hibben, Cleveland Electric Illuminating Company; managers, C. W. Ricker, A. C. Eastwood and C. E. F. Alm.

The programme of the annual inspection trips by the departments of electrical and railway engineering of the University of Illinois includes an eastern and a western trip, the former beginning on November 3d and ending November 16th, and the latter from November 4th to 8th. The eastern trip includes visits to various points of engineering interest at Niagara Falls, Schenectady, New York city, Jamestown, Washington and Pittsburg. On the western trip Bloomington, Peoria, Joliet and Chicago were visited. One of the interesting plants inspected on the western trip was that of the Sanitary District of Chicago at Lockport. In Chicago the plants of the Commonwealth Edison Company and the Hawthorne plant of the Western Electric Company were among those inspected.

MISCELLANEOUS.

The Mobile (Ala.) Commercial Club has instituted a movement for holding a convention in Birmingham on November 12th for the purpose of memorializing Congress for improving Tennessee, Georgia and Alabama waterways and digging a canal that will connect the Tennessee River with the Alabama River and deepening all the Alabama navigable streams.

The Radio Telephone Company of Wall Street, Exchange Building, New York, says that the United States navy has placed an order with it for 28 sets of wireless-telephone apparatus, to be installed on as many battleships and armored cruisers. Eleven of these are in the Pacific, while the others are in the Atlantic, and will accompany Admiral Evans on his trip around the Horn.

Another step in the development of South America is recorded in cable dispatches from San Paulo, Brazil, announcing that the government has accepted the bid of Guinle & Co. of New York city to furnish electric power in San Paulo. The electric current will at first be used for operating the public waterworks system and later for lighting purposes. Steam plants are very expensive in Brazil, owing to the scarcity of coal, and electricity generated by waterpower at a distance has been the solution of the power question. The action of the Brazilian government in giving this important contract to an American concern is regarded as of the greatest importance in the development of San Paulo and other cities in that country.

Already extensive preparations are being made for the International Congress on Tuberculosis to be held in Washington, D. C., September 21, to October 12, 1908. This will be the fifth congress, the previous ones having been held in Moscow, Vienna, London and Paris. Some of the most eminent men in the world who have given attention to the study and prevention of tuberculosis will be present. It is said that one-fourth of all the deaths between the ages of 20 and 45 years are due to this disease. Ernest P. Bicknell and Dr. Frank Billings are the Chicago members of the international committee. Dr. John S. Fulton, 810 Colorado Building, Washington, D. C., is secretary-general, to whom all correspondence from those inclined to aid this cause should be addressed.

Arrangements for the electric show to be held in Marion, Ohio, during the week of November 18th to 23d by the Marion Electric Association are practically completed. In the decorations of the exterior of the building about 500 incandescent lamps will be used. Also two of the new flaming arcs. The hall will be lighted with Gem high-efficiency lamps and other illuminants, and Holophane shades and reflectors will be largely used. The show will be open to the public from 2 until 10 p. m. each day. No admission will be charged. Manufacturing companies and jobbers will exhibit goods through their local agents.

TRADE NEWS.

G. W. Sammons is about to engage in the electrical supply business in Conway, Ark.

On November 4th the copper market was reported quiet and unchanged, the quotations ranging from 13¾ to 14½ cents a pound.

A new company composed of Wichita (Kan.) men is reported as about to engage in the manufacture of an electrolier which can be adjusted to any height in a room or over a desk. The general offices of the company will be located in Wichita, and the officers are: President, Dempster O. Potts; vice-president, W. H. Maple; secretary, I. N. Little; treasurer, A. C. Meanes.

An American consul in the United Kingdom states that there is no importing of electrical apparatus at the place in question, but a merchant there, whose name he gives, would like to communicate with makers of such apparatus and thinks it probable that he and others might become importers. The Bureau of Manufactures, Washington, D. C., can give information by referring to file No. 1565.

Internal commerce movements during September, as reported by the Bureau of Statistics of the Department of Commerce and Labor, did not indicate any decreased market activity. The freight movement on the whole was large enough to tax to the utmost the carrying facilities of the railroads, and complaints of unsatisfactory car service are again becoming numerous in various parts of the country. The traffic movement on the Great Lakes, as measured by the volume of shipments from the various lake ports, 11,342,565 net tons, was over half a million tons heavier than the September, 1906, movement.

Allis-Chalmers Company has opened an office at Deadwood, S. D., with Mr. O. F. Purnell as district manager. Special attention will be given by Mr. Purnell and the members of his staff to the sale of mining, crushing, pumping, power and electrical machinery, many installations of which have been made by Allis-Chalmers Company and its predecessors throughout that section of the country.

The Toledo (Ohio) Blade says that George J. Miller, for the last four years electrical expert for the Toledo Storage Battery Company, has severed his connection with that firm, and, with James R. Keeler, has organized the Miller Battery Company. The new firm has located at 134 and 138 Ontario Street, and will give expert battery service and do all kinds of electrical repair work. Mr. Miller, through the assistance of the Chamber of Commerce, organized the Toledo Storage Battery Company four years ago, and is the inventor of the Miller storage battery. Mr. Keeler was formerly treasurer of the Toledo Electric Company.

BUSINESS.

The Central Electric Company, Chicago, is sending out a number of attractive circulars calling attention to the various types of Columbia lamps. The company reports a very much increased business this year on Columbia lamps as compared with any previous year in its history, and confidently asserts that this increased business is due entirely to the superior qualities of Columbia lamps.

The Wesco Supply Company of St. Louis, Mo., and Fort Worth, Tex., announces that it has established a new department devoted strictly to incandescent lamps. Owing to the increased demand for Peerless lamps it was found essential to add this department, which places the Wesco Supply Company in a position to give the lamp business closer attention. The department is open to the trade, which is invited to consult this department freely for such information as may be desired.

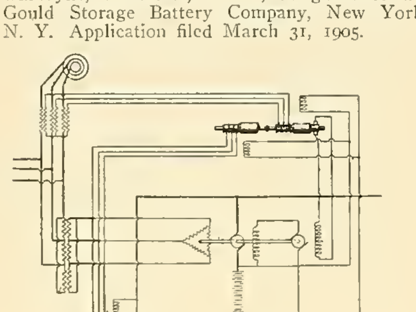
ILLUSTRATED ELECTRICAL PATENT RECORD.

Issued (United States Patent Office) October 29, 1907.

869,229. Motor Control. Eugene R. Carichoff, East Orange, N. J., assignor to the Otis Elevator Company, East Orange, N. J. Application filed January 28, 1904.

This is a controller for elevator motors. Electromagnetic switches control inversely resistances in series and in shunt with the armature in starting. Other electromagnetic switches control the reversing and main line switches, and an auxiliary switch interlocks the reversing switches.

869,243. Electrical System of Distribution. Albert S. Hubbard, Greenwich, Conn., and William A. Turbayne, Lancaster, N. Y., assignors to the Gould Storage Battery Company, New York, N. Y. Application filed March 31, 1905.



NO. 869,243.—SYSTEM OF DISTRIBUTION.

A polyphase alternating-current generator supplies current to a rotary converter, across the direct-current side of which is connected a storage battery and a booster. The latter is direct connected to a synchronous motor for driving it and to a regulating dynamo for energizing its field. The field of this regulating dynamo is supplied from an auxiliary rotary converter connected between the alternating-current source and the main converter. (See cut.)

869,244. Alternating-current Apparatus. Albert S. Hubbard, Belleville, N. J., assignor to the Gould Storage Battery Company, New York, N. Y. Application filed July 2, 1906.

Series transformers supply current to a rectifying machine of the induction type, which in turn supplies a direct-current regulating field circuit for a dynamo. This is so arranged that the current supplied to the regulating coil varies in accordance with changes in the power factor of the alternating-current supply.

869,248. Engine Stop-valve. James L. Kimball, Salem, Mass. Application filed June 29, 1906.

An auxiliary valve is arranged so that it stops the engine when opened. The engine drives a small dynamo supplying current to an electromagnet holding the auxiliary valve closed. If the speed becomes excessive the current rises to a valve opening a circuit-breaker, and thus opening the auxiliary valve.

869,275. Block-signaling System. Louis H. Thullen, Swissvale, Pa., assignor to the Union Switch and Signal Company, Swissvale, Pa. Application filed May 15, 1907.

This signaling system has a conductor adjacent to each track, an electrically-controlled signal device on each vehicle, and means for inducing a current in the circuits of the signals from the track conductors, these circuits being each tuned with respect to the current in the particular conductor for that track.

869,276. Process of Reducing Compounds with Electrically Developed Heat. Frank J. Tone, Niagara Falls, N. Y. Application filed September 22, 1906.

This process of producing silicon consists in subjecting a mixture containing silica and a compound containing silicon, oxygen and carbon to electrically-developed heat and reducing the silicon thereby to its elemental form.

869,279. Electrical System of Distribution. Edward Van Wagenen, New York, N. Y., assignor to the Gould Storage Battery Company, New York. Application filed July 2, 1906.

A fluctuating polyphase circuit is provided with a regulating apparatus composed of series transformers connected by a rectifying device to a direct-current circuit containing a storage battery and booster. Three auxiliary dynamos are provided for compensating and regulating purposes.

869,286. Electrical System of Distribution. Walter E. Winship, New York, N. Y., assignor to the Gould Storage Battery Company, New York, N. Y. Application filed March 7, 1907.

A rotary converter takes alternating current and rectifies it for direct-current distribution. A storage battery and booster are connected across the direct-current side. The booster field contains carbon-plate rheostats whose resistance is varied by changing the pressure between the plates through the medium of two coils connected to be respectively responsive to the current and voltage changes of the alternating-current side.

869,300. Arc-lamp Electrode. Richard Fleming, Lynn, Mass., assignor to the General Electric Company, Schenectady, N. Y. Application filed November 22, 1902.

An arc-lamp electrode consists of an iron tube filled with particles of iron and has means provided at one end of the tube for retaining the iron particles in the tube and for increasing the conductivity of the electrode at that point.

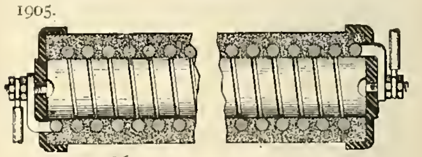
869,301. Arc-lamp Electrode. Richard Fleming, Lynn, Mass., assignor to the General Electric Company. Application filed March 26, 1903.

This electrode consists of an iron tube and a filling therefor composed principally of powdered oxide of iron. One end of the tube and its filling are fused together to form a conducting mass.

869,306. Electrical System of Distribution. Albert S. Hubbard, Belleville, N. J., and William A. Turbayne, Lancaster, N. Y., assignors to the Gould Storage Battery Company, New York, N. Y. Application filed June 20, 1906.

This patent is similar to No. 869,243, noted above, except that the auxiliary converter connected between the source and the main rotary converter is supplied from transformers whose secondaries have a variable number of turns.

869,314. Resistance Unit. Campbell Macmillan, Schenectady, N. Y., assignor to the General Electric Company. Application filed December 1, 1905.



NO. 869,314.—RESISTANCE UNIT.

This unit comprises a molded stick of material with a negative temperature coefficient, such as carbon, and a helical-resistance conductor imbedded therein. (See cut.)

869,317 and 869,318. Apparatus for Cementing the Filaments of Electric Lamps to the Stemwires. Norman Marshall, Newton, Mass. Applications filed January 27 and February 8, 1906.

These two patents cover machines that comprise a series of stem and filament holding devices, means for applying cement and for bringing the holding devices together so as to put the filament ends in juxtaposition with the stemwires.

869,321. Insulating Material and Method of Manufacturing Same. Robert Müller, Munich, Germany. Application filed January 6, 1905.

This method of making a solid, non-hygroscopic insulating composition consists in mixing an inorganic fireproof filler with asbestos and a solution of mineral pitch and volatile hydrocarbon, then compressing the mixture into the desired form and filling the voids, and finally hardening the compressed mass by evaporation of the volatile hydrocarbon.

869,324. Detector for Printing Presses or the Like. Alexander Obert, Camden, N. J. Application filed June 19, 1906.

The paper passes between a bar and surface adjacent to it, so that any imperfections in the paper will bring two electrical contacts together, thus closing a circuit which is adapted to immediately stop the press.

869,348. Storage-battery Grid. Rufus N. Chamberlain, Depew, N. Y., assignor to the Gould Storage Battery Company, New York, N. Y. Application filed February 5, 1906.

This is a lead grid having its main body or portion which is intended to become active formed of a series of relatively high, thin and closely-set leaves or ribs of rolled or spun metal, integral with the remainder or frame portion of the grid, the ribs being relatively thick at base, tapered nearly from base to apex and raised at the apex above the surface of the surrounding frame portion of the grid.

869,352. Motor-control System. Maxwell W. Day, Schenectady, N. Y., assignor to the General Electric Company. Application filed March 6, 1907.

In this system a load is to be driven through a wide range of speeds. An electric motor is provided to drive the load at low speed and a second motor to drive it at a higher speed. A generator is provided with means for varying its voltage, and controlling means are arranged to connect the generator to the first motor and gradually to increase its voltage, and then to connect the second motor and the generator in series to the constant potential mains and gradually to reduce the generator voltage.

869,356. Motor Controller. Wilhelm Fiedler, Berlin, Germany, assignor to the General Electric Company. Application filed April 3, 1906.

This controller is for quickly stopping an electric motor. It consists of a reversing switch and a cut-out controlled by the speed of the motor for interrupting the reverse current when the motor substantially stops.

869,359. Relay for Circuit-breakers. Max Fuss, Berlin, Germany, assignor to the General Electric Company. Application filed August 26, 1904.

A reversible motor is connected in the circuit to be protected. It turns in one direction when the current in the circuit becomes excessive and in the other direction when this current reverses. In either case the motor operates a switch.

869,364. Air-brake System. Lawrence A. Hawkins, Schenectady, N. Y., assignor to the General Electric Company, Schenectady, N. Y. Application filed February 3, 1906.

In this system a valve mechanism is arranged for disconnecting the triple valve from the train pipe and for connecting it to atmosphere. This mechanism is electromagnetically operated, as is also a valve controlling the exhaust from the brake cylinder.

869,365. Block-signal System. Laurence A. Hawkins, Schenectady, N. Y., assignor to the General Electric Company. Application filed March 28, 1906.

A signal system for electrically-operated roads having parallel tracks provides a connection from an end of a block to the parallel track adapted to form a path for the power current. A relay winding is inserted between this connection and a rail of the block and a signal is provided for the block and connections whereby the signal is caused to indicate danger when the relay is de-energized.

869,368. Adjustable Support for Telephone Receivers. Ross Higgins, Canfield, Ohio. Application filed February 27, 1907.

Adjustable bars are provided for holding the receiver to the ear of the telephone user. A pin on the end of the main bar engages the circuit-closing lever.

869,382. Lineman's Safety Device. William F. Newton, Spokane, Wash. Application filed April 19, 1907.

This device has a body plate with a hand grip at each end and downwardly projecting spurs on the inner side of the plate. A disengaging device is pivoted to the plate and comprises a pivoted roller attached thereto and adapted to extend through an opening in the plate beyond the points of the spurs, and an operating handle.

869,398. Automatic Device for Protecting Trains. Eduard Unverricht, Altona, Germany. Application filed January 8, 1906.

There is plurality of electric circuits, each having two tubes at a distance from each other that contain mercury. Passing trains tip one of the tubes and thus close a circuit containing a section stop for applying the brakes.

869,403. Strain Insulator. Albert Anderson, Boston, Mass., assignor to Albert and J. M. Anderson Manufacturing Company, Boston, Mass. Application filed March 2, 1906.

Two metallic rods that are placed in line have hooks at their remote ends and hemispherical heads at their adjacent ends which are separated by insulation. A spherical metallic shell surrounds these heads and is insulated from them and from the shanks of the rods which pass through the shell. Another shell of insulating material surrounds the metallic shell.

869,404. Strain Insulator. Albert Anderson, Boston, Mass., assignor to Albert and J. M. Anderson Manufacturing Company, Boston, Mass. Application filed July 5, 1906.

One metallic rod has a solid spherical head and the other one has a hollow spherical shell surrounding, and insulated from, the solid head of the other member. An insulating shell surrounds the metallic shell.

869,409. Alarm Attachment for Incubators. Charles R. Benedict, Kansas City, Kan., and John A. Hutcheson, Kansas City, Mo. Application filed March 10, 1906.

An incubator regulator is connected to a battery and electromagnet. When this regulator closes a contact the armature of the magnet releases a switch, which closes the circuit of an electric bell.

869,410. Insulating Coupling. Arthur W. Berresford, Milwaukee, Wis., assignor to the Cutler-Hammer Manufacturing Company, Milwaukee, Wis. Application filed February 21, 1903.

This coupling is adapted for joining shafts. Each of the adjacent shaft ends has a dog provided with forwardly-extending lugs. An insulating disk, which has notches in its periphery for receiving the lugs, is placed between the dogs and serves to mechanically join them.

869,413. Frequency Changer. Walter S. Bralley, Schenectady, N. Y., assignor to the General Electric Company. Application filed February 5, 1907.

This is practically an induction motor-generator set. The stators are connected to the respective systems and the rotors are short-circuited and mechanically coupled together. A small auxiliary machine is arranged to increase the resistance of one of the rotors when the load on the system increases. (See cut.)

869,420. Printing Telegraph. Berry W. Cochran, Los Angeles, Cal. Application filed April 19, 1905.

A printing telegraph transmitter consists of a plurality of printing magnets, selecting relays therefor, and a rotary circuit changer having a plurality of circumferentially disposed contacts arranged in operative relation with the armatures of the relays.

869,428. Tubulating Machine. John T. Fagan, Cleveland, Ohio, assignor to the National Electric Lamp Company, Cleveland, Ohio. Application filed December 20, 1905.

This machine is designed chiefly for affixing glass tubes to incandescent lamp bulbs in process of manufacture. It has a rotating and reciprocating chuck holding the tubes in a heating flame and then pressing them to the bulbs.

869,432. Electric Furnace. Gustave Gin, Paris, France. Application filed January 25, 1906.

This furnace has three chambers connected together by channels in the opposite ends. Each end chamber has a discharge opening opposite the opening into the connecting channel. The furnace is arranged to be tilted on a longitudinal axis, so as to discharge the material from the chambers.

869,442. Apparatus for Measuring Speed of Rotation. Walter D. Litchfield, Schenectady, N. Y., assignor to the General Electric Company. Application filed October 5, 1903.

The apparatus consists of a rotation counter connected by a clutch to the shaft whose speed is to be measured. The cluth is engaged by an electromagnet in whose circuit is another electromagnet starting a clock mechanism at the same instant that the counter is started. After a predetermined time both these are automatically stopped.

869,444. Air-brake System. George Macloskie, Schenectady, N. Y., assignor to the General Electric Company, Schenectady, N. Y. Application filed April 7, 1906.

In this system two methods of control are provided for the air brakes of a train, a pneumatic control system and an electric control system. A single handle controls both systems and there are means for automatically rendering the pneumatic system inoperative when the electric system is in use.

869,446. Process for Making Dry Cells. Paul L. Meyer, New York, N. Y., assignor to John F. Hemenway, New York, N. Y. Application filed February 19, 1906.

The process consists in placing some plaster of paris while in a fluid consistency into the zinc cup forming the containing jar, temporarily covering the jar and then rotating it so as to distribute the fluid mass by centrifugal action till the plaster of paris has set. Finally the carbon and the electrolytic depolarizer are inserted and the cell then sealed up.

869,449 and 869,450. Measured-service System for Telephone Lines. James L. McQuarrie, Oak Park, Ill., assignor to the Western Electric Company, Chicago, Ill. Applications filed February 23, 1906.

Both these patents cover registering devices for recording the number of connections made with a calling telephone line. For a two-party line a register is connected on each side of line, but only the proper one is selectively actuated when a connection is established for one of the subscribers.

869,455. Motor Car. Spencer Otis and Harry S. Hart, Chicago, Ill., assignors to the National Patent Holding Company, Chicago, Ill. Application filed July 26, 1906.

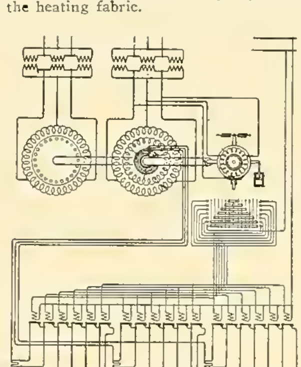
The car carries a turbo generator, a series of fluid pressure generators, each of which is independently directly connected to the turbine to supply motive fluid thereto, and suitable controllers governing the supply of current to the motors.

869,459. Electric-railway System. William B. Potter, Schenectady, N. Y., assignor to the General Electric Company. Application filed April 3, 1900.

This system provides a normally dead sectional working conductor and electromagnetic switches which energize the sections as the car proceeds. These sections are of considerable length compared to the length of the car or train and are provided with electromagnetically operated signals indicating at the beginning of a section whether that section is clear.

869,460. Electric-heating Fabric. Walter Richmond, Memphis, Tenn. Application filed June 16, 1905.

A fabric for mats or pads consists of a high-resistance conductor wound spirally about a central core, the convolutions being insulated from each other. A regulator is mounted on the central part in circuit with the conductor for automatically maintaining any desired temperature in the heating fabric.



NO. 869,413.—FREQUENCY CHANGER.

869,462. Alarm Deadlock. Morris S[illegible]an, New York, N. Y., assignor to the Alarm Lock Company, New York, N. Y. Application filed August 8, 1906.

A dead lock has a bolt with a [illegible] member mounted thereon in such a way as to be moved by a person tampering with the bolt. When this member is moved it engages a circuit-closer and rings an alarm.

869,464. Electric Heater. George F. Stevens, Lynn, Mass., assignor to the General Electric Company. Application filed May 23, 1904.

This is a water heater, the heating unit consisting of a helical edgewise wound resistance ribbon conductor having its adjacent turns insulated from each other. A number of thin conducting pipes are located in heat-conductive relation to the resistance member.

869,465. Third-rail Contact Shoe. Samuel B. Stewart, Jr., Schenectady, N. Y., assignor to the General Electric Company. Application filed July 5, 1902.

A collector shoe is pivotally mounted in a rigidly-supported frame so as to allow a vertical movement of the shoe. A spring maintains the shoe in contact with the third rail, and buffer springs permit a slight movement of the shoe in a plane parallel to the rail.

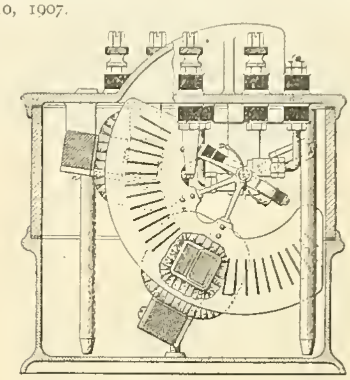
869,467. Railway Signal. Charles W. S. Turner, Mountville, Va. Application filed February 1, 1907.

This is a block-signaling system, the rails of one side of the track being electrically connected to form a continuous conductor for several blocks, while the rails on the other side are connected only for each block. Track signals are located at the distant end of each block adjoining an intermediate block, and are electrically controlled from the latter.

869,468. Electric Sign. William Wallace, Philadelphia, Pa. Application filed July 2, 1906.

The letters of the sign consist of a casing containing lamp sockets connected to terminal blocks. The letters are mounted on a supporting board by screws passing through the terminal blocks and fastening into circuit strips on the board.

869,490. Relay. Lemuel F. Howard, Edgewood Park, Pa., assignor to the Union Switch and Signal Company, Swissvale, Pa. Application filed December 24, 1906. Renewed September 10, 1907.



NO. 869,490 — RELAY.

In this relay there are in combination with a vane contacts opened and closed by movements of the vane in reverse directions, a coil and magnetic circuit for causing a movement of the vane in one direction when the coil is traversed by a high-frequency alternating current, and another coil and magnetic circuit for causing a movement of the vane in a reverse direction when the second coil is traversed by an alternating current of a lower frequency. The coils are in series and there is an impedance in shunt across the terminals of one coil and a capacity in shunt across the other coil. (See cut.)

869,531. Railway Signaling. Jacob B. Struble, New York, N. Y., assignor to the Union Switch and Signal Company, Swissvale, Pa. Application filed June 28, 1906.

A mercury arc rectifier is connected to an alternating-current source and supplies direct current to a motor for operating a signal. Track relays operated by passing trains actuate a solenoid which destroys and re-establishes the arc in the rectifier and thus stops and starts the signal motor.

869,548. Headlight or Lantern. Frederick P. Cobham, Jamestown, N. Y., assignor of one-half to Frederick E. Windsor and one-half to Lewis Schmutz, Warren, Pa. Application filed January 3, 1907.

This headlight is provided with a main electric arc lamp and an auxiliary gas burner adjacent thereto. Connections between these lamps are arranged for bringing the gas burner into operative condition, when the current for the electric lamp is interrupted.

869,550. Electric Lantern. Frederick P. Cobham, Jamestown, N. Y., assignor of one-half to Frederick E. Windsor and one-half to Lewis Schmutz, Warren, Pa. Application filed January 3, 1907.

The main body of the lantern has a lens on one side and a curved reflector on the opposite side of the lamp. The bottom is removable and is provided with a central aperture for the insertion of a lamp socket.

869,551. Water Cooler. James T. Cole, Chicago, Ill. Application filed January 21, 1907.

An ice tank has a ledge across the center of its top to hold an inverted bottle. A casing surrounds the tank and has several panels of translucent material, forming with the tank an enclosed air space. Similar panels are inserted in the top casing, which forms a chamber, containing a number of incandescent lamp sockets for illuminating the chamber.

869,554. Automatic Testing and Resetting Means for Electrothermal Protectors. Frank B. Cook, Chicago, Ill. Application filed May 19, 1906.

This testing device for a rotary heat cartridge rotatable in a certain direction upon abnormal current conditions comprises means for applying current to the cartridge to heat same, and for turning the cartridge still farther in the same direction when thus heated, as a test on the cartridge.

869,555. Block-signal System. William Daves, Bloomington, Ill. Application filed April 22, 1907.

In this system there are a number of stations, each having a station and a track signal, an operating lever for the track signal, a lock for this lever and means for governing the track signal and operating the station signal at an adjoining station. A single wire extends between stations and includes the actuating circuits for the locks at both stations.

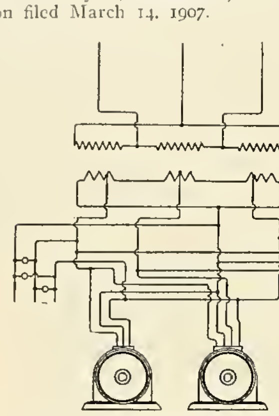
869,557. Safety Mechanism for Railway Trains. James Doyle, Niagara Falls, N. Y. Application filed May 22, 1906.

This mechanism comprises a trip arm arranged on the locomotive, a trip bar arranged along the roadbed and movable into and out of the path of the trip arm and two electrical signals, one of which is operated by the outward and the other by the inward movement of the bar.

869,576. Signaling System. Edward E. Kleinschmidt, New York, N. Y., assignor to George M. Seeley, New York, N. Y. Application filed August 10, 1906.

A signal system for single-track electric railways comprises a track battery circuit, a relay having high and low resistance coils included in this circuit, the relay being normally energized only through the low-resistance coil, and means for interposing the high-resistance coil in the circuit under abnormal conditions.

869,595. Transformation of Electric Currents. William T. Taylor, Chihuahua, Mexico. Application filed March 14, 1907.



NO. 869,595.—TRANSFORMER CONNECTIONS.

This is a distribution system from a three-phase circuit and comprises a set of three transformers connected in delta on the primary and secondary sides. Four current leads are tapped off the secondaries as follows: The first one at the junction of two of the coils, the second at the center of the third coil, the third and fourth at intermediate points of the first two coils respectively, these points being so taken that they cut off between them and the first point a portion of their respective coils whose electromotive force is to the electromotive force of the whole coil as 3 is to 2. (See cut.)

869,597. Automatic Apparatus for Stopping Moving Railway Trains. James T. Thompson, Chicago, Ill., assignor of one-fourth to C. S. Rosenthal and one-fourth to T. P. Galligan, Chicago, Ill. Application filed February 7, 1907.

A contact device on the track is adapted to be raised into the path of a contact arm on the locomotive and thus operate an electromagnet mechanism for opening and then closing an auxiliary air-releasing valve, independent of the engineer's control, for applying the air brakes.

869,598. Controlling Apparatus for Railway Trains. James T. Thompson, Chicago, Ill., assignor of one-third to Charles S. Rôsenthal and one-third to T. P. Galligan, Chicago, Ill. Application filed May 18, 1907.

This apparatus is similar to the previous one, except that an electric motor operates the auxiliary valve.

869,599. Hygienic Cartridge Battery. William Thompson and Jens C. Martin, Spokane, Wash.; said Martin assignor to said Thompson. Application filed July 26, 1906.

A medical battery consists of two cylindrical sections rotatably joined together, one section containing a dry cell and the other containing an induction coil and having an insulated cap, the sectional cylinder and insulated cap being respectively in circuit with the terminals of the secondary of the induction coil.

869,601. Ignition System for Explosion Engines. Richard Varley, Englewood, N. J., assignor to the Autocoil Company. Application filed April 5, 1907.

This system provides a single circuit controller permanently connected to the primary circuits of a number of induction coils, a dynamo circuit including a kick-off, a battery circuit including segments, and a switch for completing either of the last-named circuits through the circuit controller and its permanently connected coils.

869,602. Electrical Apparatus. Thomas W. Varley, New York, N. Y. Application filed February 21, 1906.

The apparatus is of the magneto type. It has a permanent magnet with stationary coils about its poles arranged to shift the lines of force without varying the total magnetic flux of the field. The rotating coil is connected in series with the stationary ones.

869,634. Wireless Telegraphy. William S. Hogg, United States Navy. Application filed February 6, 1907

This spark-gap apparatus has two electrodes having rounded terminals with proximate edges of highest potentials, endless and parallel throughout. One of the electrodes is cylindrical and open at both ends to form a duct for the air passing between the terminals.

869,668. Pyrometer. Charles B. Thwing, Philadelphia, Pa. Application filed January 25, 1907.

The pyrometer has a scale and an indicator therefor, a thermo-electric couple mechanism for actuating the indicator, and bearings for the indicator responding to changes in temperature so as to cause the indicator to show the temperature of the surrounding atmosphere when no current is passing through the pyrometer.

869,684. Electric Regulator. Albert H. Barber, Watertown, N. Y., assignor of one-half to Jay M. Mullen, Watertown, N. Y. Application filed March 27, 1907.

This regulator comprises a coil wound upon a spool having a square laminated iron body provided with a square opening extending lengthwise through its center, a square laminated iron core adjustably fitting the spool, the core having substantially the same amount of iron by weight as the body of the spool, and adapted to be shifted and set in a number of different positions in the square opening in the spool.

869,711. Trolley. Samuel D. Hunt, Youngstown, Ohio. Application filed April 24, 1907.

In this trolley system there is a main feed wire and oppositely arranged auxiliary side wires. The trolley head comprises a pair of upright rotatable spools having terminal spherical contact heads at both ends.

869,714. Wireless Signaling System. Joseph L. Jones, Kizer, Tenn. Application filed August 24, 1906.

This is a "wireless" system for railways. The locomotive carries a coherer and a decoherer. An electrically operated bell is controlled by the coherer. The circuit of the decoherer is closed during the propagation of waves and also through the signal mechanism, after the signal has ceased to operate.

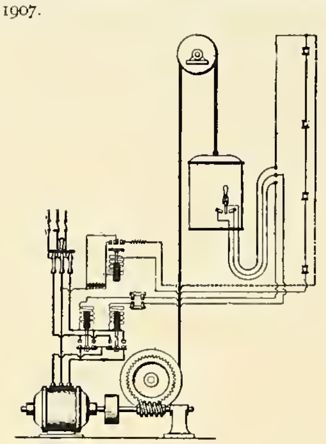
869,728. Alarm Mechanism. Leroy Paisley, Waverly, Ohio. Application filed May 9, 1906.

An alarm signaling device for a mail box has a circuit-closer in the box which actuates an electromagnet and signals at a distant point.

869,737. Multiple Socket for Incandescent Lamps. Frank J. Russell, New York, N. Y. Application filed May 29, 1907.

A multiple lamp socket has a body part carrying a series of spiral wire lamp-holding contacts and a means to calmp them in place with a detachable lid carrying a series of center contacts for the lamps.

869,760. Electrically Controlled Elevator. Carl T. Westlin, Arlington, N. J. Application filed March 2, 1907.



NO 869,760.—ELECTRICALLY CONTROLLED ELEVATOR.

The controlling circuit passes through a series of door locks when all these locks are closed. If any of them is open the control circuit is broken. An auxiliary circuit is arranged as a shunt around the locks and this circuit is kept closed by an electromagnet in the control circuit as long as current flows in the latter. (See cut.)

869,780. Electric Motor. John P. Hayes, Pittsburg, Pa. Application filed March 8, 1907.

This is a reciprocating electric motor which has field magnets, field poles and pole pieces, a reciprocating armature surrounded by the pole pieces, a commutator secured to the armature, brushes supported above the commutator, and a cut-off device comprising a metal contact bar carried by the commutator, and brushes bearing thereon and supported by the pole pieces.

869,785. Electrically Operated Signal for Railroads. Helena J. Jones, Baltimore, Md. Application filed May 13, 1907.

This block signal has two electromagnets actuating the operating arm that are connected to insulated rail sections. The danger signal is set as the train enters one end of the block and as long as it remains set a contact at the other end will operate a mechanism for applying the brakes on any car attempting to enter the block there.

869,788. Insulated Joint. Frank E. Kinsman, Plainfield, N. J. Application filed March 1, 1905.

An insulated wheel for use in electric traction has a body, a separate rim, side clamping rings and securing bolts. There is insulation between the body and rim and clamping rings. Impenetrable layers are placed within the insulation and insulating sleeves upon the bolts.

869,796. Series Shunt for Dynamo-electric Machines. Edward T. Mug, Norwood, Ohio, assignor to the Bullock Electric Manufacturing Company, Cincinnati, Ohio. Application filed November 17, 1905.

This is a shunt to be placed around the series field of a dynamo. It consists of a number of thin parallel strips of resistance material connected in series and having their ends clamped in bolted blocks. On each side of this set of strips parallel studs are provided that screw into the blocks and serve to spread them apart so as to stretch the strips.

869,812. Controller. Emmett W. Stull, Norwood, Ohio, assignor to the Bullock Electric Manufacturing Company, Cincinnati, Ohio. Application filed August 17, 1904.

This series parallel railway controller has a number of novel features, among which is an interlock between the main operating cylinder and the reversing switch, so as to prevent movement of the latter except when the operating arm is in "off" position, and so as to prevent movement of the operating arm unless the reversing switch is in "ahead," "back" or "off" position.

869,824. Control System. Louis M. Aspinwall, Wilkinsburg, Pa., assignor to the Westinghouse Electric and Manufacturing Company, Pittsburg, Pa. Application filed January 3, 1905.

In this motor-control system a circuit-breaker and reversing switch are provided. The latter is biased to "off" position; when moved to running position in either direction it is held there until released by the previous opening of the circuit-breaker.

869,825. Mechanical Shaft Oscillator. William F. Bouché, Norwood, Ohio, assignor to the Bullock Electric Manufacturing Company, Cincinnati, Ohio. Application filed June 16, 1904.

This shaft oscillator for dynamo-electric machines consists of an eccentric disk engaging the shaft at a point between its center and periphery. The disk is mounted in a spindle held at right angles to the shaft by a set of springs.

869,836. Globe Manipulator. Joseph Gaynor, New York, N. Y. Application filed February 15, 1907.

This is an instrument for inserting and removing incandescent lamps in inaccessible fixtures. It consists of two shafts, the angle between which can be adjusted. Means are provided for rotating the shafts together. The upper shaft carries bulb-clamping arms which can be opened and closed from the bottom of the lower shaft.

869,840. Dental Engine. Winfield E. Hanson, Biddeford, Me. Application filed February 21, 1907.

An electric motor is mounted on a bracket and has its shaft belted to a horizontal arm carrying a flexible shaft at its end. A switch controlling the current to the motor is adapted to be closed and opened by the swinging of the arm.

869,843. Trolley Head for Electric Traction. Garnet B. Holmes and Arthur D. Allen, Wellington, New Zealand. Application filed August 7, 1907.

The trolley wheel is mounted on a spindle secured to bearing blocks set in slots on the yoke. Curved flanges on the blocks engage the walls of the yoke to permit swinging of the blocks and spindle. Springs automatically restore these parts to normal position.

869,852. Clip for Electrical Apparatus. Hubert Krantz, Brooklyn, N. Y. Application filed July 5, 1904.

An L-shaped terminal clip comprises a base, an upstanding portion integral with the base and bent at right angles thereto and having cutaway shoulders at the top and a narrow neck terminating in an integral plate of less thickness than the upstanding portion and lying in a plane at right angles thereto and perpendicular to the plane of the base.

869,864. Automatic Resetting and Testing Means for Thermal Protectors. Frank B. Cook, Chicago, Ill. Application filed April 28, 1906.

A resetting tool for a reversible electrothermal protector has a central operable member and electromechanical means for heating the protector and operating the central member in one direction to set the protector for another operation in a reversed direction.

869,865. Spark Plug. Alfred Holsten, New York, N. Y. Application filed December 2, 1904.

This spark plug consists of a socket member, a contact finger projecting from the inner end thereof, an insulated member arranged to reciprocate within the plug and carrying oppositely closing valves and a contact member which engages the contact finger.

REISSUE.

12,710. Air-pressure Brake. Erwin Kramer, Berlin, Germany, assignor to the Westinghouse Air Brake Company, Pittsburg, Pa. Application filed July 1, 1907. Original No. 828,939, dated August 21, 1906.

In this air-brake system an electromagnetic device controls the pressure of the brake cylinder. An axle-driven electric generator supplies current to the electromagnetic device according to the speed of the car.

PATENTS THAT HAVE EXPIRED.

Following is a list of electrical patents (issued by the United States Patent Office) that expired on November 4, 1907:

439,737 Standard Galvanic Cell. E. Weston, Newark, N. J.
439,775. Electric Motor and Generator. A. Gartner, Newark, N. J.
439,838. Electric Actuating Device for Pendulum Clocks. J. H. Dyson, Mazomanie, Wis.
439,840. Electric Log. W. P. Granville, Stroud Green, County of Middlesex, England.
439,850. Secondary Battery Plate. A. E. Woolf, New York, N. Y.
439,867. Electric Railway. M. W. Dewey, Syracuse, N. Y.
439,904. Electric Arc Lamp. H. C. Shubert, Chicago, Ill.
439,916. Device for Applying a Coating to Electric Conductors. J. T. Whittlesey, Lynn, Mass.
439,929. Method of and Apparatus for Connecting Dynamos. C. T. Child, Brooklyn, N. Y.
439,974. Electrical Generator. F. L. McGahan, Indianapolis, Ind.
440,013. Electric Indicator. L. O. Chatfield, Benton Harbor, Mich.
440,023. Electrode for Secondary Batteries. J. B. Entz, New York, and William A. Phillips, Schenectady, N. Y.
440,024. Method of Making Electrodes for Secondary Batteries. J. B. Entz, New York, and W. A. Phillips, Brooklyn, N. Y.
440,096. Telephone. S. Bergman, New York, N. Y.

WESTERN ELECTRICIAN

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Pyrmont Electric Drawbridge in Australia.

One of the most important of the world's electrically equipped drawbridges is in operation at Sydney, Australia, crossing the inlet of Port Jackson known as Darling Harbor, and extending into the heart of the city. This is Pyrmont Bridge.

INTERIOR OF CONTROLLING HOUSE, PYRMONT BRIDGE.

SLEWING MOTORS AND GEAR IN MACHINERY ROOM, PYRMONT BRIDGE.

ELECTRIC SWING SPAN OF PYRMONT BRIDGE, SYDNEY, AUSTRALIA.

The bridge is 1,200 feet long, and with its approaches has a total length of 1,758 feet. It is provided with two seven-foot paths and a 40-foot carriage way, which is paved with wood.

The swing span is 223 feet long, and it is an example of one of the finest electrically operated drawbridges in use today, allowing two 70-foot clear fairways for shipping. The bridge has a floor space of 12,000 square feet and it weighs 1,600,000 pounds. It is maintained that while there are several larger electrically operated spans, this is held to be the first installation of equal size where electric motors controlled by one man from one point perform all of the necessary operations.

Two series-wound 50-horsepower motors are used for slewing or turning the bridge, driving on a horizontal shaft. Two vertical shafts connected with the driving shaft carry pinions on their lower ends meshing with a rack running around the pier. It is stated that the span can be opened in half a minute, but usually such quick work is not necessary, although of value in case of an emergency. The usual time taken is from 50 seconds to one minute.

While one motor is of sufficient capacity to open the span, the two motors are used for sake of economy and security. By means of cams on transverse shafts actuated by a motor of 35-horsepower capacity, the ends of the spans are raised 1¼ inches. This motor at the center of the swing drives a longitudinal shaft extending the whole length of the span.

A five-horsepower electric motor is used for operating the safety gates, and an automatic electric device is used for stopping the gate in the proper position. The controlling house is located in the center of the swing span, as shown, and the gates are controlled by the man in this building manipulating the proper switch levers on the switchboard, which is equipped with the usual circuit breakers, ammeters, voltmeters and controlling rheostats.

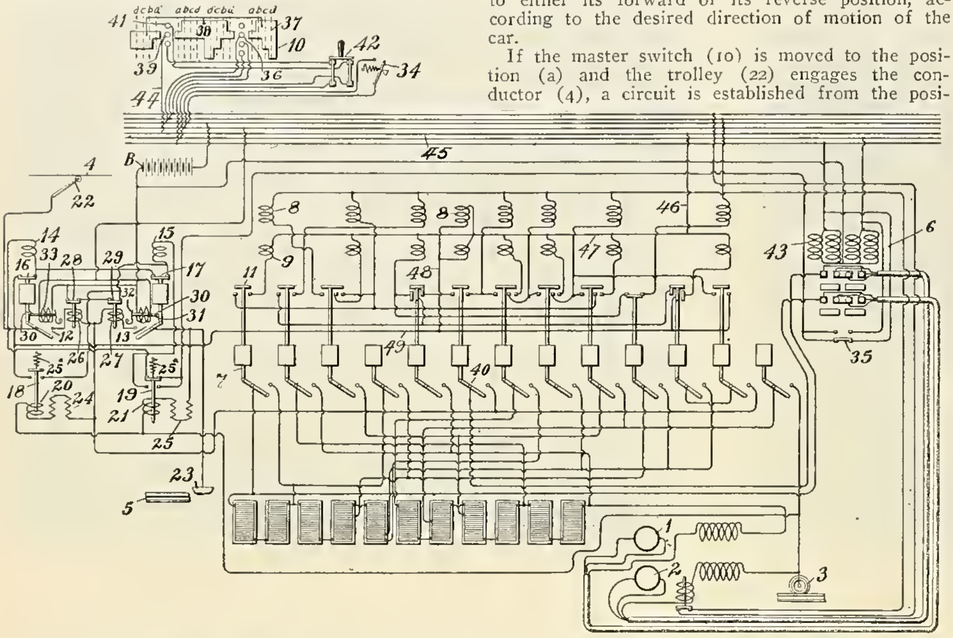
This electric swing bridge was designed by Mr Percy Allen, who also carried out the work of installation for the government of Australia. The electrical apparatus was installed by the Australian General Electric Company, and it is stated the total cost of this work was over half a million dollars, including the engineering expenses.

It is held that the electrical operation of swing bridges is very economical, with many advantages over steam or other form of power. The Pyrmont bridge, it is said, has been opened 31,207 times without any expenditure on repairs, the current for operation being about 1½ cents per operation of opening and closing the bridge. This includes the necessary moving of end lifts and opening and closing of gates.

A remarkable wrought-iron caisson, 42 feet in diameter, was sunk to rock bottom 60 feet below the water mark, to carry this large electric drawbridge. The material was dredged out as the sinking proceeded, until the cutting edge was finally bedded, and then the water was pumped out, and rubble concrete used for filling the caisson.

Interlocking Circuit-breakers for Electric Locomotives of the New Haven Type.

An important requirement for electric railways that operate in different sections with trolley and third-rail conductors charged with different voltages or varieties of current is that the controller equipment be provided with interlocking circuit-breakers making it impossible to take current from both sources at the same time. A good example of this type of railway is the New York, New Haven and Hartford, which, as is well known, uses the single-phase high-voltage trolley on its own electrified sections and the direct-current low-tension third-rail on the New York terminal section jointly with the New York Central and Hudson River Railroad. On these New Haven locomotives the motors are adapted to operate on either system, but manifestly not simultaneously. The automatic apparatus for preventing a mixup of such two sources was invented by John L. Crouse of New York city, who was granted a patent thereon on October 22d, which he assigned to the Westinghouse Electric and Manufacturing Company.



INTERLOCKING CIRCUIT-BREAKERS FOR ELECTRIC LOCOMOTIVES OF THE NEW HAVEN TYPE.

The accompanying diagram shows the application of this invention to a motor-control system patented by George Westinghouse and L. M. Aspinwall. The main feature of this system is the use of electro-pneumatically operated switches that automatically operate in succession. The details of this control will not be considered here, as it is aimed principally to describe the interlocking circuit-breaker devices.

Motors (1) and (2) are supplied with energy from a track rail (3) and either a trolley conductor (4) or a third rail (5), the connections of the armature and field-magnet windings of the motors being controlled by a reversing switch (6) and the connections of the motors with reference to each other and the amounts of resistance in series therewith being controlled by electro-pneumatically operated switches (7). Operating magnet windings (8) and retaining magnet windings (9) for the valves of the switches (7) are supplied with energy from a battery (B), and their circuits are initially governed by means of a manually operated master switch (10) and are thereafter controlled by automatic interlocking switches (11) which are actuated by main switches (7).

Circuit-breakers (12 and 13) are provided in the circuits from the trolley conductor (4) and third-rail conductor (5), respectively, the operations thereof being governed by means of magnet windings (14 and 15), respectively. The circuit-breakers (12 and 13) serve to operate interlocking switches (16 and 17), respectively.

Relay switches (18 and 19) are respectively provided with operating magnet windings (20 and 21), the former being connected in circuit when trolley (22) engages the trolley conductor (4), and the latter when the third-rail shoe (23) engages the third-rail conductor (5). Resistances (24 and 25) are connected in series with the windings (20 and 21), respectively, for the purpose of reducing the potentials applied to the terminals of those windings. The switches (18 and 19) are normally maintained in the positions shown in the drawing by means of springs (25^a), the switch (18) being closed only when the winding (20) is energized, and the switch (19) being moved to and held in its lower position only when the winding (21) is energized.

Operating magnet windings (26 and 27) for switches (28 and 29) are respectively connected in circuit when the corresponding circuit-breakers (12 and 13) are closed, and when the current delivered to the motors (1 and 2) is in excess of a predetermined amount, the switch (28) or the switch (29) opens and thereby causes the corresponding circuit-breaker to open. When these circuit-breakers are open, catches (30) are engaged by the latches (31), which are held in latching position by springs (32) until the windings (33) are energized, and the latches are then withdrawn. A manually operated switch (34) controls the circuits of the magnet windings (33). An interlocking switch (35), which is operated by the reversing switch (6), prevents the supply of energy from the battery (B) to any of the relay-operating devices just described until the reversing switch has been thrown to either its forward or its reverse position, according to the desired direction of motion of the car.

If the master switch (10) is moved to the position (a) and the trolley (22) engages the conductor (4), a circuit is established from the positive terminal of the battery (B), through contact finger (36), drum segments (37 and 38) and contact finger (39) of the master switch (10), conductors (44, 45, 46 and 47), valve-operating magnet winding (8) of main switch (40), conductors (48 49), interlocking switches (16 and 17), and switches (29 and 28), to the negative terminal of the battery, closure of the switch (40) being effected by the operating magnet windings (8), when energized.

If the master switch (10) is moved to the position (b), a circuit is established from the positive terminal of the battery (B), through contact finger (36), drum segments (37 and 38) and contact finger (41) of the master switch (10), switch (42) and operating magnet winding (43) of the reversing switch (6), to the negative terminal of the battery. The reversing switch (6) and the interlocking switch (35) are then thrown to the positions shown and a circuit is established from the positive terminal of the battery (B), through the master switch (10) as before, interlocking switch (35), relay switch (19), operating magnet winding (14), interlocking switch (17), and switches (29 and 28), to the negative terminal of the battery. Energizing of the winding (14) effects closure of the circuit-breaker (12), and the main circuit is then established through the motors (1 and 2) and the reversing switch (6) from the trolley conductor (4) to the track rail (3), in a manner peculiar to this system of motor control. At the same time the magnet winding (20) is energized and the relay switch (18) is closed, the circuit through the operating magnet winding (8) of the main switch (40) being thereby changed as soon as the interlocking switch (16) is opened, so that it passes through the relay switch (18) and switches (29 and 28) to the negative terminal of the battery.

If the third-rail shoe (23) engages conductor (5) and the master switch (10) is moved to the position (b), the magnet winding (21) is energized and operates the relay switch (19) so that its lower contact terminals are electrically connected and the operating magnet winding (15) of the circuit-breaker (13) is energized. After the circuit-breaker (13) is closed, the operating magnet winding (14) of the circuit-breaker (12) cannot be energized because its circuit is interrupted by the opening of the interlocking switch (17).

If the shoe (23) should come into contact with the third rail (5) while the trolley (22) is still in engagement with the conductor (4), the switch (19) will be moved to its lower position, thereby breaking the circuit through the valve-operating magnet winding (14) and causing the circuit-breaker (12) to open. The winding (15) will be immediately energized and the circuit-breaker (13) will be closed. It follows, therefore, that both of the circuit-breakers (12 and 13) cannot be closed simultaneously, since the circuits of the corresponding valve-operating magnet windings (14 and 15) are governed by the relay switch (19), so that both magnet windings cannot be simultaneously energized.

Light Freight Handling by Electric Lines.[1]

By P. P. Crafts.

Although some of the older and slower roads began to conduct a so-called express business several years ago, the freight-carrying field was not entered with spirit until the modern high-speed road, built on private right-of-way, with heavy construction, was developed. It was then discovered that the interurban could not only compete with the steam roads and express companies, but that, due to its frequent and reliable service, it could also develop a freight business that could not have been developed by them.

To be sure, a number of the earlier roads have charters which do not admit of their carrying freight or express, but, on the other hand, the managers of many roads, although unhampered by such restrictions, have not given the subject the attention which it deserves.

As a result of the errors made by the earlier roads, coupled with their faith in the final outcome of a concerted and careful campaign, some of the newer high-speed roads in the Middle West made a start. Today, it is a common thing to read of interurban railways financed and constructed with a view of handling freight as well as passenger traffic, as it is now becoming an important factor in the earnings.

Where parallel steam competition exists, interurban managers should not be discouraged, for shippers will favor the road which gives them good passenger service, provided, of course, rates are equalized and proper attention given to that branch of the business.

Generally speaking, it is a mistake to assume the position that freight will be carried only as an accommodation to your patrons, and then charge an exorbitant rate or neglect to ship promptly, or to take proper care of the shipment after arrival at its destination. On the other hand, many managers, in their anxiety to build up a profitable business, have overloaded their roads with expensive handling facilities, such as costly freight depots, intricate accounting systems, free team deliveries, etc., which have eaten the profits that might otherwise have been realized.

For that reason, it is sometimes a mistake to charge a higher tariff on passenger cars than is charged on freight trains. Rather say to the shipper that you will handle his small rush shipments, on passenger cars when possible, at the regular rate, as an accommodation, so long as he confines himself to the freight trains as far as possible. It is very gratifying to the average shipper to know that the road upon which he depends will accommodate him when he gets caught short of some commodity, or that his profits will be increased by being able to obtain quick shipments of perishable goods. This also induces him to carry a smaller stock of staple articles, the result being that the road gets the benefit of a larger number of shipments at the minimum rate, which is in fact the most profitable part of the freight business, except in carload lots.

Whether a freight business will be profitable depends somewhat upon the following conditions:

1. The population served outside of the main terminal and its dependence upon that terminal as a trading center.
2. The proximity of other trading centers to the population served outside of the main terminal, and the railway facilities tending to attract business away from the main terminal.
3. Steam trunk-line connections leading to the main arteries of commerce and the ability of interurban roads to establish joint rates with them.

A full exposition of the third condition cannot be given without consuming too much time. In general, however, an interurban road with proper freight-handling and terminal facilities, which offers quick and efficient service, together with joint rates with some trunk line, in competition with other trunk lines operating between competitive points, may reasonably expect a fair division, or a greater portion, of the freight traffic. As stated, shippers desire the best service with lowest rates, but, assuming rates to be even, shippers are generally favorable to the roads which provide good passenger accommodations; consequently the interurban roads reap the reward of frequent passenger service.

Owing to the antagonistic attitude of the steam roads, however, it is generally difficult to establish joint rates except where competition does not exist between them, unless connection may be made with some competing road which disregards the pooling or territorial agreements.

1. A paper, slightly abridged, read before the American Street and Interurban Railway Association at Atlantic City on October 17, 1907. The author is general manager of the Iowa and Illinois Railway Company, Clinton, Ia.

Let us trust that the day is rapidly approaching when the national and state commissions will take such action as will induce our larger and more powerful brothers to recognize the despised interurban. The progressive and agressive attitude of the interurban managers, if continued, will exert more influence in that direction than anything else that can be done.

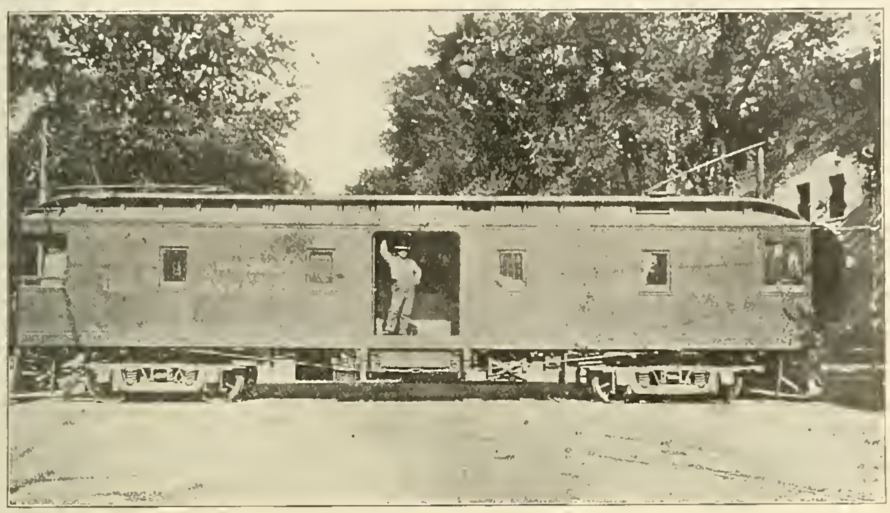
Interurban freight traffic may be properly divided into the following classes:

1. Strictly light packages, transported only in baggage rooms of passenger coaches, at express rates or at a fixed charge per package or per hundred pounds, regardless of class, and generally termed express business.

2. Less than carload freight transported on fast baggage cars at regular freight or special tariffs under regular or special classifications, generally the former.

3. A combination of class two and the haulage of a few local carload shipments daily at regular tariffs and classification.

4. Regular carload tariff hauled by steam or heavy electric freight locomotives at regular tariffs and classifications. Or any combination of the above-mentioned classes.



MODERN ELECTRIC EXPRESS CAR.

Depending upon local conditions the freight traffic of a road may be confined to any one of these classes, or it may be started in the first class and grow to the fourth class. As the fourth class will be discussed in another paper, I will treat only the first three classes, particularly the second class.

A freight business of the first class may be conducted at small expense and is of material assistance in the earnings of a road. The freight carried consists generally of packages easily transported in baggage compartments of passenger cars, which are usually empty except for a very few trips per day. Usually no extra office force is required, the only expense being for stationery, books and possibly a small storage space at the main terminal. In some cases, when the charges are a certain rate per package, regardless of weight within reasonable limitations, a proper system of tickets dispenses with waybills, expense bills, etc.

Interurban roads which conduct their freight business under the head of the second class more nearly approach operating conditions parallel to the time-freight business of steam railways. The ability of the interurban roads to make fast time and to deliver at highways, farm crossings and warehouse or store doors is an inducement to either the shipper or the receiver, which assists in obtaining the business. Being usually restricted, however, to a narrow car similar in appearance to a passenger car, due to operating over city streets, an interurban road has limitations of its freight-earning capacity.

The profits of such a business depend largely upon the opportunity of the management to secure combined freight and passenger depots at the terminals and in the larger local towns, so that extra labor in billing and handling at stations may be avoided, upon the charges of terminal city railways for the right to haul freight over their tracks, and upon the hour of day when freight may be delivered to receivers.

Generally speaking, the margin of profit in this class is close and only careful management will produce a profit, particularly during the first few months after the business is started. Expenses must be carefully watched and attractive freight houses and convenient hauling facilities at terminals sacrificed for something which costs less to maintain.

Damage claims must be very carefully handled, and to that end it is advisable to adopt some system of billing and accounting which permits a shipment to be easily traced from its starting point to the final destination. Some interurban roads have adopted simple billing systems, requiring only one writing to make the receipt, way bill, expense bill and office copy. Such a system, however, does not permit of proper checking, particularly if merchandise is transported over more than one road.

After an interurban road enters the second class, a good local commercial agent is a necessity. The business, consisting of a great number of small shipments, requires constant development and care, particularly if competition exists. A live commercial agent, who is a good street man, and not a desk man, earns his salary many times over, particularly if he understands how to deal with shippers. The business obtained depends considerably on the personality of the commercial agent.

I fear that many managers, in charging expenses to the freight business, do not give proper consideration to such items as additional clerks, printing and stationery, insurance on goods in freight houses, a proper percentage of the receipts to cover loss and damage, power for freight cars, proportion of track and line maintenance, telephone service, interest on the freight-handling investment, etc. Neglect of these items deceives the manager as well as his stockholders, and unless receipts grow beyond the safe point the awakening will be painful and embarrassing.

Perhaps a brief description of the freight business conducted by the Iowa and Illinois Railway Company may be of interest as illustrating the point brought out in the foregoing paragraph. We went into the freight business in a very tentative manner. In fact, it took considerable time for us to decide whether or not there was sufficient business in less-than-carload lots to warrant the purchase of a freight car and the expense of operating a freight business.

The next grave question was that of rates, and, after considering for some time a reduction of the rate below that permitted by the Iowa state laws for class "A" roads, we finally concluded to adopt the maximum tariff and to consider the business as freight and not express.

At first our old passenger depot in Davenport served also as a freight depot, but within a very few months, we outgrew the capacity of the space allowed to freight and were forced to take our passenger business to a new location. In Clinton, we still have sufficient space to handle the business, but within a few months we will be compelled to seek additional storage room.

Immediately upon starting the business, we engaged a commercial agent, and the quick growth of the receipts to the point where we are paying expenses showed our wisdom in so doing. Within one year, with one freight car engaged in the business and the use of passenger coaches to carry some freight, the business grew to a gross exceeding $10,000 a year. During the summer and fall of 1906, we were compelled to operate our freight car two round trips per day for nearly 75 per cent. of the time, and after the contract with the American Express Company was put into effect, we purchased and placed in service a trailer freight car, having the same capacity as the motor. The improved facilities which we have been able to offer shippers since purchasing the second car have increased the business at a rapid rate.

We make a specialty, on less-than-carload business, of beating the time of the steam railroads twenty-four hours between Davenport and points on the Chicago and Northwestern Railway in the western part of the state. For this reason, we obtain considerable business which is transferred to that road.

Besides this, rush shipments in small quantities of perishable goods, such as milk, cream, butter, eggs, fruit, etc., from certain stations are handled in the baggage rooms of the passenger coaches.

We find that a trailer freight car is much cheaper to operate than a motor, but, of course, it can handle only through business. It does not seriously delay the passenger coach to which it is coupled.

When the freight business was started, we adopted what we considered to be a very simple set of forms for billing and accounting, but we soon ascertained that the tracing of damaged and stray shipments was very difficult, and after carefully looking over the field we finally adopted the forms used by the Chicago and Northwestern Railway. These appeared at first to be very complicated, but a short acquaintance indicated their simplicity and the ease of tracing damaged and stray shipments.

We make a specialty of rush orders by telephone via our private line. Often a merchant in Clinton who finds himself short of some particular article telephones to us and through our Davenport office via the private line, we transmit the order to the shipper in Davenport. Shipments so ordered are frequently in Clinton within two hours from the time we were called up at the Clinton office.

Wherever possible, we deliver from the cars to the store doors, which saves drayage and naturally brings business to us. A number of small platforms at which we stop the local express cars have been built by the shippers between towns.

We constantly endeavor to please our shippers and to show a spirit of co-operation, which has a great influence on the growth of the business.

We endeavor to be conservative in charging off expenses against the freight business and work into it anything which rightfully belongs there. We go so far as to charge off monthly three per cent. of the gross receipts. This is piling up a tidy fund, but we propose to allow the account to grow, for at any time we may have to meet heavy freight damages, due to fire, water or wreckage.

At the present time, the earnings from this business amount to 15 per cent. of the total gross, and we hope to see it reach 20 per cent. on the same basis, i. e., while our freight business comes under the head of the second class.

Our transfer business has been developed under heavy steam-road competition at lower rates, for in obeying the state laws we have been compelled to charge two local rates which are higher than the rate for the same mileage in a continuous haul on one road. The saving of time mentioned above has accomplished that result.

A recent ruling by the Iowa Railway Commission reduces the tariff on two locals 20 per cent., and although our receipts per shipment will be naturally reduced, the increase in volume of business will be gratifying.

The percentage which earnings from freight traffic bear to the total gross earnings of course depends largely on local conditions, but of those roads which have favored me with statistics, I have ascertained that these earnings vary from five to approximately 40 per cent. of the total gross. Interurbans which handle carload business, in addition to the traffic of which this paper treats, in some cases enjoy gross earnings from freight exceeding those derived from passenger traffic.

I believe the experience of interurban railways to this date is that such satisfactory results are now being obtained, I am safe in predicting that any average interurban railway, the existence of which is warranted by prospective passenger traffic, can be assured of a profitable freight business, which within a few years, if not immediately, will become an important factor in its earnings.

Institute Meeting in New York.

At the meeting of the American Institute of Electrical Engineers in New York on the evening of November 8th President Stott was in the chair and Secretary Pope announced that the library in the Engineers' Building is now open in the evening and will be until further notice open every weekday evening until nine o'clock. That means that if sufficient interest is shown the library will probably be kept open on weekdays continuously.

The paper of the evening was on the "Comparative Performance of Steam and Electric Locomotives," and was read by the author, Albert H. Armstrong of Schenectady. Those taking part in the discussion were W. J. Wilgus and Dr. Cary T. Hutchinson of New York, N. W. Storer of Pittsburg, W. S. Murray of New Haven, William McClellan, C. L. de Muralt and W. N. Smith of New York, B. F. Wood of Altoona, C. P. Steinmetz of Schenectady and Mr. Armstrong. An abstract of paper and discussion is given on succeeding pages in this issue.

Among those present at the meeting were Professor Morgan Brooks and 35 engineering students of the University of Illinois, Urbana, Ill., on an inspection tour.

The Supreme Court of the United States has just handed down a decision upholding the constitutionality of the Massachusetts state law requiring street-railway companies to sell tickets to school children at half rates.

Comparative Performance of Steam and Electric Locomotives.[1]

By Albert H. Armstrong.

* * * *

Not considering the reasons governing the introduction of the electric locomotives at terminals and in tunnels we find in a comparison of the characteristics of the steam and electric locomotives a contrast so marked that it shows not only the superiority of the electric locomotive for general railway conditions but it also suggests changes of a fundamental nature in present methods of operation now necessary with steam locomotives. And these benefits to be secured occur not only in the operation of passenger trains, but are felt in to an even greater degree in the haulage of the heaviest freight trains, a field supposedly the exclusive domain of the steam locomotive.

* * * *

There is a marked difference in the speed characteristics of the steam and electric locomotive, and indeed there is also a marked difference in the speed characteristics of different types of electric locomotives. Although this paper is not intended to enter into any discussion of the relative merits of different types of electric locomotives, there is so striking a difference in the several speed characteristics, each of which possesses special advantages for certain operating conditions that Fig. 1 has been prepared contrasting the characteristics of the steam locomotive and the direct-current gearless, alternating-current single-phase geared, and alternating-current three-phase geared electric locomotives. As all types of motive power share in common the fact of a certain critical speed beyond which full tractive effort cannot be maintained, the curves in Fig. 1 have been prepared on the basis of showing the relation between percentage of maximum tractive effort available at speeds higher than the critical speed, ordinates being tractive effort and abscissas percentage of critical speed to running speed.

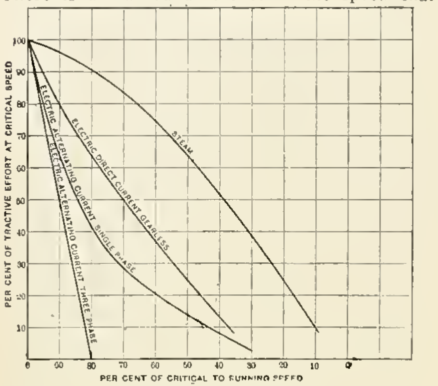


FIG. 1. TYPICAL CHARACTERISTICS OF STEAM AND ELECTRIC LOCOMOTIVES.

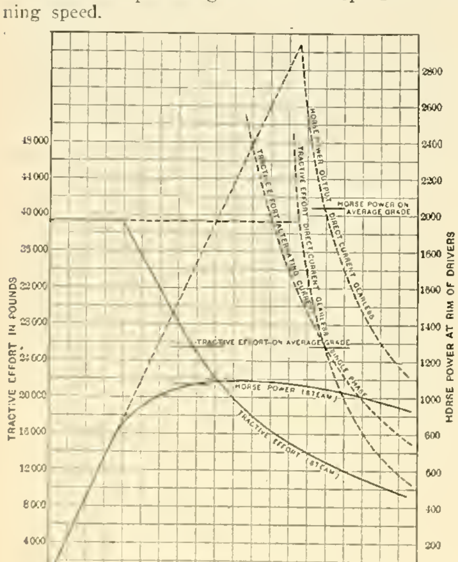


FIG. 2. STEAM AND ELECTRIC LOCOMOTIVE CHARACTERISTICS.

A more familiar presentation is given in Fig. 2 showing a concrete case of a 22 by 30-inch steam locomotive of the simple type equipped with 57-inch drivers, contrasted with both an alternating-current geared and a direct-current gearless electric locomotive designed for the same tractive effort both maximum and running, but for a higher speed. The contrast of these different speed characteristics brings out sharply the small speed variation with different tractive efforts delivered by the electric

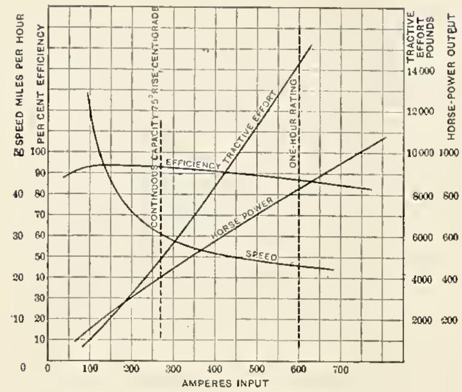


FIG. 3. DIRECT-CURRENT GEARLESS MOTOR CHARACTERISTICS, 1,200 VOLTS.

locomotives, this small variation being even more marked in the case of the direct-current gearless than in the case of the alternating-current geared motor working at a lower iron saturation and thus affording a more sloping speed characteristic.

The steam locomotive chosen is typical of those in general use upon our mountain-grade divisions, the tonnage rating in operation of this particular locomotive being such as to call for a tractive effort of 25,600 pounds on average grade and 33,200 pounds on the maximum ruling grade occurring on a certain engine division, thus leaving a margin of 6,300 pounds above the demands of maximum tonnage on maximum ruling grade for starting the train from rest.

* * * *

The electric locomotive may be equipped with motors of several different types, each having characteristics best qualifying it for certain classes of work. Fig. 3 and Fig. 4 illustrate the usual speed, torque and efficiency curves of two typical motors, the direct-current gearless and the alternating-current single-phase geared type. The type of motor to be adopted is a matter requiring full local

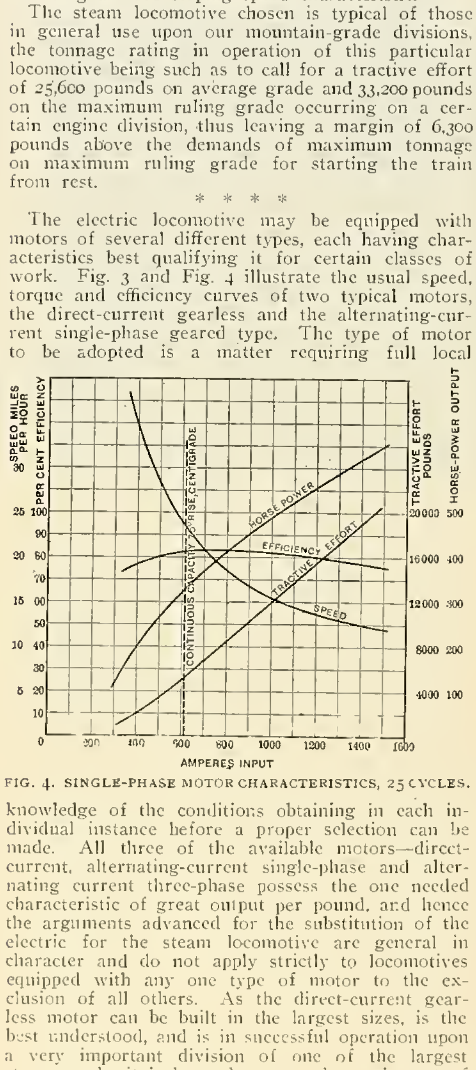


FIG. 4. SINGLE-PHASE MOTOR CHARACTERISTICS, 25 CYCLES.

knowledge of the conditions obtaining in each individual instance before a proper selection can be made. All three of the available motors—direct-current, alternating-current single-phase and alternating current three-phase possess the one needed characteristic of great output per pound, and hence the arguments advanced for the substitution of the electric for the steam locomotive are general in character and do not apply strictly to locomotives equipped with any one type of motor to the exclusion of all others. As the direct-current gearless motor can be built in the largest sizes, is the best understood, and is in successful operation upon a very important division of one of the largest steam roads, it is here chosen as the equipment of a typical electric locomotive.

The large output, 840 horsepower for one hour and 400 horsepower continuous, shown in Fig. 3, illustrates what can be accomplished with this type of motor. The output of the complete locomotive is dependent upon the number of motors permitted with the construction adopted. Thus, such a four-motor equipment is capable of delivering a tractive effort of 56,800 pounds at a speed of 23 miles an hour approximate (depending upon the voltage), while the efficiency of conversion at this output would be 87 per cent., rising to a maximum of 93 per cent. at higher speeds and lower tractive effort. Another form of construction, say one similar to that employed in the largest Mallet compound steam locomotive, would permit the use of two four-axle articulated trucks, providing an equipment of eight motors and an output of 113,600 pounds at a speed of 23 miles per hour.

The same motors could readily be rewound to give the same tractive effort at considerably increased speeds if desired without materially increasing the internal losses of conversion. Bearing fully in mind the fact that a single operator has this enormous energy under perfect control and that such a locomotive could do the work of two or more Mallet compounds and several locomotives of the simple consolidation type, and it becomes evident that in the electric locomotive there are tremendous possibilities of improving present methods of railway operation as now conducted with the steam locomotive. Carrying the thought a step farther and appreciating that several such electric locomotive units may be operated in a group forming a combined unit, it becomes evident that in the electric locomotive we have a type of motive power capable of furnishing any output in tractive effort and speed that present or future operating conditions may demand.

* * * *

With the electric locomotive standing or coasting down grade there is no demand whatever made upon the generating station, and hence the only expense carried through these periods is that for train crew and a certain amount for maintenance. On the other hand, with the steam locomotive there is a considerable amount of fuel burned and water wasted when standing at sidings and when coasting. In the case of mountain railroading with its

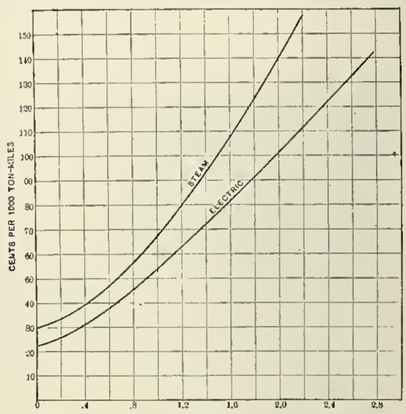


FIG. 5. SERVICE CAPACITY OF STEAM AND ELECTRIC LOCOMOTIVES.

frequent and prolonged delays this waste may reach considerable proportions.

* * * *

Locomotive performance capacity curves may be plotted which will show approximately the true relation between the several items of fuel, crew wages and motive power maintenance by adhering to the following assumptions:

Ratio schedule to running speed up-grade steam locomotive, 50 per cent.
Ratio schedule to running speed electric locomotive, 60 per cent.
Schedule speed down-grade steam, 15 miles per hour.
Schedule speed down-grade electric, 18 miles per hour.
Cost of coal, $3.00 per 2,000 pounds.
Cost of electric power, $0.0075 per kilowatt-hour.
Efficiency of distribution, 70 per cent.
Crew wages per hour steam, $2.15.
Crew wages per hour electric, $1.80.
Maintenance locomotive steam, $0.137 per mile.
Maintenance locomotive electric, $0.05 per mile.
Fuel waste per idle hour steam, 400 pounds.

An inspection of performance curves shows that in practical operation the fuel expense approaches more nearly to the value of the other items considered instead of being greatly in excess of them, as indicated in theoretical performance curves, showing up-grade operation only. For operation on lesser grades than 2.2 per cent., all items are reduced and the total and subdivided comparative costs are given in the following table and in Fig. 5:

Comparative Operating Expenses per 1,000 Ton-miles Steam (Simple) and Electric Locomotives.

Average of Up and Down-grade Operation.

Steam Locomotives.

Grade	½ per cent	1 per cent	1½ per cent	2 per cent
Coal	15 cents	25.5 cents	38 cents	53 cents
Crew	13.5 cents	24 cents	36 cents	50 cents
Maintenance	10.5 cents	17.8 cents	26 cents	36 cents
Total	39 cents	67.3 cents	100 cents	139 cents

Electric Locomotives.

Grade	½ per cent	1 per cent	1½ per cent	2 per cent
Power	20 cents	35.5 cents	50.5 cents	66 cents
Crew	7.2 cents	12.2 cents	18 cents	24 cents
Maintenance	3.6 cents	6.2 cents	9.0 cents	11.9 cents
Total	30.8 cents	53.9 cents	77.5 cents	101.9 cents

Saving Effected by Electric Operation.

Grade	½ per cent	1 per cent	1½ per cent	2 per cent
	8.2 cents	13.4 cents	22.5 cents	37.1 cents

A study of the above table is most instructive, as it shows that while the percentage saving with electric operation is approximately the same whatever the ruling grade, yet the actual money saving is much greater on the heavier grades. As about the same investment must be made in each case for distribution system, including third-rail or overhead trolley, sub-stations, etc., the inference must be drawn that heavy-grade divisions present a more attractive field for electrification than level sections when considered from the purely economic standpoint. There are other items of saving and other reasons for electrification which may be more or less controlling in individual cases, but it seems possible to make the broad statement that the mountain-grade division offers a particularly attractive field for the electric locomotive, and its introduction should be the means of affecting such

1. Extracts from a paper read before the American Institute of Electrical Engineers in New York on November 8, 1907. Mr. Armstrong is an electrical engineer of the General Electric Company.

economics in both freight and passenger transportation as to pay a satisfactory return upon the investment required.

* * * *

The comparative cost of electric and steam locomotives is generally considered as very favorable to the steam units, but reversing the usual methods and comparing the cost of electric with that of the steam locomotive or locomotives required to replace it may reverse the relations. The electric locomotive requires no more than casual inspection, can be sidetracked indefinitely and still be ready for instant operation at full capacity, can run 24 hours without a stop if necessary, and all these advantages and others offer a guarantee for a much greater annual mileage than is possible with its steam competitor. Then, too, compare the cost of a group of steam locomotives (no single unit could be designed to give the output) capable of delivering even 4,000 horsepower continuously with a single electric unit of this output, and the difference in cost is not great. It may be stated broadly that for a given gross annual ton-mileage moved the cost of steam locomotives may be even greater than the cost of the electric units replacing them.

* * * *

As against the reduction in fuel expenses promised by the use of the compound steam locomotive fitted with superheaters and feed-water heaters, the electrical engineer has up his sleeve the great possibilities offered by regeneration of power while electrically braking on mountain-grade divisions. The amount of power saved by this means may in certain installations amount to as great a percentage of the total as is the saving affected in coal expenditure with steam locomotive by compounding and providing superheaters and feed-water heaters. Such an electrical saving is of course restricted to heavy-grade divisions, but the feasibility of electric braking by regeneration is unquestioned. Indeed with three-phase induction motors regeneration is automatic, the motors being perfectly reversible and returning energy when operating down grade with no change whatever in their connections. Other types of motors may be adapted for regeneration with slight modifications in the control system.

* * * *

In this paper the writer has attempted to outline some of the fundamental reasons for the electrification of steam roads; the figures submitted are used for illustrative purposes only and are not intended as being directly applicable to any concrete case. Many of the points touched upon, such as steam-locomotive improvements, compound versus the simple, and the comparative advantages of different types of electric locomotives, etc., could all be treated in separate papers by themselves, so replete with interest are the different points raised. Rather than befog the main question at issue, which is the electrification of steam roads, detailed proof of many statements made has not been attempted, as the introduction of such proof would unnecessarily extend a paper already too long. Nor does the writer believe that the time is ripe for the electrification of steam roads at large; indeed, the electrical enthusiasts would be hard put to it if called upon to show reason for the electrification of many branch steam lines carrying a small tonnage at infrequent intervals. There are, however, certain divisions of our steam railways which, either on account of their broken profile or heavy traffic, offer an opportunity to introduce a superior type of motive power which will effect such economies in operation as to provide adequate return on the investment required for the electrification. There are still other divisions where a much desired increase in the track tonnage capacity can only be effected by double tracking so long as the steam locomotive is adhered to as the type of motive power used. Double tracking a mountain-grade division is often a matter of enormous expense, and electrification of the single track may relieve the present traffic congestion at a moderate cost.

Discussion (in Abstract).

W. J. Wilgus, consulting engineer, New York: Instead of apologizing for adding to the number of papers on the electrification of steam railroads the author should feel entitled to congratulations for calling attention to many of the advantages of the electric locomotive that have heretofore escaped analysis. In my judgment the cause is injured rather than benefited by arguments for the wholesale application of electricity to steam railroads, and it is pleasing to note the increasing tendency in our technical societies to sane discussions that will really enlighten the railroad officer anxious to be in the van of progress.

Unquestionably electricity in heavy traction work has come to stay. As the author states, until now the reasons that have led to the principal changes of motive power are entirely apart from questions of economy in operation. Conservative advocates of heavy electric traction, while urging its self-evident advantages in the abolition of the products of combustion in tunnels and cities, the increasing of terminal capacities and opportunities for growth of traffic have refrained from dwelling too strongly on saving money. They have been contented with the belief that more money could be made. The burden of additional interest charges, taxes, maintenance and depreciation attendant upon the substitution of electricity for the old form of motive power has very properly caused the careful engineer to pause in admitting even to himself that in addition to increase capacity to handle traffic there might be a net saving in cost of operation. This caution has sprung from the absence, until recently, of any actual data on the cost of heavy electric-traction operation.

The pioneer electrical installation in heavy trunk line service on the New York Central and Hudson River Railroad has now been in complete and successful operation since July 1, 1907, the gradual change from steam power having commenced in December, 1906. The working side by side of both kinds of motive power has given unsurpassed opportunities for the observation of their comparative capacity and efficiency. The results are even more gratifying than were expected, and substantiate many of the author's claims of superior capacity of electric equipment, although the conditions widely differ from those that he has assumed.

At this point it may be well to venture a word of caution on the subject of costs. Comparisons are worthless unless all elements of expense that will affect the results are included. For instance, the cost of current delivered at the contact shoes should include not only costs of operation and maintenance, interest, depreciation, taxes and insurance on the power station, but likewise on the entire distributing system. If this is properly done the real cost of current, as finally delivered at the electric equipment, will be found very largely to exceed the usual assumptions. The author's cost of current seems to me to be considerably too low.

On the other hand, the cost of maintenance and care of equipment should embrace not only wages and supplies but also interest, taxes, insurance, maintenance and depreciation on the structures and real estate required to house and repair the equipment. Steam locomotives require extensive engine houses, coal and water stations, ashpits and appurtenances, often on very expensive lands, whereas electric equipment needs the simplest form of inspection sheds occupying limited areas of land. Also steam locomotives require extensive and complicated heavy-repair shops, usually at far-distant points, that necessitate costly dead mileage and lengthy idle periods, while electric equipment, because of its simplicity, can be much more quickly repaired in nearby shops and returned to service.

Many of these features have been mentioned by the author, but possibly their importance can be emphasized by giving some concrete examples from actual practice on the New York Central.

Because of less cost of maintenance of electrical equipment and less idle time in shops the greater cost of interest charges and depreciation is not only neutralized but a net saving in repairs and fixed charges over steam equipment is effected of 19 per cent.

Electric locomotive inspection and light repairs as compared with coaling, watering, drawing fires, repairs, etc., of steam locomotives shows a saving in time in favor of the former of over four hours per day, equal to 18 per cent.

The electric locomotive, while busy, is a much more nimble and efficient machine than the steam locomotive, showing an increase in daily ton-mileage of 25 per cent.

While not so important in freight service, the question of locomotive weight is a large factor in a comparison of the relative economy of handling passenger traffic by steam and electricity. For instance, in switching service at the Grand Central terminal, 65 per cent. of the total steam-ton mileage is due to locomotive or "dead" weight, while the electric locomotive percentage is but 54 per cent., a saving for the latter of 11 per cent.

In the regular schedule service the steam locomotive shows 51 per cent. dead ton-mileage as against 35 per cent. for the electric equipment, a saving for the latter of 16 per cent.

When we realize that the saving of "dead" ton mileage has a direct proportionate effect on the cost of fuel and current and an indirect effect on wages and fixed charges, its importance is manifest.

The author calls attention to the speed advantage of electric over steam locomotives in mountain-grade operation. This is strikingly apparent in the New York Central installation, where the increase in coal consumption for car ton mileage in high-speed service as compared with low-speed service is shown to be 165 per cent., whereas under exactly the same conditions the increased consumption of current for electrical equipment is but 18 per cent., a difference in favor of electrical operation of 147 per cent.

The net result of all of the economical advantages of electrical operation over steam for the conditions existing on the New York Central, after including all elements of cost of additional plant, shows a saving in summer months of from 12 per cent. to 27 per cent., depending on the character of service. A larger saving may be expected under winter conditions.

In addition to this saving the nuisance and dangers from smoke and gas in the Park Avenue Tunnel have been eliminated and the capacity of the Grand Central terminal has been increased about one-third. Later when the New Haven company effects its change of power, complete electrical operation in the tunnel will permit the use of shorter blocks, and correspondingly increase the capacity of the four-track main-line entrance to the terminal.

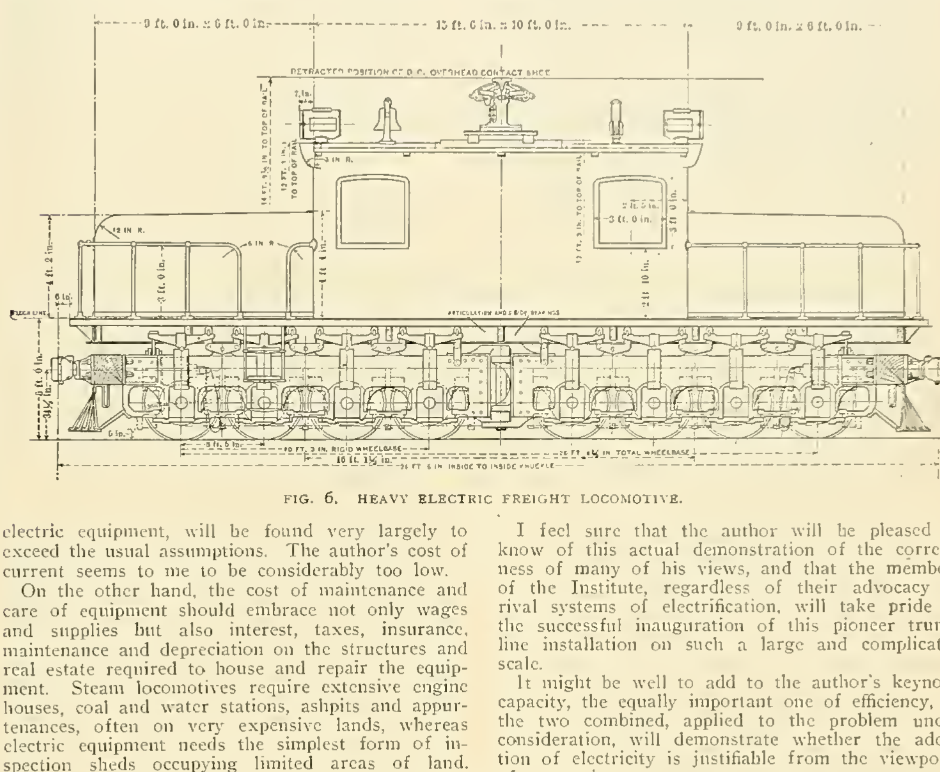


FIG. 6. HEAVY ELECTRIC FREIGHT LOCOMOTIVE.

I feel sure that the author will be pleased to know of this actual demonstration of the correctness of many of his views, and that the members of the Institute, regardless of their advocacy of rival systems of electrification, will take pride in the successful inauguration of this pioneer trunk-line installation on such a large and complicated scale.

It might be well to add to the author's keynote, capacity, the equally important one of efficiency, as the two combined, applied to the problem under consideration, will demonstrate whether the adoption of electricity is justifiable from the viewpoint of economics.

Dr. Cary T. Hutchinson, consulting engineer, New York: You choose or design an electric motor to have sufficient capacity to give average service; you have to choose the steam locomotive for the maximum service, and that is the fundamental difference in the method of rating. The Mallet compounds, which have been referred to, are not the eight-axle type but the six-axle type, with which I happen to be familiar, in service on this same ruling mountain grade of 2.2 per cent., cannot do better in every-day service than pull 800 tons or less up the 2.2 grade at a speed of 8.5 miles an hour. That is equal, I think, to about 1,200 horsepower at the driving wheel. This locomotive will weigh, with the tender, 250 tons. An electric locomotive weighing 100 tons will haul this same 800 tons up the same grade at a speed of 15 miles an hour instead of 8.5, and will develop approximately 1,800 to 1,900 horsepower instead of 1,200. It will not do it for six or eight hours, but long enough to get up a grade of 15 or 20 miles. That gives a horsepower output per ton for the steam locomotive on the six-axle type of only 4.8, and for the electric locomotive of 18, which is nearly four times as great. Another point not mentioned in regard to the electric locomotives, due to the lesser weight, is the saving of the dead haulage. There are 150 tons difference in the two machines working under the same conditions, and taking a mileage of 100 miles a day there is 1,500 ton-miles a day, worth $30 a day, or $10,000 a year difference in the actual cost in the dead haulage of the two machines.

I have been concerned a little lately in working

[Continued on page 394.]

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DEPARTMENTS.

Mr. Tom Johnson bobbed up serenely again last week in the fair city of Cleveland, being elected mayor for the fourth time. Mr. Johnson is one of the most plausible of municipal-ownership advocates, and withal a pretty good mayor, but he is more lonesome than he was in former days when his good and great friend, Mr. Edward F. Dunne, frequently invited him to the mayor's office in Chicago for consultation. Mayor Johnson promises three-cent street-railway fares, but experience has shown that ante-election promises made during the turmoil of a political campaign are not always followed by accomplishment. Whether the plump statesman of the Cuyahoga can "make good" remains to be seen.

What's this? Gas light more healthful than electric light on the score of better air to breathe? It is to laugh. Surely this is a case where some one has been stealing the livery of Heaven to serve the devil in. Mr. Vivian B. Lewes, in a lecture before the British Institution of Gas Engineers at Dublin, is the gentleman who brings this charge, which is in fact contrary to all experience. With ingenuity worthy of a better cause he strives to turn to advantage the great drawbacks of gas lighting—the giving off of heat and the deadly carbon dioxide gas—by contending that they set up ventilation to diffuse the impure air from human lungs through ceiling and walls. As if (to cite merely one objection to this argument, if it can be called such) apartments were not usually directly connected with the outside air in warm weather and provided with heating means to set up air currents in cold seasons. We are not much impressed with this gentleman's lucubrations in comparing gas and electric lighting, but perhaps he would have more success if he turned his attention to another variety of illumination—moonshine.

While waterworks and electric-light plants are quite commonly combined under municipal ownership, the interest of privately owned central stations in the water supply of their cities has been very limited. Occasionally some lighting company may furnish current for electrically driven pumps, but there the connection ceases. Now a new avenue seems to be opening, as implied by the report in the Western Electrician of November 2d of the meeting devoted by the Western Society of Engineers to a paper on "The Production of Ozone and Its Use in Purifying Water."

Fifteen years ago attention was called in this journal to the ozone plant installed at Marseilles, Ill., by Ernest Fahrig and Gustave Monrath, this plant being designed for making ozone-charged table water from a well whose waters were so highly sulphuretted as to be unpalatable before the ozonizing. Six years later we told of the higher efficiency obtained by Emile Andreoli in England and by Baron Tindal. The latter's experiments at Oudshoorn in Holland had led to an installation at St. Maur on the Seine, where 20,000 cubic meters of the Seine water were being treated at a cost of 25 francs per 1,000 cubic meters. That meant a cost of about six francs (or $1.20) per 1,000 gallons, and when added to the interest on the plant and the cost of maintenance brought the running expenses up to a figure which barred this process from more general consideration.

Since that time others at various points on the Continent have taken up this problem, and the meeting of the Western Society of Engineers referred to was called especially that members might learn of the work of Prof. Leon Gerard, whose experiments in Belgium have more than trebled the highest efficiency of all previously designed ozonizers. With his latest commercial apparatus a production of 110 grams of ozone per kilowatt-hour has become feasible, so that (roughly speaking) it will require only 50 watt-hours to purify one thousand gallons of water. Figured at Chicago rates, where the average income to the city may be estimated at two cents per gallon (for about 400 million gallons daily), that would mean a cost for the ozonizing current amounting to two per cent. of the city's income for its water supply. And what does two per cent. or even five per cent. of this water revenue mean to the community as compared with the resulting freedom from typhoid and allied diseases?

With the clearly established effectiveness of ozone as a destroyer of bacteria, it has been only the low commercial efficiency and high maintenance cost of the purifying apparatus that has checked this use of the alternating current. Now the simultaneous reducing of the maintenance charges and trebling of the efficiency are placing electrical water purification on a commercial basis, thereby opening up a new source of revenue for central stations. To the electric-light man this means an opportunity for an added day load, hence the introduction of such apparatus into America will deserve the careful attention of central-station managers.

Railroad electrification, referring to the possibility of electrically operating trunk-line railroads now using steam locomotives, is one of the most important subjects now engaging the attention of engineers and railroad managers. In the voluminous discussion of this subject both at home and abroad the American Institute of Electrical Engineers has borne a prominent and worthy part. Its railroad papers and discussions of the last few years have been highly valuable. The latest of these railroad discussions was that of last week in New York, when Mr. Albert H. Armstrong read a paper on "Comparative Performance of Steam and Electric Locomotives." The writer pointed out, in his excellent paper, the particular advantages of electric operation on the steep grades of mountain divisions, but the discussion was quite general.

Among those taking part in the discussion were Messrs. W. J. Wilgus, formerly vice-president of the New York Central, and W. S. Murray, electrical engineer of the New York, New Haven and Hartford Railroad, and these practical men, with exceptional opportunities for obtaining precise information at first hand, gave some figures about the economies of electric-railroad operation that are most interesting and important. It is very gratifying to have this testimony to the economy of electric railroads in actual operation, and we commend the statements made by these gentlemen and reported on another page in this issue, to the attention of all interested in this large and complicated subject. It is particularly pleasing to record these economies in view of the statement on behalf of the Illinois Central that the expense of electrical operation is much greater than that of steam, to which the Western Electrician took exception two weeks ago.

The telephone ordinance adopted by the City Council of Chicago and approved by the mayor might be better, from the point of view of the public, but, on the other hand, it might be a good deal worse. On the whole, it may be taken as fairly satisfactory. It represents concessions on both sides, as most agreements of this character do, and only reached its final shape after the widest agitation and discussion lasting about two years and including as one feature a report (presented last April) of a special telephone commission, consisting of Prof. Dugald C. Jackson, William H. Crumb and George W. Wilder.

The flat rate for business telephones, which finds no favor in the eyes of the company, but for which a vigorous fight was made, is retained; there has been some actual reduction of rates, and for existing rates a better class of service is secured. Thus the nickel-a-day service, which affects some 40,000 subscribers, is to be four-party instead of ten-party—a most desirable improvement. Two-party residence service will be given for $3.75 a month instead of $6 a month as at present. There will be no toll charges within the city of Chicago, and connection may be had with any telephone within the city limits for five cents. In many other ways the new franchise will give better service and lower rates.

One good feature is that a disturbing and vexed question is settled, for no one doubts that the telephone company will accept the ordinance, and thus an interminable and long-drawn-out controversy, such as was witnessed in the traction embroglio, is avoided. The ordinance points the way for better telephone service in Chicago, which is needed, and it is now the duty of public and company to accept it in good faith and meet its provisions, so that, as Chicago is the leading city of the country in telephone manufacture, it may also have the best exchange service at a moderate price.

Color Values of Artificial Lights.

On the evening of November 8th the Electrical Section of the Western Society of Engineers held a well-attended meeting to listen to the presentation of a paper on the "Color Values of Artificial Lights," by Mr. H. V. Allen of the General Electric Company. Mr. Allen came to Chicago as a substitute for Mr. W. D'A. Ryan of Lynn, who had been scheduled to appear but found it impossible to do so. The paper was rather short, but was well illustrated by lantern slides and a number of interesting experiments.

The wave theory of light was first reviewed and the effects of wave length and frequency of vibration shown on color effects. A spectrum was shown and colored objects held in different parts of it appeared to absorb almost all the rays except of their own color. Artificial fogs were produced to show that the red rays were the last of the sun's rays to be absorbed.

The predominating colors of different illuminants were given as follows:

Enclosed arc lamp (about 110 volts), clear globes, bluish white; with opal globe and diffuser, white.

Enclosed arc lamp (3¼-ampere, 140-volt, direct-current), violet (beyond color correction).

Nernst lamp (new glower), pale lemon-yellow: with seasoned glower, deep lemon-yellow.

Incandescent lamp, new, yellow; seasoned, pale orange-yellow.

Welsbach and vapor hydrocarbon lamps, new, greenish white; seasoned, greenish yellow.

Ordinary gas flame, reddish yellow.

Mercury-arc lamp, blue-green.

The preponderance of bluish rays of the arc lamp can be corrected by using opalescent globes and proper reflectors. Experiments were shown that produced colored rays from a white light without using any colored screens or globes, but merely opal screens of various thicknesses. The soap bubble is a further demonstration of this fact.

Most artificial lights are produced through the medium of an incandescent substance. The higher the temperature attained by the incandescent substance the higher the efficiency of that source. Thus in incandescent electric lamps the order is tungsten, tantalum, metallized, ordinary carbon filaments. The high efficiency of the arc lamp is due to the great temperature of the arc.

The enclosed arc lamp provided with balancing and selective diffusers was advocated as producing the whitest light and therefore the closest approach to daylight. For this reason, it was stated, it was best suited for the illumination of drygoods stores where color values are of great importance. A large number of views of such installations was shown, as well as of offices, shops and depots using that system. Even distribution of light and absence of direct rays were other advantages of these arc lamps.

At the back of the room four booths had been fitted up side by side and separated by black partitions. In each was placed a pyramid covered with seven samples of differently colored dress goods, the samples being identical in each booth. The first booth was lighted from above by a Welsbach gas burner, the second by a Nernst lamp, the third by an enclosed arc lamp and the fourth by Gem incandescent lamps. These booths were illuminated after the reading of Mr. Allen's paper and were critically examined by all present. The arc booth was said by Mr. Allen to reproduce the color values nearest to the true colors by daylight, and while this may have been so for most of the colors, it was noticed that in this booth the blue tints were brought out strongest and that brown was changed to bluish so that it was not recognizable as brown. In the other booths the various colors were more or less enhanced but not entirely distorted as was the brown referred to.

The discussion of the paper brought out a statement from one gentleman that the question of colors of illuminants had perhaps been given too much importance in view of the fact that the engineer must accept differently colored lights, and in fact we have no daylight standard of color.

Mr. Allen admitted that the use of diffusing reflectors cuts down the efficiency of the arc lamp but gives much better distribution. He stated that dust and dirt collecting on the globes and reflectors cut down the efficiency still more, but can be washed off as often as the lamps are trimmed.

The discussion got away from the subject. It was concluded in a very appropriate manner, however, by Mr. A. C. Morrison, who spoke of the psychology of colored light. After giving humorous illustrations of the language of color he spoke of the importance of further investigation of the effects of colored lights and decorations on the sensations and stated that it was particularly of importance in schoolrooms and homes.

Notes of Wiring Inspection.

At Menominee, Mich., an effort will be made to secure the adoption of an electrical inspection ordinance.

There has been considerable agitation at Madison, Wis., recently in behalf of an electrical inspection ordinance, and one will shortly be introduced in the City Council. It will have the support of the lighting company and some of the contractors.

In Ottawa, Ill., only one fire of electrical origin has occurred during the last six years. The new work does not comply with Code requirements in every particular, and the exceptions are pointed out to the superintendent of the local lighting company.

From Boonville, Ind., it is reported by insurance interests that the interior electrical construction work has no supervision, except what may be given by the local lighting company. A few of the newer installations are fairly well installed, but a very large percentage of the work throughout the city is defective. Among the common defects found are the use of small-sized wires, wood cleat supports and no bushings, unsoldered joints, overloaded circuits, lampcord used as line wire and no bushings where cord enters sockets.

At Marseilles, Ill., the standard for wiring is reported rather poor, but the lighting company is doing all it can to improve it. The worst work is done by window dressers and clerks, who make extensions by means of flexible cord carried across the ceiling. The merchants are not very prosperous and many are lighting their premises by means of gasoline-vapor systems, with generator installed inside the building. The proprietor of the local lighting plant is installing a large-capacity generating station, operated by waterpower, for the purpose of supplying current to adjoining cities. The potential to be employed is 35,000 volts. The route of the pole line will be along the Illinois and Michigan Canal. Some concrete poles will be used.

At Green Bay, Wis., the chief of the fire department is the ex-officio electrical inspector. With a few minor exceptions the knob-and-tube work now being installed is in full compliance with Code requirements, but the exposed wiring such as used in the factories is not quite as competently supervised, it is said. A number of old and defective equipments have been overhauled and placed in good condition. Outside wiring has been considerably improved. Many of the telephone wires have been placed underground and much of the lighting company's feeder system has been rebuilt. It is reported that the high-voltage system has not been provided with the necessary guard equipment, and a protest may be filed with the city authorities on the subject.

At Marinette, Wis., the ordinance regulating the installation and maintenance of electrical wiring is being rigidly enforced. The wiring now going in is practically standard and shows considerable improvement over that examined two years ago. Old and defective equipments are coming in for attention as rapidly as possible. No extensions are permitted to be made in old work unless all of it is overhauled and placed in safe condition. Any dangerous wiring which comes to the attention of the inspector is condemned and the necessary changes ordered. Some bare wires on poles carrying current to the trolley system are being criticized by the inspector and it will probably be ordered down or insulated. There is some talk of bringing a high-voltage transmission line into the city from the Peshtigo Falls.

La Salle, Ill., reports considerable agitation for some time in behalf of an electrical inspection ordinance. The present city administration is up-to-date and desires to keep the city abreast of the times, and has taken much interest in the matter of regulating the electrical hazard. An ordinance drawn by the underwriters' electrical bureau has been submitted for the consideration of the mayor and the subject will be taken up with the City Council at once. The city conducts a street-lighting plant and it is proposed to authorize the superintendent to regulate all electrical wiring and apparatus. It is planned to extend the lighting service to the outlying districts, and for this purpose a new generator is being installed to furnish a primary current of 2,300 volts pressure, the center of the city being lighted by means of a low-potential direct-current system.

The city of Peru, Ill., conducts a municipal lighting plant for both commercial and street lighting, and it is proposed that the superintendent shall be directed to regulate the installation, operation and maintenance of all electrical wiring and apparatus. An ordinance establishing the National Electrical Code as the standard for wiring and providing for its enforcement by creating the office of electrical inspector has been submitted to the mayor for consideration with the City Council. The standard for wiring adopted by the two leading contractors is said to be very fair, but considerable interior wiring is installed by linemen temporarily out of a job and the work is reported as rather crude. There are said to be some contractors who fail to bring their work up to Code requirements and are thus enabled to submit lower estimates than contractors who aim to do standard wiring.

Ontario Cities Get Low Figures for Niagara Power.

The figures in relation to the cost of distribution of electric energy from Niagara Falls, as sent by the hydro-electric commission to the city of Stratford, Ont., on the basis of 1,965 horsepower per annum, are as follows: Total cost of distribution on capital account, $45,011; annual charges, $7,800, including interest at the rate of 4½ per cent. per annum; operating expenses, $2,000; cost of administration, $400; line loss, $1,116. The total cost of distribution per horsepower per year, on this basis, including all charges, works out as $3.97. The original estimate for Stratford, on a basis of 5,000 horsepower, varied from $17.84 as the minimum to $20.40 as the maximum. The Stratford estimate includes poles, wiring, etc., and everything required in a complete equipment.

The commission's estimate for Galt, Ont., has been prepared on a basis of 1,225 horsepower, with total cost of distribution $46,195 and total annual charges $7,200, which brings the horsepower cost per annum for distribution after the energy has been taken from the government transformers to $5.88. These estimates allow for 24 hours' use of power. The Ontario government delivers the power to municipalities stepped down to the voltage required for the purposes of distribution and use.

Elaborate Electric-clock System.

The superintendent of the United States capitol building and grounds, Elliott Woods, is calling for proposals until November 27th for the installation of an electric-clock system in the new office building for the House of Representatives. This system is to consist of one master clock, capable of driving 500 units, to be located on the first floor of the building; also 422 secondary clocks in various parts of the edifice.

All the conduits and outlet boxes are in place and all wiring will be done by the government. Eight of the secondary clocks, or multiples thereof, may be placed on each circuit, and each bidder will be expected to state, as a part of his proposal, the maximum and minimum number of secondary clocks that can be run on each circuit. The entire system is to be electrically operated. The master clock is to be self-winding, and it shall work the dials of the various secondary clocks and shall keep them synchronized at all times. The secondary clocks are to require neither winding nor setting. The electric service to the master clock will be supplied by the government at 110 volts. The particular clock systems on which bids shall be submitted shall be at the option of the bidders.

Cross-arm Controversy in Fort Wayne.

The Home Telephone Company of Fort Wayne, Ind., has obtained an injunction against the city preventing the stringing of the electric-light wires on cross-arms of the company's poles. The city asserts the right to the use of the poles under the company's franchise, which says the city may use the top cross-arms for "fire and police wires and for other purposes." The company contends that the high-tension wires would seriously damage its service and would be dangerous to patrons and employes. The city, however, has let the contracts for a municipal electric-light plant on the theory that it could use the cross-arms and thus save the heavy expense of poles in hundreds of cases. Judge Heaton refuses to give the city an injunction restraining the telephone company from interfering, and in order to hurry the test to the Supreme Court the city gave the company notice of its intention to begin stringing wires. The company had an injunction order ready, however, and work will be delayed until the controversy can be settled, and this means an appeal to the Supreme Court. S.

Winnipeg Power Project Delayed.

Writing under date of November 9th, the Winnipeg correspondent of the Western Electrician says that the development of electrical power at Point du Bois by the city of Winnipeg, Man., has been checked. He says:

"At a short and lively meeting of the Board of Control the contract for the construction was awarded the Anglo-Canadian Engineering Company of London, England, at a figure approximately $3,250,000, the company agreeing to take Winnipeg debentures at 94 to the value of $5,000,000, a portion of the debentures to go toward paying for the power development and the balance to be paid for by the company. When the recommendation came before the City Council it was adopted by a vote of 13 to 5, but when the mayor's signature was desired it was found that he had vetoed the decision of the City Council." It is learned that the work will not be proceeded with until next fall, and it is said that the tender of the engineering company is not satisfactory.

Comparative Performance of Steam and Electric Locomotives.

[*Continued from page 391.*]

up one of these very mountain problems on the Great Northern road, and after much consideration decided to put in the three-phase system, and when I talked this over with the operating people on the road, considering one of the great bugbears of the three-phase system, as ordinarily supposed, that is to say, the fixed speed, they looked on that as a distinct advantage; they regarded it to be in favor of the system that the locomotive could not run above its speed going down hill, thereby simplifying the handling of the train. That is one of the considerations which led to the adoption of the system, this fixed speed up and down grade, on this freight proposition; the passenger proposition does not enter into it.

N. W. Storer, Westinghouse Electric and Manufacturing Company, Pittsburg: I want to say that I am in hearty accord with Mr. Armstrong in the concluding remarks of his paper, that I believe that the keynote of the whole subject of electrification of steam railways lies in the capacity. The greater loads per train crew that can be hauled, the greater speeds both on level track and on grade, the greater safety on grades, all tend toward greater capacity, and that is exactly what is going to force the electrification of a considerable number of the roads in this country. I am not a wild enthusiast on immediate electrification of everything, but I believe it is coming as fast as the manufacturing companies of the country are able to handle it.

I do not care about introducing any questions as to the relative advantage of alternating current or direct current, single-phase or three-phase into the peaceful discussion of this evening, but there are one or two points that may not be out of place. The direct-current locomotive is able to control the train on the down grade at almost any speed at which it is desirable to operate, by the use of resistances for absorbing the regenerated power. The three-phase locomotive will control the locomotive at speeds above synchronism by absorbing the excess power in resistance, the single-phase locomotive is able to control it at almost any speed at which it is desired to control it and restore energy to the line efficiently at all speeds.

I think in Fig. 1 the names got a little mixed. I believe Mr. Armstrong will agree with me that he has the direct-current gearless marked on the wrong curve. That should be on the lower curve. The single-phase should be on the upper one. That is due to the fact that the single-phase locomotive will have a higher tractive effort at higher speeds proportionally than the direct-current locomotive.

I believe that the three types of locomotives suggested—the direct-current, alternating-current single-phase or alternating-current three-phase—will all three offer enough advantages to cause the electrification of steam railroads in a good many localities, and just which one would be the best is not necessary to take up at this time.

W. S. Murray, New York, New Haven and Hartford Railroad, New Haven, Conn.: Generating, transmission-line and railway-equipment efficiencies are too well known not to be able, having determined the rim horsepower required for propelling trains, to figure back to the power house the amount of kilowatt capacity required to operate a predetermined schedule of trains. We cannot afford to quarrel with the machine efficiency of the steam locomotive. It is the equal of the machine efficiency of the electric motor morning, noon and night. We will take issue, however, on the efficiencies which lie behind the two engines, viz., the generation of steam in the boiler of the locomotive versus its generation at the power station with its attendant transmission and conversion into electricity for application to the motors driving the locomotive.

The following table shows the saving of fuel which will be effected on the New York division of the New Haven road when all freight and passenger trains now operated by steam receive their drawbar by the electric method of traction:

	Ton-miles, Per Annum.	Tons of Coal, Steam Traction.	Tons of Coal, Electric Traction.	Cost of Coal, Steam Traction.	Cost of Coal, Electric Traction.	Saving of Electric Over Steam Traction.
Express, Passenger.....	592,240,000	57,447	29,870	$183,830	$ 89,620	$ 94,210
Local, Passenger.....	348,000,000	58,300	28,600	186,560	85,800	100,760
Freight......	2,223,000,000	187,844	139,010	563,530	417,030	146,500
Total......	3,163,240,000					$341,470

In express work 2,055 indicated horsepower-hours are developed in the evaporation of 57,594 pounds of water, giving an average, therefore, of 28 pounds of water per indicated horsepower-hour, and on local trains this figure is slightly increased, the evaporation being 42,687 pounds of water for 1,435 horsepower-hours, making the rate 30 pounds of water per indicated horsepower hour. I mention these figures, as we are all familiar with the turbine guarantees of 20 pounds of water, including auxiliaries, per kilowatt-hour at the switchboard, which, reduced to a horsepower basis, would be 15 pounds of water as measured at the switchboard. Remembering the ratio of 7 to 10 in the evaporation of locomotive versus stationary boilers per pound of coal, it is not a stretch of conscience to concede that twice the draw-bar pull can be developed by the electric method of traction for coal burned under the boilers of stationary plants as compared with coal burned in the fireboxes of locomotives.

The average figures that I have been able to secure on electric-engine repairs per locomotive-mile are about two cents. Increasing this figure 25 per cent. for safety and assuming the same number of electric engines replacing steam locomotives (as a matter of fact there would be less electric engines required on account of the greater mileage per diem derived from electric locomotives), the total would be $120,924 per annum, showing a saving over steam locomotives of $196,038. Therefore, the net saving on fuel and locomotive repairs in favor of electrification gives a round sum of $562,470 per annum. This, upon a capital basis with money at five per cent., represents $11,249,000, a rather effective credit on the expense necessary to investment.

William McClellan, Westinghouse, Church, Kerr & Co., New York: The speaker of the evening has taken what I consider the proper view and based his whole argument on capacity. He has come out with the statement that heavy grades are probably the places where this saving can be shown most conclusively, and where we can attack the steam-railroad problem, hoping for the greater success at the present time, and in that view I want to say that I am very heartily in accord. The trouble is when we reckon even the cost of electrification, as I have said before, we take the total cost of electrification and forget that there is scarcely a scheme of electrification proposed or put through where the capacity was not to be greatly increased. I contend that the way to consider the problem is to take the increased capacity as the desideratum and find out what it would cost if you could do it at all with the steam locomotive, and compare that with what it would cost to do it with the electric locomotive, and the argument would take on a different color.

C. L. de Muralt, consulting engineer, New York: Capacity is the real electrification problem, and that is what we needed to have brought out by a man of Mr. Armstrong's standing, so that everyone should really understand it thoroughly. I believe when one or two of the large railroads will have electrified they will all find that economy will have slipped in, with or without their particular intention, but, as Mr. Armstrong points out, the large electrification which will be done in the near future will very likely be done because the traffic can be handled over existing track with electric locomotives in very much greater quantity than could be done with steam locomotives. My office has recently had occasion to work out a problem where a road of something like 80 miles of double track was actually at the end of its ability to handle traffic as far as steam locomotives were concerned. The question came up of doing the same, or something like what Mr. Armstrong mentioned, namely, putting in new tracks. In this case there would have been two additional tracks which would have cost something like $15,000,000. Electrification with complete new power stations and new distributing system and new locomotives would cost something in the neighborhood of $3,000,000, and by the handling of the present traffic by electricity there would have been a saving in operating expenses of something like $200,000 out of $8,000,000, while with the electric equipment pushed to its limit the traffic increase would have been something like 40 to 50 per cent. over the present traffic capacity. There, therefore, was a case where electricity should be used and should be installed just as soon as the money could be raised.

W. N. Smith, Westinghouse, Church, Kerr & Co., New York city: It is very true that the whole question focuses upon capacity, but there are several different ways of looking at capacity, and one of the aspects that has not been given very much consideration to my knowledge in most of the communications on the subject is the matter of the capacity for train movement of any given piece of single-track railroad. While the possibilities of double track, as to increase, are considerable, the possibilities of single track are probably a good deal less, particularly if the profile is undulating and conditions generally are difficult, and it is quite conceivable that you might find that you could not get as many trains over a given piece of single track as it would take or require in order to make it an object to electrify that particular section, in which case, of course, electrification would be reduced to an absurdity. I mention this as a possibility.

B. F. Wood, Pennsylvania Railroad, Altoona, Pa.: There is one point I will emphasize, and that is that some of the railroads in the East are being reconstructed to reduce the gradient, and that at a very great cost. That, in some cases, is enough almost to offset the cost of electrification so far as the matter of economy is concerned. I do not believe that really exists, at least from a motive-power standpoint, until you get a density of traffic of, say, half-hourly service at least, unless there is some other condition that will demand it.

Dr. C. P. Steinmetz, General Electric Company, Schenectady: The electric locomotive is better at higher speeds than the steam locomotive, and you have to get the advantage of this feature if you desire to get the best results. It, therefore, does not mean a mere substitution, but also means a readjustment, especially of the most important part of the railway, the freight traffic, readjusted to higher speed. Higher speeds necessarily mean increased capacity of the system, even without any increased draw-bar pull, even with lesser draw-bar pull, and in this feature I believe lies the main advantages of electric traction, but it makes it necessary to readjust the method of operation to the changed condition of railroad motive power to get the best results of the electric locomotive. You can merely substitute, but you will get better results by not merely substituting but also by increasing the speed to operate at the most economical speed of the electric locomotive, which in general is higher than the most economical speed of the steam locomotive.

Mr. Armstrong: I am glad the fine figures given by such authorities as Mr. Wilgus and Mr. Murray bear out in some degree what must have been estimates in the paper. I agree with certain speakers, and I think that Mr. Wood is one of them, that the economy of operation does not constitute sufficient reason for electrification. I think we cannot bring out that fact too strongly. We can go to steam-railroad managers and say that for $10,000,000 or $15,000,000 invested they can get a return of 10 per cent., 20 per cent., or even 25 per cent. on the money invested, and you will get polite attention and nothing more. They are not looking for an investment that will give merely a financial return. They are looking for something to increase their gross receipts and save them from further expenditure. If you can show them how an investment involving $10,000,000 on their part based on prospective plans for additional track facilities to take care of traffic can be rendered unnecessary and that by the expenditure of $5,000,000 you can accomplish the same purpose, it will receive attention on their part. I still adhere to the idea that the main reason for electrification is increased capacity of the locomotive, increased capacity of the track, which means increase in gross receipts and saving expenditures for double track, etc. Mr. Smith was somewhat in doubt as to the saving effected in the electrification of single-track roads. It is just on these roads where the greatest amount of money can be saved. A single-track road is limited in its tonnage capacity by trains going in both directions over the same track with frequent meeting points, trains operating under all the disadvantages of being hauled in many cases over sharp profile with steam locomotives. Many of the forced stops of steam locomotives on up grade on account of the necessity of taking on coal or water would be eliminated in the case of the electric locomotive. It is entirely safe to say, then, that the advantage of electrifying a single track is great.

Electric Smelting in Ottawa.

The correspondent of the Western Electrician in Ottawa, Ont., says that before the end of the present month it is expected that silver and nickel ores from Cobalt will be coming to Ottawa in considerable quantities to be smelted under the new electric process. The first unit, of 100 tons capacity, which has been successfully treating ores from Cobalt as well as copper ores from Montana mines, will be installed in Ottawa as soon as it can be delivered. Five other machines of the same capacity, now under construction in Newark, N. J., will be added as soon as possible. A number of mining men from Montana, Cobalt, Los Angeles and Ottawa visited the plant while in operation in Newark, when the refractory ores from the Nipissing mines were in the process of smelting and refining. Each of the machines is a complete smelter in itself, and is ready for work as soon as the wires are connected and the electric current turned on. The machines are automatic, and one man can manage the entire plant.

Barclay Automatic Telegraph System.

Supplementing his reference of last week to the Barclay automatic telegraph system in the article on "Automatic Telegraphs in the United States," Mr. D. McNicol calls attention to the fact that this system is now in use on the following-named circuits of the Western Union Telegraph Company:

Chicago to Kansas City.
Chicago to Buffalo.
Chicago to St. Louis.
Pittsburg to Philadelphia.
Pittsburg to Buffalo.
New York to Atlanta.
New York to Pittsburg.
New York to Philadelphia.
New York to Buffalo.
New York to Boston.

ELEMENTS OF ELECTRICAL ENGINEERING.

By Geo. R Metcalfe.

XLII. Electric Railways.

Electrolysis.

The subject of electrolysis is closely allied to the question of track bonding, which was considered in the previous chapter. When two pieces of metal are immersed in an electrolyte composed of water slightly acidulated and a current is passed between them, particles of one metal are decomposed and are deposited on the other metal. This is exactly the same process which is known as electroplating. The material carried from one piece of metal to the other travels in the same direction as the current; that is to say, the metal connected to the positive side of the circuit travels from positive to negative and is deposited on the negative piece.

An action very similar to this takes place between the water and gas pipes buried in the ground near street-railway tracks and the tracks themselves. The positive pole of the station generator is connected to the overhead trolley line and the negative pole to the track, and the current travels from the trolley line through the car motors and back to the station over the tracks. As the tracks are in direct contact with the ground the current from the track has a tendency to leave the track and return to the station over any adjacent metallic water pipes or gas pipes situated near the track.

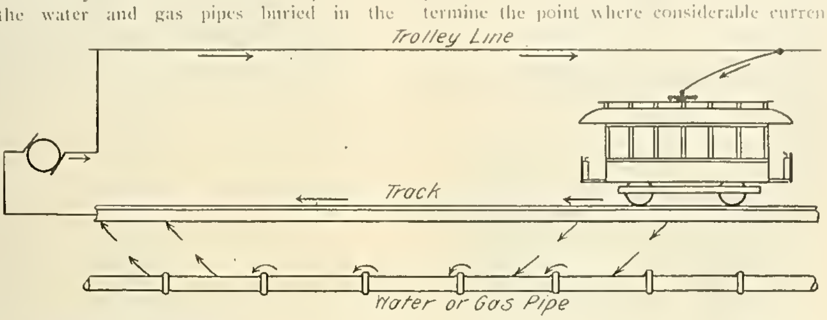


DIAGRAM SHOWING HOW ELECTROLYSIS IS PRODUCED BY STRAY CURRENTS FROM TRACK CIRCUIT OF ELECTRIC RAILWAY.

The current will, of course, travel in the path of least resistance, and if the resistance of the track circuit is high at any point, due to broken bonds or to lack of sufficient conductivity, the current will leave the tracks at this point and escape to the nearest underground conductor, and will travel upon this either back to the station or to some other point of the track circuit. This action could not, of course, take place in absolutely dry ground, but there is always sufficient moisture beneath the surface to act as an electrolyte.

The fact that buried pipes carry a current is not in itself of importance, as the current passing through a solid conductor has no effect upon it whatever, but when the conductor is immersed in an electrolyte, and the current leaves this conductor and passes through the electrolyte to another conductor, it carries a certain amount of metal from the first conductor and deposits it on the second. If this action is continued for a time the pipes carrying gas and water become eaten away, and in some cases sections of these pipes have almost entirely disappeared.

The amount of current which escapes from a track circuit to neighboring pipes depends altogether upon the relative electrical distance of the track circuit, the earth and the pipes. It takes, however, but a very small amount of current to produce this electrolytic action, and it is therefore very necessary to give the track circuit ample carrying capacity if this action is to be avoided.

The accompanying diagram will explain how electrolysis takes place. The direction of the current is indicated by arrows, and we will first assume that there is not sufficient carrying capacity in the track circuit between the car and the generator, and that more or less current passes to the neighboring lines of pipes, which carry it to a point near the station, where it again returns to the track circuit. Where the current passes from the tracks to the pipe, no damage will be done to the pipe, but the tracks will be eaten away. Where the current leaves the pipe, however, and passes to the tracks, the pipe will be eaten away. The same condition would exist to an exaggerated extent if one or more bonds in the track circuit were broken. In this case a large proportion of the return circuit would be shunted around the broken joints through the pipe, and as the amount of current carried by the pipes would be large, the pipes would be eaten away rapidly.

The obvious and only true remedy for avoiding electrolysis of neighboring pipes is to provide a track circuit of such low resistance that there is practically no tendency for the current to return to the power house by any other path. This means that the bonds must be ample in size, put in place with great care, and sufficient supplementary ground wire or track feeders must be used.

Another remedy is sometimes applied which, however, is apt to lead to further troubles in other parts of the water and gas pipes. This is to determine the point where considerable current flows from the pipes to the track circuit, and to connect this point on the pipes to the track circuit with a heavy wire or cable. This will obviously stop the electrolysis at this point, but it also reduces the resistance of the circuit through the pipes, which causes more current to return over this path.

Owing to the covering of oxide or rust on the surface of the pipes, there is generally considerable resistance at the joint between two lengths of pipe. This causes the current to leave the first length of pipe and pass around the joint through the earth to the adjoining length of pipe, so where the pipe carries considerable current this electrolytic action is taking place around each of the joints. It is therefore advisable to keep the current off from neighboring pipes as much as possible, and this can only be done by keeping the resistance of the track circuit lower than any other possible path.

In order to find out where electrolysis is liable to occur, it is customary to measure the difference of potential between the pipes and the track circuit at various points. Where there is considerable difference of potential between them it indicates that there will be considerable flow of current if the ground is sufficiently moist or contains enough acid or salts to form a good conductor.

There have been many places where water and gas pipes have been badly damaged or entirely destroyed by electrolysis, but there are very few places where this trouble cannot be entirely avoided by providing thorough bonding and ample capacity for the track circuit.

[*To be continued.*]

Note.—This series of articles, intended to survey, briefly, the whole field of applied electricity for light, power and heat, was begun in the Western Electrician of February 2, 1907.

Unusual Lightning Phenomena.

Writing to the Monthly Weather Review under date of September 11, 1907, Dr. Irving Langmuir of Stevens Institute, Hoboken, N. J., says: "I remember three storms I have witnessed at different times in which flashes of lightning left their paths distinctly marked by strings of fire beads. Two of these storms were in the Alps, one at Berchtesgaden in Southern Germany, and one on the mountain near Lake Lucerne, in Switzerland. The third was at Jackson, N. H., in the White Mountains. Each of these three storms was exceptionally violent, among the most violent I have ever witnessed. The phenomenon was observed only with flashes which were comparatively close, within perhaps 2,000 feet. In each storm several flashes left beaded trails, but not every flash which struck near by exhibited that peculiar appearance. I should estimate the time during which the beads remained visible as at least one second, a time amply sufficient to observe distinctly. It appeared to me that the whole course of the flash remained luminous, with a dull-red glow, but that at intervals along the path bright points like sparks appeared to remain suspended in the air. The sparks appeared to be moving horizontally as though blown along by the wind."

QUESTIONS AND ANSWERS.

Inter-pole Motor.

B. D., Chicago: What are the advantages claimed for the inter-pole motor?

Answer.

The inter-pole or commutating-pole type of motor has several advantages, the chief of which is great speed variation. Besides this, inter-pole motors are reversible, are nearly sparkless and have a somewhat larger output for the amount of material used in their construction than common motors. The difficulty in the way of securing a wide range of speeds in a single motor is sparking at the brushes. Sparking is due to the inability of a motor field to reverse or commutate the current quickly enough. The current in the coil under the brush, created by the north pole of the field, is still flowing as it passes under the brush into the south polarity of the field magnetism. There is, as the brush leaves the commutator segment, a spark or sparks representing the residue of this current. To some extent a distortion in the field magnetism, called the pole "fringe," overcomes this in ordinary motors, but at best they have a small range of speed variation.

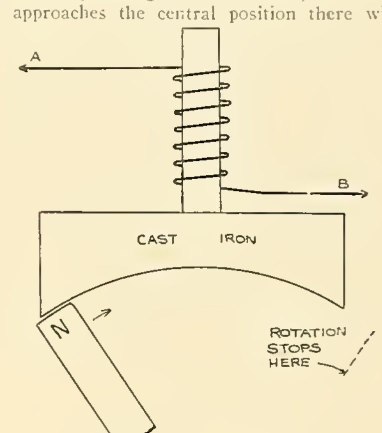
The inter-pole motor has smaller field poles inserted between the main field poles, which effect the quick reversal of the armature current. The inter-poles are connected in series with the armature, and thus the reversing field is kept nearly proportional to the current which it has to reverse. The brushes on an inter-pole motor are placed at the neutral point. Owing to this and the fact that the same current flows through the inter-poles and the armature the motor can be run forward or backward at will without changing the brushes.

Direction of Induced Current.

E. E. H., Pleasant Hill, Mo.: If a north pole be presented in a circular motion to an iron core covered with wire (see drawing), will an alternating current be induced or a direct current, the magnet being moved in one direction only?

Answer.

An alternating current will be induced in the coil. The current induced in a coil of wire is proportional to the change in the number of lines of force running through it. Therefore, as the north pole approaches the central position there will be an increase in the lines of force and a current will flow from (A) to (B). At the central position the number of lines is greatest, but for several degrees of rotation it remains about at a maximum, so that the change in lines is nearly zero and the current in the coil dies down. As the pole recedes from the central position there is a decrease in the lines of force and a current in the opposite direction—from (B) to (A)—is induced. Thus a cycle, or two half-waves, is produced by this device.



DIRECTION OF INDUCED CURRENT.

It is to be observed, however, that the current induced would be insignificant in value, as the greater part of the lines of force would pass through the cast-iron pole-piece and back to the south pole of the magnet without affecting the core of the coil.

The full title of the electrical organization of Missouri, the formation of which was recently noted in the Western Electrician, is the Missouri Electric Light, Gas and Street Railway Association. The officers are: President, J. D. Porterfield; vice-presidents, W. B. Hays, R. Irvine, N. H. Ledford; secretary and treasurer, Charles Z. Pierson of the St. Charles Electric Light and Power Company.

Peculiar Accident to Submarine Power Cables in Sydney, Australia.

The London Electrical Review recently published the particulars of an accident that occurred to two high-tension submarine cables in the harbor of Sydney, New South Wales, on August 7th last. These cable supplied 6,600-volt current from the Ultimo power house to the sub-stations for the street-railway lines of North Sydney. The accident was caused by a steamer dropping an anchor during a sudden gale that had driven it downstream out of its course. The squall was so strong that the steamer dragged its anchor for a considerable distance across the harbor, grappling and dragging the cables, which finally held it. When the gale subsided the steamer again got under steam and, hauling on its anchor, it again proceeded forward and apparently carried the cables with it for about an equal distance on the other side of the true course, where somehow the vessel managed to get rid of them.

Meanwhile all the car lines in North Sydney had been suddenly deprived of electric power. This was restored by starting up the steam plant at the sub-station, which had originally been a generating station, and through a temporary connection made with the city sub-station by using boosters to raise the voltage to that of the trolley lines. On sending down divers it was found that the North Sydney shore ends of the cables had been bodily torn out and no trace could be found there of the missing cables. At the city end the cables were taken out and hauled aboard a pile-driving punt, which had been secured to pick up what could be found of the cables. One was found to be severed 200 yards from shore and the other one 400 yards. The harbor was dragged and the missing parts were found a great distance away. They were found to be badly mixed up with a large anchor which they had apparently picked up in their travels across the harbor.

The cables were of the three-core type and were laid in 1902-3. The total length of each was about 750 yards, running about 50 yards to the ton. The cables were made extra strong, especially at the joints, which were 100 yards apart, and connected during the original cable laying with considerable difficulty, but final success, as the cables had given no trouble during the four years of continuous use. Enough of the undamaged parts of the cables remained to form almost one cable across the harbor, and by joining on some spare lengths this was laid in about two weeks from the date of the accident. The salvaged parts of the old cables were tested to 11,000 volts without breakdown before being used again.

Union Pacific Railroad's Testing Laboratory.

One of the most complete railroad testing laboratories in the country has been completed at the new Omaha shops of the Union Pacific Railroad Company. The laboratories occupy part of the new shop office building. In the test room the machinery, all of which is electrically driven, includes a 250,000-pound Riehle automatic machine for tensile tests. The records of this machine are made autographically. A similar 50,000-pound Riehle automatic machine, milling machine, shaper, lathe, drill press, hacksaw and bench grinder are also part of the equipment of this room, which includes a complete set of apparatus for testing cement and soapstone storage tanks. The room is lighted with Cooper Hewitt mercury vapor lamps. For conveying material to the testing machines there is a tramway with chain hoists.

Every modern device for use in the work for which it is intended is included in the equipment of the chemical laboratory. In addition to the main room there are several special departments for photographic work, bacteriological investigations, electrical experiments, a balance room and a stock room for chemicals and supplies. The tables are covered with vitrified tile and the walls of the rooms are lined with white glazed tile.

For this laboratory a complete equipment has been provided of Sartorius and Troemer balances, a Berthelot-Mahler bomb calorimeter, microscopes for investigations in bacteriology and metallurgy, a spectroscope, constant-temperature ovens with thermostats, a high-pressure autoclave for experiments with boiler waters, calorimeters and standard thermometers in addition to the usual apparatus.

Besides the routine testing, inspection and analysis of various materials to ascertain if they conform to the company's specifications, its laboratory workers are constantly engaged in original investigations, both chemical and physical, into the properties of the various materials that come into railway engineering. One unique investigation carried out by this department was a study of weed growth, the results of which partly determined the design of the company's gasoline weed burner.

An assistant engineer of tests and four resident inspectors are in charge of the physical laboratory. An assistant chemist with four analysts, a photographer and bacteriologist are in charge of the chemical laboratory. Besides the resident chemists there are two traveling chemists who supervise the operation of water-treating plants. The nonresident force is divided into a number of districts in charge of resident inspectors.

Whitney General-service Portable Instruments.

New lines of portable instruments for direct and alternating current are being offered by the Whitney Electrical Instrument Company through Machado & Roller, general sales agents, Monadnock Building, Chicago, and 203 Broadway, New York. These instruments, designed with special reference to their use in general testing work, sometimes at headquarters and often at distant points, are furnished on the unit system. One of the annoying points about a call for testing out some electrical apparatus is the difficulty of carrying the paraphernalia needed to prepare to make and to make the

WHITNEY PORTABLE VOLTMETER.

readings. An ammeter and a voltmeter are almost invariably needed, and in addition there must be flexible cables for making the various temporary connections for the instruments, probably a couple of ammeter shunts, memo sheets and a variety of tools.

Here is where the advantages of the unit system of the general-service type portables are apparent. Each instrument and the tool and utility boxes is provided at its sides with a simple system of hooks and buttons which may be closed up out of the way when a single case is to be carried, but which will unite into a compact block such number of them as may be desired to form a full equipment for any ordinary test. Thus the whole outfit can easily be carried, there is a place for everything and there is less likelihood of arriving at the work to find some article missing.

The accompanying illustration shows the 150-volt direct-current general-service type voltmeter. In this apparatus the company employs the construction which has given satisfaction in its switchboard type apparatus and its more expensive standard portables, namely, the "wire-guided" d'Arsonval. The coil itself is rectangular, the wires being wound on a seamless metal frame whose vertical sides turn about the axis of the rectangle as a center in air-gaps existing between the concave faces of the pole-pieces of a permanent magnet and a cylindrical central iron core in the conventional manner. In the "wire-guided" mechanism the coil has attached to it ruby jewels such as are found in high-grade watches and through which are pierced smooth cylindrical holes with rounded lips.

All voltmeters listed have their resistances self-contained. The ammeters of under 75 amperes capacity have their shunts self-contained, as this is more convenient, and the conductors for carrying such currents are not unduly unwieldy. In higher-capacity ammeters the shunts are separate articles, being of the standard switchboard types, but with the clamp screws having wing nuts so that they may be tightened with the fingers if desired. As all the direct-current shunts give a uniform drop of 50 millivolts at their terminals when carrying full load, any number of different capacity shunts may be used with a single instrument, the scale indications being multiplied by a suitable simple factor, according to which shunt is selected. All separate shunt instruments are thus also millivoltmeters of 50 millivolts capacity and as such capable of use for very low-potential measurements and for bar-to-bar tests on armatures and the like.

The mechanisms in the alternating-current general-service type ammeters are of the company's hot-wire class, which has become widely known during the years that it has been on the market. It possesses two marked advantages, namely, that it may successfully be used with shunts and that it is absolutely inductionless. The first of these points means the ability to use a plurality of shunts with a single instrument, thus saving markedly in equipment cost and allowing the instrument to be placed where it may conveniently be read without necessitating running the main current cables to and from it. The absence of self-induction is always desirable in that the line conditions are then not affected and is essential for high-frequency measurements, such as are needed in wireless telegraph and electro-therapeutic work. The advantages of construction claimed are: First, that the temperature compensation is perfect; second, that the mechanical stress on the expansion wire may be and is kept very low so that the fatigue error is much reduced; and third, that high sensibility is attainable. The entire moving system is mounted on a base plate and by the aid of a button projecting between the binding posts of the instrument may be rotated over a small angle around a heavy shaft secured to it in line with the axis of the needle staff. As the scale is stationary, this enables one to correct for a bent needle without interfering with the mechanism in any way.

In the general-service type alternating-current voltmeters, two different classes of mechanisms are employed, depending on the range desired and on special conditions. As in the case of the direct-current instruments, all of the alternating ones have mirrors under the needle ends to avoid parallax errors in taking readings.

The standard general service instrument case measures but 6¾ by 7½ by 4 inches. The average direct-current instrument weighs about five pounds, and the average alternating-current three pounds. The tool box is 6¾ by 7½ by 1¾ inches and weighs complete about 2½ pounds. The utility box is 6¾ by 5 by 4 inches and weighs less than 20 ounces empty.

Two New Lighting Specialties.

The accompanying cuts illustrate two of the latest electric-lighting specialties placed on the market by the Benjamin Electric Manufacturing Company of Chicago. Fig. 1 shows a new current tap which allows an extension cord to be

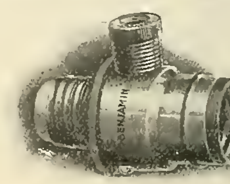


FIG. 1. CURRENT TAP.

led off from the socket. The tap has a rotating sleeve, which eliminates the necessity of turning the device in order to attach it to the socket. It can be fixed in any position and permits the use of any standard shade holder. It contains a compressible rubber ring, forced into position by a combination bushing which grips and holds the cord. The porcelain base is protected in such a manner that it is not easily broken.

Fig. 2 illustrates a portable hand-lamp holder and guard. This is intended especially for wiremen working around switchboards and for pitmen in electric-railway shops. The lamp guard is made of hard fiber and is removable. The

FIG. 2. HAND-LAMP HOLDER.

portable socket is deeply embedded in the body of the wooden handle. The guard parts are turned edgewise radially to the lamp. The distribution of the light, therefore, is as free as with any metallic guard. The portable has no metal parts to cause short-circuits or grounds.

Limits Issue of Securities.

A dispatch from Albany, N. Y., dated November 10th, says that the New York State Public Service Commission for the Second District has made public a decision which sets forth its attitude toward competition in public-service facilities within a city. The decision is in the matter of the proposed purchase by a new corporation, the Lockport Light, Heat and Power Company, of the Lockport Gas and Electric Company and the Economy Light, Fuel and Power Company of Lockport. The decision, while admitting that the proposed purchase does technically constitute a merger within the meaning of the law, forbids the company to issue securities for a capitalization above $700,000, equivalent to the total issues of the two old companies. The new company desired to issue stocks and bonds to a total of $1,200,000.

Electric Reading Lamps.

Fixtures for electric lighting have constantly improved in excellence of workmanship and beauty of design, and in no class of fixtures is this tendency more noticeable than in portables, such as the two electric reading lamps illustrated herewith. These lamps, with many other designs, are shown by the Central Electric Company of Chicago. The one in Romanesque finish has two lights and stands 17 inches high, with pull sockets and a glass shade of pink, green or ivory color under tracery. The lamp with the dome shade has one light, stands 17½ inches high, with metal parts in old brass finish. It is of moderate price.

Such lamps as these form appropriate holiday gifts. The Central Electric Company pays especial attention to fixtures and has a handsome showroom fitted up to display this class of material. Out-of-town central-station companies send their customers here when visiting the city to select the latest fixtures, the Chicago company giving expert aid and acting as the agent of the central-station company if desired. A large number of fixtures is sold in this way. In particular there is a demand for portable lamps, which, owing to the pleasing effects not obtainable with gas, have become popular.

Two-light Fixture in Romanesque Finish.

One-light Fixture with Dome Shade.

ELECTRIC READING LAMPS.

Facts About Corliss Engines.

Allis-Chalmers Company of Milwaukee is issuing a bulletin on "Compound Corliss Engines" which contains, besides illustrations of each type, many facts of general interest to power users throughout the country. "So far as we are aware," it is stated, "the first compound Corliss engine designed for power purposes was built in the shops of this company, and to our Mr. Edwin Reynolds, who for nearly half a century has been so prominently identified with the history of this type, should be given credit for introducing the principle of compounding into general Corliss engine practice. The earliest Corliss engine was built in 1848, and 28 years later the famous "Centennial" engine, which was supposed to embody in its design and construction the very highest development of the engine builder's art, was nothing more than a pair of simple engines. The first Reynolds-Corliss engine, built in 1877, marked the beginning of an epoch in the history of the steam engine. The first compound Reynolds-Corliss was built three years later and is still in regular operation."

Continuing, it is said that there is a general though decidedly erroneous impression among steam users that no great advantages can be gained by compounding unless high-steam pressures are used. While it is true that high pressures are conducive to economy in steam consumption, it is equally true that at lower pressures the percentage of saving by compounding is relatively very nearly as great when engines are run condensing as at higher pressures. It is true that a compound Corliss will be more economical at 150 pounds than at 100 pounds initial pressure, and it is also true that a compound condensing Corliss when operating under 100 pounds initial pressure will use 40 per cent. less steam than a simple non-condensing engine under the same pressure. In fact, the great economy of compound Corliss engines was demonstrated and their reputation established at a time when pressures higher than 80 pounds were rarely used. The economy of compound non-condensing engines is less marked at lower pressures, but even at 100 pounds initial pressure a compound non-condensing engine will effect a saving of approximately 15 per cent.

To determine whether it is better to use a compound engine requires careful consideration of the commercial and engineering conditions in each particular case. The compound engine is unavoidably more expensive than the simple engine, against which must be offset the saving in cost of fuel and also in cost of boiler-room equipment, owing to the smaller steam-making capacity necessary. The price of fuel and steadiness of operation of the plant have an important bearing, for if fuel is inexpensive, or if the engine is to run only a few hours a day or for a short period each year, the annual saving may not warrant the additional cost of the plant. On the other hand, if the engine is to be run steadily the annual saving, even with low-price fuel, will more than warrant the additional investment. The permanency of the plant is also a factor in the problem.

The Business of the Western Electric Company.

A special meeting of the stockholders of the Western Electric Company was held on November 5th at the offices of the company, 259 South Clinton Street, Chicago. In accordance with the directors' recommendation an issue of $15,000,000 five per cent. 25-year bonds was authorized. The bonds will be used both for the extension of the company's business and for the payment of floating indebtedness. It was announced that no part of the issue would be put out at this time. The following information was presented for the information of the stockholders.

"The sales for the first six months of 1907 were $29,614,000, or 1.3 per cent. more than for the first six months of 1906. For the four months ended September 30, 1907, the sales were $15,745,000, or 35.1 per cent. less than for the corresponding period of 1906.

"The total number of employes on December 1, 1906, was 26,922 and on October 1, 1907, 16,183, a decrease of 39.9 per cent.

"Summary of payables less cash, at December 1, 1906, and October 1, 1907, is as follows:

	Dec. 1, 1906.	Oct. 1 1907.	Increase.	Decrease.
Payables	$22,881,000	$15,347,000	....	$7,534,000
Less cash	1,626,000	3,732,000	$2,106,000	....
Total	$21,255,000	$11,615,000	....	$9,640,000

"Accounts receivable and undiscounted receivables on hand were at December 1, 1906, $20,354,000 and at October 1, 1907, $12,838,000, a decrease of $7,-484,000.

"Our inventory of finished merchandise, work in process and raw material at October 1, 1907, is estimated at $22,000,000.

"The rate of production of telephone apparatus at the factories is still somewhat in excess of the orders from customers, although the number of employes has been reduced 39.9 per cent.

"We know, however that our telephone customers are using up their own stocks to such an extent that we believe they will soon be placing more orders with us than they are doing at present. The expected additional business from our present telephone customers, together with that which will arise from our sales to Independent telephone companies, to whom we are now prepared to sell apparatus freely, will require the present rate of production to be increased and consequently additional hands to be employed."

To Manufacture Tungsten Lamps.

The Tungsten Electric Lamp Company was incorporated on October 29th, with capital stock of $100,000, by the following-named incorporators: G. G. Lockwood, A. C. Garrison, H. B. Vanzwoll, A. S. Terry, L. P. Sawyer, H. H. Geary, J. C. Fish, H. C. Rice, E. H. Haughton, E. W. Gillmer, J. B. Estabrook, W. D. Packard, William Coale, E. J. Kulas.

Mr. J. W. Frech, Jr., was elected president of the company. Mr. Frech has made a study of the manufacture of tungsten lamps, having made two trips abroad for the purpose. The lamp men who are the incorporators will back up Mr. Frech with their experience and resources.

District Telephone Meetings in Indiana.

Two district meetings of the Indiana Independent Telephone Association were held last week. The first was that of the Eleventh District at Seymour, on November 5th, at which W. H. McPherson, vice-president, presided. The following subjects were discussed: "Rural Construction," opened by John L. Hosea, manager of the Citizens' Telephone Company at Columbus. Mr. Hosea advocated the necessity of building substantial and permanent lines rather than the hurry-up lines for immediate revenue. "Unprofitable Business" was assigned to C. E. Brown of the Brownstown Telephone Company. Better rates and toll-line fees were suggested as a partial remedy.

"Limit of Free Service" was a subject treated in a practical manner by C. M. Bowers of the Mooreshill Telephone Company. Mr. Bowers advocated the doing away entirely of all free service, and said that between all exchanges there should be a toll-line charge, and that no two systems should exchange service free between each other, because it has been demonstrated that the telphone business cannot be successfully handled by co-operative companies. The report from the company representatives showed the Independent telephone business in the district to be in a flourishing condition and the territory well developed. W. H. McPherson and C. M. Bowers were elected delegates to the international convention to be held in Chicago. The delegates and visitors were enjoyably entertained by the Seymour Telephone Company.

The other meeting was held at Winchester on the 8th inst., J. A. Brown, vice-president, presiding. A. C. Lindemuth of the Richmond Telephone Company addressed the meeting on "The State Association," and emphasized the fact that the local Independent telephone operators must look to the state organization for effective work and help.

T. O. O'Rourke of Muncie spoke on the subject of "Unprofitable Business." Mr. O'Rourke said that much of the unprofitable business was occasioned by the employment of incompetent help and unskilled labor, presumably because it can be secured more cheaply; by the extending of rural lines beyond a reasonable distance from the exchange, where distance increases the cost of repairs; by the building of leads without proper consideration of future development, but, chief of all, by the attempt to do business at too low rate.

"Cost of Operating" was the final subject on the programme and was scientifically considered by C. S. Norton of Indianapolis, who said that a company should have a definite and comprehensive system of bookkeeping. Income should be reckoned under three heads: Exchange rentals, toll-line rentals and miscellaneous earnings. The expense should be divided into five heads: General, operating, maintenance, fixed charges and surplus. A definite per cent. of the earnings should be set aside for each of these divisions, and the expense held rigidly within those limitations. He suggested the following percentages for exchanges ranging from 500 to 3,000 subscribers: General, 20 to 25 per cent.; operating, 25 to 30 per cent.; maintenance, 15 to 20 per cent.; fixed charges, 15 per cent.; surplus, 15 to 25 per cent.

The delegates elected to the international convention were Frank White of Portland and T. O. O'Rourke of Muncie. The delegates were pleasantly entertained by the Eastern Indiana Telephone Company of Winchester. S.

Telephone Situation in San Francisco.

Telephone interests represented by Ferdinand Butterfield are attempting to have the permit under which the Home Telephone Company of San Francisco is laying its underground mains revoked on the ground that the company's franchise in San Francisco, secured soon after the fire for $25,000, was worth $750,000. The Home Telephone Company has supplied a large area of the city with underground conduits and is still working a large force of men with all possible haste. The company has plans for a six-story telephone-exchange building, but has not yet commenced its erection. The Home Telephone Company of Oakland, backed by similar interests, has had its plant in operation some months.

End of Telegraphers' Strike.

The strike of the commercial telegraphers of the United States, which had been in progress about two months, was brought to a close on November 6th by vote of the members. The demands of the union were rejected by the two telegraph companies and the strike has been declared off after a failure to realize any concessions. The men are now applying for their former positions, many of them having as yet failed to secure work.

Chicago Telephone Company Gets a New Franchise.

The Chicago Telephone Company has been granted a new franchise to operate a telephone system in Chicago. The City Council by a vote of 44 to 23 passed the franchise grant at three o'clock on the morning of November 7th at the end of a session lasting nearly seventeen hours. Mayor Busse signed the ordinance on November 11th and the franchise will be in effect as soon as it is accepted by the company, which must be done within 30 days. It is not likely that the company will refuse the franchise.

This action ends one of the most thorough investigations ever preceding the disposal of a public-utility measure in Chicago. For several years the Chicago Council committee on gas, oil and electric light has been conducting negotiations looking to the drafting of an adequate franchise ordinance for the furnishing of telephone service in Chicago. Several organizations and companies made bids for the franchise, presenting measures which embodied the conditions under which they proposed to serve the subscribers. The Chicago Telephone Company (whose present franchise expires in a little more than a year), because of its present extensive and modern plant, was the most logical successor to the field, but was shown no favors on this account, the negotiations having been conducted purely on the theory of securing the lowest possible rates commensurate with good service. The principal contender with the old company was the Manufacturers' Telephone Company, an organization composed of members of the Illinois Manufacturers' Association. Toward the close of the negotiations a plan was also suggested whereby to broaden the franchise of the Illinois Tunnel Company so that its automatic system now in operation in the central Loop district might be extended to cover the entire city.

The Council committee having the negotiations in charge made an exhaustive study of the situation. Hundreds of meetings were held where hearings were given to all interested, numerous inspection trips were made to other cities, and, most important, the committee had the advice of a commission of experts, consisting of D. C. Jackson, W. H. Crumb and G. W. Wilder, on the whole subject of telephone service. As a result of its work the committee reported to the Council the ordinance just passed, which was only slightly amended.

Some of the aldermen and a number of civic organizations opposed the measure on the basis that better terms could be secured. Still lower rates, greater compensation to the city and compulsory long-distance connection with Independent telephone companies are the principal points on which they are not satisfied.

On the whole the measure may be said to be a good one. The important points in a grant of this kind are thoroughly covered. These are: Reduced rates; publicity of accounts; the power to regulate rates in the future, and power to regulate service. The ordinance establishes a flat rate of $125 for unlimited business service and $72 and $56, respectively, for one and two-party-line residence service. Besides, a carefully worked out measured-service rate is provided for the various classes of service, and the public rate is reduced from 10 cents to five. Extensive improvements are provided, and, under the strict publicity-of-accounts clause, the city can at all times be in a position to take advantage of its power to reduce the rates further at stated periods if the company's profits seem to warrant.

A Summary of the Franchise.

The principal points of the ordinance as passed by the Council and signed by the mayor are as follows:

The franchise gives the Chicago Telephone Company permission to operate a system for the electrical transmission of sounds and signals until January 8, 1929. The company shall pay to the city semi-annually three per cent. of the gross receipts of all its telephone business both inside and outside of the city. The company's books shall be kept in form prescribed by the city comptroller, and the city shall have the right to inspect all records at any time.

After 30 months from the acceptance of the ordinance by the company the City Council may, by an amending ordinance, change any of the rates charged for any kind of service, such new rate to be in effect for the five following years. The Council shall change the rates only upon 30 days' notice to be given the company by the comptroller, and shall require the company to produce all records and data to assist in establishing reasonable rates. In case the company contests the reasonableness of the new rates and is not sustained by the courts it shall refund all excessive charges to subscribers together with five per cent. interest thereon.

City fire and police-telegraph wires are given free use of company poles or conduits, and instruments are to be loaned to the city free. City is to have an unlimited number of free telephones in the City Hall, and in all other municipal buildings or offices at a discount of 25 per cent. from current rates. Police and fire stations and ward yards to have a free service for incoming messages only. Board of Education secures, by contract, free unlimited service telephones at schools and offices it may designate. Free service or discrimination to city officers or employes is prohibited.

A flat rate of $125 a year is provided for single-party business telephones, unlimited use. The flat rate for residences, unlimited use, is $72 for a single-party line and $56 for two-party lines.

Measured rates for business houses are $60 a year for the first 1,200 calls, three cents each for additional calls up to 3,600, and two cents each for additional calls up to 7,200. A free line is given for every 6,000 calls in excess of 7,200.

Measured-service subscribers may have an unlimited number of extra single-party lines at $24 a year. Commutation trunklines for outgoing calls only will be furnished at $1 a day. Every subscriber having two or more measured-service lines shall have a switchboard installed free. "Local" lines from switchboards shall be $1.50 per quarter each.

A combined business and residence service is provided on the prepaid nickel-instrument plan. Under this service a single-party line must guarantee 20 cents a day and two-party lines 12½ cents. For residences only—two-party line, 10 cents a day guarantee; four-party line, five cents. Deficiencies in guarantees may be deducted from any surpluses of next 60 days.

Where there is a sufficient demand neighborhood exchanges may be established within the city north of Devon Avenue, west of Fortieth Avenue, and south of Seventy-first Street. The charge for a call from a neighborhood exchange to any other part of the city shall be five cents for five minutes. Monthly rates for unlimited service in neighborhood exchanges on one, two and four-party-line telephones shall be: Business, $4, $3 and $2; residence, $3, $2 and $1.50. No charge shall be made for conversations from other exchanges to neighborhood exchanges.

The charge for any single message from one telephone within the city to another telephone within the city shall not exceed five cents. Ten cents for the first three and five cents for each additional minute shall be charged for a toll connection to any point within 15 miles of the City Hall, one mile of the city limits, and in Illinois. Meters shall be put on measured-service subscribers' instruments as soon as practicable.

Extensions running outside of premises shall be $2.50 per three months for each quarter mile, with a minimum charge of $5. Private lines, not connecting with any telephone exchange, shall be $2.50 for three months for each quarter mile, with a minimum charge of $10. Instruments for the same shall be $1.50 each per three months.

The city commissioner of public works shall require the company to maintain its plant and service at the "highest practicable efficiency." Extensions and improvements of the service may be required by the City Council in its discretion. The Council may regulate any service "other than mere telephone service" which the company in the future may deal in. The installation of all equipment in the streets shall be under the supervision of the Department of Public Works.

The city, upon 12 months' notice, may purchase for municipal operation the plant and equipment of the company on January 1, 1919, January 1, 1924, or at the expiration of the grant in 1929. The price to be paid shall be the cost of duplicating the equipment, and, if on either of the earlier dates, together with five per cent. of that amount as compensation for the compulsory sale. The property shall be valued by a board of appraisal, on which the company shall select one member, the city one and those two a third.

The city does not admit the rates in the ordinance are reasonable, and specifies that all changes in equipment shall be made in 18 months after acceptance. The company shall not enter into any rate agreement, division of territory or assignment of rights with a competitor.

All lines shall be underground conduits in the territory bounded by the lake and Howard, East Ravenswood Park, Foster and Western avenues, Diversey Boulevard, Kedzie, Chicago and Fortieth avenues, Twenty-sixth Street, Centre Avenue, Seventy-ninth Street, Vincennes Road, Seventy-third Street, Cottage Grove Avenue, Seventy-ninth Street, Baltimore and Ohio tracks and Eighty-ninth Street. Commissioner of public works shall permit and supervise underground work. Poles and overhead wires shall be in alleys so far as possible and removed in advance of paving. Distribution from conduits for three blocks may be made by poles, except between Twelfth Street and the river, where it shall be in the sub-sidewalk space. Wires and conductors can be eight feet above buildings with the consent of the owner.

Contracts are said to have been closed by the Independent Telephone Company of Omaha, Neb., with President Charles Cockrell of the New State Telephone Company, which operates toll lines in Iowa, Nebraska and South Dakota whereby the New State company will connect with the Omaha exchange and become a party to a corporation which will handle all toll business in and out of Omaha.

Telephone News from the Northwest.

A receiver has been appointed for the Citizens' Telephone Company of Sioux Falls, S. D., on the application of the Royal Trust Company of Chicago, trustee for the mortgage bondholders. The interest has been defaulted. E. G. Kennedy has been named receiver.

The Central Minnesota Telephone Company seeks permission to install a new exchange with an automatic system, and increase the rate 50 cents a month, at Glenwood, Minn.

Roy Wertz, who has been with the Citizens' Telephone Company of Sioux Falls, S. D., has been offered the management of the Johnson County Telephone Company at Iowa City, Iowa.

The Woonsocket Telephone Company of Woonsocket, S. D., has sold its interests there to O. Schuler of Letcher, S. D., and Guy McCardy of Lane.

The Mesaba Telephone Company contemplates putting in an exchange to take care of the business at Bovey and Coleraine, Minn.

The Wisconsin Telephone Company will build a new exchange at Neenah, Wis., which is to be finished by March 1st. R.

Telephone Extensions in New Mexico.

The building of Independent telephone lines into remote parts of New Mexico has made great progress during the last year. The Silver City-El Paso and Southwest Telephone Company is constructing a system of long-distance lines which will give outside connection to El Paso, Las Cruces, Rincon, Engle, Los Palomas, Silver City, Deming and intervening towns. This company has just purchased the telephone line which runs between Las Cruces and El Paso from the Texas and New Mexico Telephone Company. The acquired line will be merged into the general system which the company is building. The Silver City-El Paso company has a capital stock of $100,000. It has planned to extend its lines to all of the principal towns and cities of New Mexico and Arizona. Among the men interested in the company are John H. Morgan of El Paso, who is manager of the Southwestern Independent Telephone Company of that place, W. E. Baker of Las Cruces, William D. Murray, president of the Silver City Telephone Company, and C. B. Bosworth of Deming, N. M.

GENERAL TELEPHONE NEWS

A Rochester (N. Y.) dispatch says that the United States Independent Telephone Company has sold the Utah Independent Telephone Company, one of its subsidiary corporations, to R. L. Day & Co., investment-bond dealers of New York. The price paid was $910,000, which, with $50,000 forfeited by Elmer R. Jones, representing Salt Lake capitalists who took options on this property, makes the sum realized for the Utah holdings $960,000.

A convention of the officials of the Wisconsin Telephone Company and the representatives of all the connecting companies in the Fond du Lac division was held on November 1st in Fond du Lac. The purpose of the meeting was to discuss the telephone business in a general way and to consider the matter of providing better service. There are 50 companies in the Fond du Lac district having connection with the Wisconsin company, and these companies have 6,000 telephones.

The annual convention of the Nebraska Independent Telephone Association will be held in Lincoln on January 15th, 16th and 17th at the Lindell Hotel. Nebraska sent representatives to three adjoining state conventions last year, and has the promise of a good attendance from them in return at the coming convention. The association has been very successful this year, and it is thought that the 1908 convention will be the most enthusiastic ever held in the state. R. E. Mattison of 350 Fraternity Building, Lincoln, Neb., is secretary of the association.

The Union Home Telephone Company of Los Angeles, controlling the Independent systems of 10 Southern California cities, has made public an arrangement whereby its interests have been combined with those of the United States Long-distance Telephone Company. J. M. C. Marble, president of the Union Home company, has resigned, and Frank W. Watcher has assumed the management of both corporations. The amalgamation, it is expected, will be ratified by stockholders at the annual meetings in January. It is announced that the consolidation is in the interest of economy.

Among the telephone companies recently incorporated are the following-named: Mission Telephone Company, Hobart, Okla.; Quanah-Mangum Telephone Company, Olustee, Okla.; Walnut Hill Telephone Company, Bradley, Ark.; Texas-Oklahoma Telephone Company, Paris, Tex.; Golden Rod Telephone Company, Wahoo, Neb.; Ozark Telephone Company, Pocahontas, Ark.; Columbia Telephone Company, Tama, Iowa; Daisy Mutual Telephone Company Blackburn, Okla.; Britton and Rural Telephone Company, Britton, Okla.; Choctaw City Telephone Company, Choctaw, Okla.

CORRESPONDENCE.

Continental Europe.

Paris, October 29.—Paris is to have a new subway line which will run in the general direction of north to south, passing as far as the city limits in each case. It commences at the St. Ouen gate, running by the St. Lazare railroad station, then crosses the Seine, passes the Montparnasse railroad station, and ends at the Versailles gate. This line is distinct from the Metropolitan subway and is controlled by what is known as the North-South Electric Railroad Company, which secured the concession from the Municipal Council, and is capitalized at $7,500,000. As to the tunnel, it will have about the same section as the present subway and contain a double track. There will be some differences, however, in the construction of at least a part of the underground stations. But what is the striking feature is the use of a double steel tube passing under the Seine. The Metropolitan lines all cross upon bridges, but these are not in the center of town, while the new Metropolitan section will have a tunnel under the Seine which is formed by sinking compressed-air caissons. On the contrary, the North-South line will use the Berlier tube system. The tube is built of steel segments bolted together, each ring being made of iron voussoirs like a bridge arch. The shield system with compressed air is employed for running the tube under the Seine, and this work is already commenced. Each track is contained in a separate tube. At the shore ends the tubes are joined together and connect with the main tunnel.

The new time-signal system which is placed upon the Eiffel Tower is attracting considerable attention. It has been installed by a Russian engineer, Mr. Hourko, who first brought out the apparatus at St. Petersburg. The time figures are made up of incandescent lamps, as I already noted, these being placed upon a series of light horizontal strips which are suspended at the second platform. An ingenious system has been devised to operate the lamps to show the hour and minute, commencing at sundown. The use of a clockwork drum is not practicable, as the clock, to be accurate, must generally be a small one, and could not therefore operate a drum directly. Each circuit corresponding to a figure is connected to a separate relay, and the relays are worked in succession from the clock, as it closes a light mercury contact which operates the relay, and the latter throws on the main current into the lamps. The system is a practical one and requires but little attention.

Professor Bordas of the Paris University has discovered that radium will act upon common kinds of clear stones and transform them into precious stones. He observed that a clear stone left in contact with radium for some weeks becomes colored, or that the original color is quite changed. Thus he starts with a light red corundum stone and, by exposing it to radium, he obtains a veritable ruby such as is valued at $150 a carat. Such results may have a marked influence upon the value of precious stones in the future.

The international exposition which has been organized for Marseilles in 1908 will no doubt be of interest. It is an electrical exposition and is intended to promote such interests in the south of France, which is now the center of a large distribution of current from the Alpine hydraulic plants, while the large cities, such as Marseilles, are well equipped with lighting and traction systems. A. DE C.

Great Britain.

London, November 2.—On Saturday last an accident occurred upon the Metropolitan Railway on the outskirts of London which, unfortunately, resulted in three deaths and several passengers injured. In addition to being the first accident of this nature upon an electric railway in London which has been fatal, it breaks a continuous record of 44 years of the railway company in question during which time no less than 3,000,000,000 passengers have been carried without fatal accident. For some at present unexplained cause a train was allowed to run into a station in a thick fog while another was standing there. The speed of the second train is given by the driver at about 20 miles an hour, and the effect was most remarkable. The rear car of the standing train was forced over the first car of the oncoming train and the two remained interlocked, having the appearance of one car being dropped through the roof of the other. Afterward the interlocked carriages were towed away on their own wheels by a steam locomotive. Strictly speaking, the accident cannot be called an electrical one, but was caused either through defective working of the signals or by neglect or an oversight on the part of the signalman. Although a most exhaustive inquiry is being carried out by the Board of Trade, no very definite conclusion can yet be come to. The signaling system employed is a lock and block, with electrical interlocking. When a train is signaled to leave a station, and does so, it operates a treadle on the line, which electrically changes a disk in the signal box from "train on line" to "line clear," and everybody concerned in the accident, with the exception of the signalman, aver that to get this change of disk without a train having operated the treadle is an absolute impossibility.

The new session of the Institution of Electrical Engineers opens on the 14th inst., and a departure will be made almost for the first time in the history of the Institution. Lord Kelvin, the president elect, owing to his absence from town during the autumn, will not deliver his presidential address, and in its stead a paper on "The Dielectric Strength of Insulating Materials and the Grading of Cables" will be read by Mr. Alexander Russell.

There has just been published by the engineering standards committee a specification for consumers' electric supply meters, i. e., motor meters for continuous and single-phase current. The subcommittee of the engineering standards committee, which has been responsible for this production, is a very representative body, comprising meter makers, supply-station engineers, government officials, consulting engineers and independent electrical engineers of repute. The rules laid down only apply as between the maker and the buyer of the meter, but the support of supply-station men is necessary to insure the absolute success of the efforts of the standards committee. The capacities of the meters specified are 3, 5, 10, 25, 50, 70 and 100 amperes. Generally, the specification lays down manufacturing details. The insulation of the meter is to be a test of 1,000 volts to 1,500 volts between the circuits and the case for one minute, and the resistance must not be less than five megohms. The meter will, in effect, have to be maintained by the manufacturer during a period of three years, i. e., if it is found faulty within that period it may be returned.

One complaint follows another in connection with the new telephone tariff of the National Telephone Company and the Postoffice. The campaign against the general use of the message-rate system is being vigorously pursued, but meanwhile complaints are being made from all quarters that subscribers are being charged for many more calls than they make, in some cases amounting to hundreds. Charges are made that the meters are unreliable and do not tally with the register of calls kept by the various subscribers. The answer of the Postoffice is that many calls made by the staff in various offices—which were made with impunity under the unlimited-rate system—should now be registered in the office, but being "private" calls they are not. Consequently this accounts in many cases for the discrepancy. Several very good proofs have been given by the officials that the meters do not register inaccurately, and there are now, probably, a good many explanations being asked for in offices over this matter.

Official figures just published at the request of Lord Monkswell in the House of Lords show that the total number of persons killed through coming into contact with the live rail of electric railways since 1904 until the present date is four railway servants and 12 passengers. There have in addition been injuries to 61 other persons.

Experiments are being carried out with a new electrical system of signaling upon the driver's cab of a train, so that he shall not have to depend upon his sight of the signal nor upon the fog signal. These particular experiments are being conducted upon a line in the south of London, and they have just been inspected by the Board of Trade officials. A short length of third rail or a "ramp" is placed close to each signal, and shoes, placed underneath the engine, make electrical contact, and complete a circuit with the signal box. Without going into details, the effect is to reproduce upon the engine, in miniature, the signal as given from the box. In the signal box there are lights which indicate that the driver has received the signal, while, to make doubly sure, when the train is on the third rail, telephonic communication between the driver and signalman is made possible. Some such system has been worked by the Great Western Railway in the west of London, and another is being tried upon the Liverpool Overhead Railway. G.

Dominion of Canada.

Ottawa, November 9.—The Dominion government's wireless-telegraph service on the Pacific Coast will be in operation by the first of January, next. The Shoemaker system is being installed, and on this account the Marconi company will enter action against the government for alleged breach of contract.

The City Council of London, Ont., has decided to submit a by-law to the ratepayers of the city at the civic elections in January, next, to provide for the expenditure of $235,000 for transmission of Niagara power to the city.

The electric plant near New Liskeard, Ont., has been formally opened. It is supplied by hydraulic power from the Wabis River. The total fall from the dam to the power house, half a mile distant, is 105 feet. The water is carried in a 36-inch pipe and supplies a power which is estimated to be sufficient for the requirements of the town, both for lighting and other purposes.

Montreal men have secured possession of the St. Lawrence Power Company, and the big plant at Cornwall, Ont., has changed hands. M. P. Davis, of Ottawa, owned a controlling interest in the company, and he has transferred the plant and franchises to George G. Foster of Montreal and others. The St. Lawrence Power Company is a going concern. It now develops power from the Cornwall Canal and lights the canal as well as disposing of light and power to various industrial concerns.

The engineers of the Ontario Hydro-electric Power Commission have completed the surveys for the main transmission lines from Niagara Falls to the municipalities in the Western Power Union, and are now engaged in the survey of several of the branch lines. The main lines are from the Falls to Hamilton, from thence to Toronto, from Hamilton to Brantford, Woodstock, Ingersoll and London, and from Hamilton to Guelph, Hespeler, Galt, Berlin, Stratford, St. Marys and London. It will thus be seen that a loop system is contemplated in the event of all or most of the municipalities definitely deciding upon the adoption of the power scheme. As the lines would be duplicated, a breakdown in the service would be a practical impossibility. The total length of the main loop will be about 300 miles. W.

Winnipeg, Man., November 9.—The British Columbia Electric Street Railroad Company has for some time realized the inadequacy of its terminal facilities at Vancouver, and has now prepared plans for a four-story building to be erected on the present terminal site at the corner of Carroll and Hastings streets, to cost $100,000. R. H. Sperling, Vancouver, B. C., is general superintendent of the company.

Robert Meighen has been elected a director of the Montreal Street Railroad Company, to replace the late Colonel Henshaw.

The Okotoks Electric Light Company, Okotoks, Alberta, has notified the Town Council of that place that it will dispose of the plant as soon as possible and closed it down on November 1st. Officials of the company state that it has been operated at a loss for some time past.

A transfer has been made of the property of the Tweed Electric Light and Power Company of Tweed, Ont., to J. T. Kissack, who, with his brother, is proprietor of the Paisley Electric Light Company of Paisley, Ont.

A petition has been circulated at Havelock, Ont., asking the Havelock Electric Light and Power Company to install a local telephone system.

At a meeting of the Town Council of Souris, Man., the clerk was instructed to correspond with D. A. Keiser, C. E., Winnipeg, Man., in reference to a dam on the Souris River and the possibilities for development of waterpower. Alderman Stirling may be addressed.

An electric-lighting system has been installed at Brandon, Man., for the purpose of lighting the pumping station, and so successful has it proved that the City Council is considering the installation of a plant to do all the municipal lighting. A steam turbine and generator were imported from Leeds, England, giving a capacity of 200 16-candle-power lights. Superintendent Shaw is in charge of the work. R.

New York.

New York City, November 9.—The tunnel under the East River from Joralemon Street, Brooklyn, to the Battery, which has given the engineers so much trouble, and which has had to be strengthened with an inner lining of reinforced concrete, is at last in a fair way to completion without further difficulties. All of the many leaks have been stopped up effectively and it is quite dry now, although there are a few pools left from the former leaks throughout the length of the tunnel. Tracks have been laid from either end for a short distance, but no power has been installed as yet. The Borough Hall station is practically finished, and for some distance toward the river the roadbed has been completed, even to the laying of the third rail. At the Manhattan end the tube is not so far along. Chief Engineer Rice stated to a number of the members of the Brooklyn Engineers' Club who recently made a trip through the north tube that cars would be running by December, but not to carry passengers.

Now that the Belmont tunnel from Forty-second Street, Manhattan, to Queens Borough has been completed, considerable agitation is being created by the prominent members of that borough to bring about the immediate opening of the tunnel. Already there have been many meetings of the civic bodies throughout Brooklyn and Queens, and the agitation is now spreading to other Long Island towns. The questions at stake are the settlement of the conditions under which the tunnel shall be operated and the question of the fare that shall be charged. The several civic bodies unite in asking for free transfers from the Queens trolley lines and an additional three-cent transfer to any of the Interborough lines. A hearing before the Public Service Commission is scheduled for November 14th.

For the last few weeks Mr. E. H. Harriman has been receiving reports of the performance of "Motor Car No. 8," which is being tried out on the Union Pacific Railroad. Mr. W. R. McKeon, a mechanical engineer, under whose direction this work has been assigned, has sent in favorable reports, and it is said that the immediate construction of a large plant to be devoted entirely to the construction of this new type of railroad vehicle has been ordered. The engine used is of 200 horsepower, with six cylinders, two-cycle, so arranged that it can use either gasoline or alcohol. It is expected that this new type of car will be watched with interest by all electric interurban railway companies, as it will be one of their direct competitors.

Considerable apprehension has been entertained that the recent restrictions placed upon the appropriations for public improvements would prevent work being done on the construction of the Fourth Avenue subway in Brooklyn. Controller Metz, however, has made it clear by a public interview that the subway is one of the improvements to which preference will be given by the financial officers of the city. The necessary money which will be required to begin the work will be appropriated as soon as the Public Service Commission is ready to take up this question. The commission has not as yet advertised or let the contracts for any of the several sections into which the subway is divided. The engineer's estimate for this work approximates $1,500,000, or about $7,500,000 for the five sections, extending from the Manhattan Bridge through Flatbush Avenue, through Fourth Avenue to Forty-first Street.

It is expected that the affairs of the Brooklyn Rapid Transit Company will shortly be examined by the Public Service Commission, and it is said by the company that it will welcome the investigation, as the affairs of the company are in a perfectly healthy condition. As to the earnings of the company, they were never better. The company also reports the September earnings as over two per cent. on the stock of the company. S.

Ohio.

Toledo, November 9.—The town of Rawson, Ohio, decided at a meeting of its council Monday night to light the city with electricity. Arrangements will be made with the Western Ohio company to wire the streets at once. This will be followed by an arrangement for commercial lighting.

After coming in contact with a circuit of 33,000 volts George Huffer, electrician in charge of the sub-station of the Lima and Toledo Traction Company, near Ottawa, Ohio, survived to succumb later to the effects of the burns received from the wire.

Manager Johnson of the Sandusky (Ohio) Telephone Company has just issued a new directory. In addition to the regular alphabetical list a numerical list is given. When a patron is notified that a certain number has called him he can turn to the numerical list and find with ease whom the number represents.

It is said that the Columbus and Lake Michigan branch of the Ohio Electric Railways will be electrified at once instead of waiting until next spring as formerly planned. H. L. S.

Michigan.

Detroit, November 9.—The Edison Illuminating Company of Detroit is installing two 1,500-kilowatt motor-generator sets, one in sub-station "K" in the North Woodward district and one in sub-station "A" downtown. These units are of the latest type, with interpoles and air blast on the commutators, and they are of almost the same size and weight as the 1,000-kilowatt sets which the company has in service.

The R. G. Peters Salt and Lumber Company is considering the construction of an electric railway between Cadillac and Manistee. The company already has a narrow-gauge road extending nearly to Cadillac, and as the roadbed is excellent it could be converted into an electric line very easily. The scheme also includes the development of a water-power in the Pine near Thorpe, and preliminary plans for the dam are being prepared. As Cadillac is not to be included in the route of the road to be built by the Manistee River Power Company, this is very welcome news to the residents of Cadillac.

The Grand Traverse Railway is offering $200,000 of first-mortgage bonds to the people between Charlevoix and Elk Rapids. The bonds are to be sold at par and the money to be payable to the Carter Construction Company on completion of the road between these points. The total issue of bonds is to be $1,200,000.

The Michigan United Railway has decided not to interchange freight cars with steam roads. The Railroad Commission law passed at the last session of the Legislature makes it mandatory for a steam road to accept cars from any electric line, but optional with an electric road as to whether it will receive cars from a steam road.

On November 19th the proposition of the council of Trenton to sell the electric-light plant and waterworks to the Detroit Edison Company will be voted on by the people. The trustees say that the price offered for the plant is liberal and that the cost of operation has been $4,700 per annum, with receipts of only $2,600. D.

Indiana.

Indianapolis, November 9.—The Logansport and Marion Traction Company has accepted a franchise to enter the city of Logansport over Nineteenth Street to the terminal station. The officials announce that work on the line will be begun at once.

L. J. Crawford, superintendent of transportation for the Fort Wayne and Wabash Valley Traction Company, has offered cash prizes of from $20 to $50 for the best set of photographs taken of scenery and stretches of track along the company's line. It is the purpose to use the pictures in advertising the road.

The Indiana railroad commission has sent out a number of inspectors to make a thorough examination of the condition of interurban railways relative to sanitation or dangerous equipment either in power house or rolling stock upon the road. Recent accidents have occasioned the commission to inquire into the causes of so many mishaps that have occasioned loss of life.

Officials of the Fort Wayne and Springfield Interurban Railway Company emphatically deny that there is any intention to sell the road to the Fort Wayne and Wabash Valley Traction Company.

The Louisville and Southern Indiana Railway and Lighting Company has secured a franchise to enter Louisville and is preparing to open its new service.

The Fort Wayne and Wabash Valley Traction Company has notified the City Council of Huntington that it will not accept of the franchise offered it to furnish the city with light and power because of the exaction of 10 per cent. of the gross earnings to be paid into the city treasury. The company says that it has built and equipped an immense power plant in Fort Wayne with a view of furnishing current for light and power purposes to all the surrounding towns and cities, and to agree to give 10 per cent. of its gross earnings would be a precedent which the company could not carry out. The people of Huntington are about equally divided on the proposition and a grant on more liberal terms may be offered.

The South Bend and Southern Michigan Traction Company has abandoned its power house at Scottsdale and entered into a contract with the Indiana and Michigan Electric Company of South Bend to furnish power for the operation of its line between South Bend and St. Joseph, Mich.

The commissioners of Marshall County have granted a franchise to the Indianapolis, Logansport and South Bend Railroad Company to construct an electric railway along the east side of the Michigan road through the county. The franchise is for 99 years, and provides that work must be begun within six months and the road completed by November 1, 1909. The City Council of Plymouth recently granted the company a franchise within the city.

The Indianapolis and Louisville Traction Company has completed its line through to Seymour, meeting the Indianapolis and Southern at that point. This furnishes trolley services between Indianapolis and Louisville. Through-car service will be put on the lines next week.

The Union Trust Company of Indianapolis has been appointed receiver for the Indianapolis, Newcastle and Toledo Railway Company and the Indianapolis-Newcastle Construction Company, practically one, now building a line between Indianapolis and Newcastle, and almost completed. The work of completing the line will go forward under jurisdiction of the court.

The Town Board of West Lafayette has granted a franchise to the Merchants' Electric Light Association for the construction and equipment of an electric-light plant. The franchise provides that the same rates shall be charged as are provided in the city of Lafayette.

The Zionsville Light and Power Company is completing the work of setting poles and stringing wires for electric lights along the streets and alleys of the city. The work of installing the plant will be finished in a few days.

A new electric-light plant has been completed and put in operation by a stock company in Clay City. The town has been in darkness since last May, at which time the electric-light plant was destroyed by an explosion. S. S.

Illinois.

Peoria, November 9.—The Illinois Traction Company has incorporated another electric railway under the name of the St. Louis and Staunton Railway Company, the principal office to be in Champaign. It is proposed to construct the line from Edwardsville, which is on the main line of the traction company, to a point near the city of Staunton.

The Illinois Traction Company will place two limited cars on the run between Springfield and Danville, commencing December 1st. The time allowed is four hours and 20 minutes. It is also the intention of the company to place an hourly car on the two runs between the city of Springfield and Peoria as well as on the Bloomington line. This schedule will be in effect by the first of the year.

The net earnings for the month of September of the Illinois Traction Company are reported as $157,027.97, compared with $126,774.16 for September, 1906.

James Magill, president of the Crescent Electric Manufacturing Company of Valpariso, Ind., was in Rock Island this week for the purpose of looking over the plant of the Trio Manufacturing Company with a view of consolidating the two concerns and establishing a large manufacturing plant in Rock Island to manufacture the goods made by both concerns.

The Improved Electric Railway Company of Jerseyville has been incorporated with a capital of $200,000 to manufacture and operate electrical appliances. Among the incorporators are S. L. Hill and William Embley.

At a meeting of the Corn Belt Traction Company John J. Pitts was elected president and J. A. Keenan of Leroy treasurer. It was announced that the sum of $200,000 was provided for the commencement of the building operations. The right-of-way has been secured with the exception of a few small stretches. V. N.

Oklahoma.

Oklahoma City, November 9.—The Oklahoma and Southwestern Interurban Electric Company has been chartered for $2,250,000 to build 190 miles of track from Oklahoma City to Hollis, in Greer County, across the counties of Oklahoma, Cleveland, Comanche and Greer, at a cost of $10,000 a mile. The incorporators are H. W. Curry of Eaton, Ohio; J. N. Street of Bloomington, Ill.; C. A. Swartz, J. P. Van Allen, S. W. Johnson, O. D. Reed and C. E. Richardson of Fredrick; Frank B. Lucas, Samuel Eckler, Jr., J. E. Woodworth and Thomas R. Clift of Guthrie.

The Johnstown Electric Company of Oklahoma City and Johnstown, Pa., has been incorporated with a capital stock of $50,000. The incorporators are John E. Mognet and Charles M. Moses of Johnstown, and E. V. Remington of Oklahoma City.

The Shadduck Electric Light Company has increased its capital stock from $3,000 to $15,000. The increase will be used to increase the plant. New machinery will be added as soon as arrangement can be made.

The Comanche Telephone Company of Chattanooga, Okla., has been chartered for $5,000, to build an exchange and rural lines. T. E. Hibbard and F. O. Hibbard of Snyder and W. S. White of Mountain Park are incorporators.

The Mustang Telephone Company has absorbed the Farmers' Mutual Telephone Company, and the following-named officers have been elected: President, Frank Dalton; vice-president, F. G. Dennis; secretary, R. C. Malroy. K.

Northwestern States.

Minneapolis, November 9.—Application has been made by the American Trust and Savings Bank of Chicago and others for a receiver for the Anoka Waterworks, Electric Light and Power Company.

It is proposed that the village buy the electric-light plant at Sherburn, Minn.

The Nevada (Iowa) Electric Company has sold its system to M. A. Harrison and H. H. Caughlan. Numerous improvements are contemplated.

Jos. E. Cummings of Duluth proposes to build a power plant near Littlefork, Minn.

A new electric-light plant will be installed at Papillion, Neb.

New machinery, including engine and dynamos, will be installed in the electric-light plant at Stewartville, Minn.

An electric-light franchise has just been granted to Jenkins & Forrest of Omaha, at Central City, Neb.

The Mitchell Illuminating and Power Company has incorporated with a capitalization of $100,000 and will build a $60,000 power plant at Mitchell, S. D. The Council is considering a franchise for the new concern. R.

Pacific Slope.

San Francisco, November 6.—The City Electric Company, backed by the Mack and Fleishhacker interests, has started up its new independent electric power plant on the water front of San Francisco at North Beach for a test run. By the middle of November it is expected that this company will begin supplying the United Railroads of San Francisco 4,000 kilowatts for the operation of electric cars. One of the street-railway company's large frequency-changers had to be installed at North Beach in order to permit of the delivery of current at 25 cycles to the high-tension wires of the railway system. An additional supply of power is greatly needed, as the quantity of current that is supplied by the Pacific Gas and Electric Company is still inadequate to operate the cars.

The City Electric Company's plant is installed in a fine reinforced-concrete power station with a salt-water supply from the bay for condensing purposes. The equipment includes two Westinghouse-Parsons turbo-generators with a capacity of 2,500 kilowatts each, supplying current at 11,000 volts, three-phase. Steam is supplied by Babcock & Wilcox boilers using fuel oil. Samuel Naphtaly is superintendent for the company. He also has general supervision of the hydro-electric transmission lines, in the interior of the state, controlled by the Fleishhacker interests. These include the Truckee River General Electric Company, which has two plants near Floriston, Cal., and the American River Electric Company, with a waterpower plant near Placerville and a steam reserve plant of moderate capacity. With the opening of the San Francisco installation for commercial business the city will have the first genuine competition in electric lighting that it has enjoyed for three years, and the new system starts out with a full load of a desirable character.

The Los Angeles Board of Works has been authorized to institute legal proceedings to condemn a right-of-way along the line of the Los Angeles aqueduct for a municipal railway. As the big conduit is to be over 200 miles in length, the project may become important.

Bids will be received by the San Bernardino County (Cal.) Board of Supervisors up to November 25th for a franchise to erect poles and string wires for the transmission of electricity for heat and power on certain streets.

The power house at Satacon, Ariz., the Indian agency, was recently destroyed by fire.

Work will begin in a few days on a transmission line between Redlands and San Bernardino, Cal., for the Home Gas and Electric Company. The company will supply Coulton and Rialto, in addition to the other towns.

A power plant is planned to furnish electric power for the various mining companies in the vicinity of Wickenburg, Ariz.

It is reported that C. A. Lunceford, who promoted the Adams County electric railway in the state of Washington, has organized a corporation with a capital of $10,000,000 to build an electric railway from Spokane, Wash., to the Columbia River.

The Cascade Public Service Company, believed to be backed by the Pacific Traction Company, has commenced condemnation proceedings against the property of the Nisqually Power Company for valuable water rights on the Nisqually River near Olympia, Wash. The company contemplates the appropriation of 1,500 cubic feet of water a second for the generation of electric power.

Manager Buck of the Union Construction Company, which has been putting up the plant and wire lines of the Stanislaus Power and Water Company in Tuolumne and Caleveras counties, Cal., but was compelled to cease operation last week, owing to the failure of the Knickerbocker Trust Company of New York, announces that the corporation expects to resume work on the power system within 30 days. Up to date good headway has been made on the new line, which will run through San Joaquin County and into San Francisco. Most of the right-of-way has already been secured, and agents are now working in Contra Costa County.

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PERSONAL.

Mr. M. A. Doty has been made president of the Electric Light and Power Company of Munising, Mich.

Sir Oliver Lodge has accepted the presidency of the Faraday Society in succession to the late Sir William Perkin.

Dr. Thomas B. Shumway, president of the Plymouth and Middleboro Street Railway Company, died at his home in Plymouth, Mass., on November 5th.

Mr. Angus S. Hibbard, vice-president and general manager of the Chicago Telephone Company, returned from an extended European tour last week.

Mr. J. Scribner, the manager of the lighting department of the Chicago office of the General Electric Company, has an article on "The Local Office" in the General Electric Review for November.

Mr. W. L. Dry, formerly chief electrician of the Citizens' Electric Company of Eureka Springs, Ark., has been appointed superintendent of the properties.

Mr. H. W. Hillman, of Schenectady "electric-house" fame and author of "Looking Forward," is now commercial manager of the Grand Rapids-Muskegon Power Company.

The first meeting of the stockholders of the Macon (Ga.) Electric Railway and Light Company, recently held, created the office of second vice-president, and Mr. M. F. Hatcher was designated to the position.

Mr. Arthur J. Lembeck, assistant city electrician of Sioux City, Iowa, has resigned to take a position with one of the railroads. The board of commissioners will hold an examination among applicants to fill the position.

Mr. C. G. DuBois, late secretary of the Western Electric Company, Chicago, is now comptroller of the American Telephone and Telegraph Company, Boston. He was succeeded by Mr. H. A. Halligan, the present secretary of the Western Electric Company.

The following-named associates of the American Institute of Electrical Engineers were last week transferred to the grade of member: Clifford Wayne Humphrey, Chicago; Robert Carr Lanphier, Springfield, Ill.; Albert Gustav Wessling, Cincinnati; William Nelson Smith, New York; Charles Ezra Scribner, Chicago; Kempster B. Miller, Chicago.

The Milwaukee News says that Prof. Charles F. Burgess of the University of Wisconsin was in Milwaukee last week making arrangements for the work of valuing the public-utility plants of the city. Professor Burgess is one of a commission of experts which has been engaged to value the plants of the gas and electric companies of the state for the use of the state railway commission.

Mayor Tom L. Johnson of Cleveland, Ohio, was re-elected for the fourth time as mayor of Cleveland last week. Mr. Johnson is one of the leading municipal-ownership advocates of the country. His campaign was conducted on a platform promising three-cent single fares on street cars. His opponent, Congressman Theodore E. Burton, who also promised reduced fares, is an expert in political economy, who has achieved an enviable reputation as an authority on banking and on other commercial practice. His defeat is attributed by some to the erroneous idea of many of the voters that he was in some way connected with the public-utility corporations. The vote was 48,339 for Johnson and 39,026 for Burton.

Mr. H. L. Hibbard, electrical expert to the Bureau of Construction and Repair, United States Navy Department, has resigned that position to enter the service of the Cutler-Hammer Manufacturing Company of Milwaukee, maker of electric controlling devices. Mr. Hibbard's experience in navy-yard and shipboard work extends over a period of eight years, four of which were spent in the office of the superintending naval constructor at Newport News, in supervising installations of electrical apparatus on ships built and equipped at that yard. More recently Mr. Hibbard has been stationed at Washington, where, as electrical expert to the Bureau of Construction and Repair, he has had supervision of all electrical work coming under the cognizance of that bureau. In his new position with the Cutler-Hammer company his knowledge of Navy Department requirements and methods will undoubtedly be of great value in the extension of that company's line of electric controlling panels for navy-yard and shipboard use.

Mr. W. Edgar Reed, electrical engineer, formerly with the Westinghouse interests, for some time in Paris, and for a considerable time at East Pittsburg, has opened an office for general consulting work in the Machesney Building, Pittsburg. Mr. Reed entered the service of the Westinghouse Electric and Manufacturing Company in 1891 as an engineering apprentice. Upon finishing in the Westinghouse works he took a course in the Massachusetts Institute of Technology, from which he was graduated in 1897. Later he took a post-graduate course in Paris at the laboratory of the late Prof. Henri Moissan. Following this Mr. Reed became connected with the French Westinghouse Company at Havre, France, filling the position of chief designing engineer from 1898 to 1903. In 1903 Mr. Reed came to Pittsburg, filling the position of designing engineer for the French and American Westinghouse companies, which position he has filled up to this time. He has had long experience in designing both continuous and alternating-current machinery, and has also had much experience in the practical applications of such machinery. Mr. Reed is a member of the American Institute of Electrical Engineers and also of the Engineers' Society of Western Pennsylvania.

ELECTRIC LIGHTING.

Maysville, Mo., proposes to issue electric-light bonds to the amount of $10,000.

Bonds to the amount of $25,000 are proposed for Pratt, Kan., to install an electric-light plant.

The city of McKinney, Tex., proposes to expend $8,000 on the extension of its electric-lighting system.

O. G. Adams and associates of Sulphur, I. T., will develop the Mystic Cave, and will light it with electricity generated from a waterfall within the cave.

James Bright has obtained a franchise for supplying Steelville, Mo., with electricity for street lighting. He will generate the electricity at the Evans Mill, one mile east of Steelville.

Earl C. Westcott has been placed in charge of the electric-light plant in Plymouth, Neb., and will operate it until arrangements can be made to secure light from Omaha.

The electric power plant at New Pinecreek, Ore., owned by the California-Oregon Light, Heat and Power Company, was destroyed by fire last month, the loss being total.

The Common Council of Owosso, Mich., is said to be considering the matter of discontinuing some of the street arc lamps and substituting for each four or five incandescent lamps placed much lower.

George L. Rose of Tecumseh, Okla., is among the stockholders of a new company organized in Shawnee, Okla., for the purpose of putting in an electric-light plant and telephone system in Shawnee and Tecumseh.

The formal incorporation of the new electric-lighting plant at Thomasville, N. C., has been perfected under the name of the Thomasville Light and Power Company. J. W. Lambert and associates are the incorporators.

Messrs. C. E. Hamilton, J. S. Lewis and L. R. Harrington have incorporated as the Citizens' Water, Light and Power Company, Carbondale, Ill. The company is capitalized at $75,000 and proposes to operate a public-utility plant.

The City Cedar Mills, Lebanon, Tenn., have been awarded a 10-year contract to supply lights and current for the town. The company will also sell power at four cents a kilowatt-hour, the city to receive two per cent. on the gross income.

Gen. R. A. Ayers of Big Stone Gap, Va., has purchased the electric plant at that point which supplies electricity to Big Stone Gap and Appalachia, Va. The concern will be operated under the name of the Powell Valley Power Company.

An agreement has been reached between the city of Green Bay, Wis., and the Green Bay Gas and Electric Company regarding the price of street lighting. The city will pay $70 for arc lights unless the state rate commission changes the rate, the price fixed by the commission to be accepted by both parties.

The light committee of the Council of Kansas City, Mo., proposes a new ordinance which will contain a provision for the appointment of a supervisor of street lights at a salary of $150 a month, whose duty it will be to determine if the gas and electric-light companies are complying with the provisions of their contracts and to determine on the utility and economy of the lights to be installed from time to time.

Some time ago the city of Kirkwood, Mo., was reported to have shut down its electric-light plant, in connection with which Mayor Ochterbeck is quoted as follows: "Our plant was built about the year 1901, and on account of its being a municipal matter the city did not get an up-to-date plant and is today suffering from having a plant that does not meet the requirements, and the cost of production is too high; consequently it does not pay the city if we take into consideration depreciation and the interest on our investment."

The Muncie (Ind.) Star of recent date says: "Martinsville, Ind., is fortunate in having such an ably managed corporation as the Martinsville Light, Heat, Power and Water Company. In strong contrast to the usual grasping monopolies this corporation has first considered the real wants of the citizens and then supplied those wants both copiously and economically. There is not one discordant note and all have only words of the highest praise for the service it renders. The corporation has one of the most extensive and best-equipped plants in the West. Clemins Blank, manager and secretary of the company, is a man of wide experience, and has fully demonstrated his ability to successfully cater to the wants of the people of Martinsville."

The Dearborn Street Improvement Association of Chicago has decided to use flaming arc lamps for the illumination of Dearborn Street from Van Buren to the Chicago River. The lamp post will probably be of the gooseneck pattern, carrying the lamp about 20 feet above the pavement. It is planned to install 156 of these lamps, the first cost to be met by property owners on a frontage basis. The lighting committee of the association, of which Alderman Francis Taylor is chairman, expects that the city will pay toward maintenance an amount equal to what it would cost properly to light the street and the cost of the extra illumination will be borne by the association, the city to furnish the current. Property owners in several other streets have organized and may also use the flaming arc.

ELECTRIC RAILWAYS.

An extension of its electric railway from Crete to Kankakee, Ill., recently completed by the Chicago and Southern Traction Company, has been opened for general passenger traffic.

The South Side Elevated Railway of Chicago has substituted plainly lettered boards for the colored disks which were used for a time to indicate the nature and destination of trains. Patrons complained of not being able readily to decipher the red, green and yellow disk signals.

Construction of the first street railway in Annapolis, Md., has begun. The work is being done by the Washington, Baltimore and Annapolis Electric Railway Company, which is building a modern electric railway between Baltimore and Washington, with a branch to Annapolis.

The Chicago and Southern Traction Company, which took over and extended the old Chicago Electric Traction lines, has opened through service to Kankakee. Beginning November 10th through cars leave Halsted and Seventy-ninth streets every hour and 30 minutes, beginning at 7:28 a. m.

The Connecticut Company has been experimenting with a new-style combination trolley car and automobile. The idea is to use the car tracks as far as possible and then run off the tracks to the exact destination. The experiments so far are said to have been successful, and it is possible that such a vehicle will be used for the company's express business.

The Woodstock, Marengo and Sycamore Electric Railway Company of Chicago has been licensed to incorporate with a nominal stock of $25,000. A road is authorized from Woodstock, Ill., through McHenry and De Kalb counties to Sycamore, Ill. The incorporators and directors are Charles A. Spenny, Edward B. Harang, M. W. Powell, H. S. Hedberg and E. C. Spinney.

An interesting feature in the annual statement of the Spokane and Inland Empire Electric Railway Company covers the physical characteristics of the portion of the road in the state of Washington. This shows that on 102 miles there is an aggregate of 280 curves, 50 ascending and 36 descending grades, and about 66 miles of absolutely straight track and 21 miles of level track.

The Chicago and Milwaukee Electric Railroad Company's cars are now making regular stops at the new Lake Forest station. The depot is the finest architecturally along the company's line, and is said to be one of the handsomest structures of its kind used by an electric railway. It is of dark vitrified brick and light stone and has an arcade supported by large white pillars at either end. It is in the center of a small park.

Construction of an interurban electric railway from Chicago to Lake Geneva, with branches to Fox Lake and Woodstock, is announced as the purpose of a $2,000,000 Chicago corporation, licensed a few days ago. The concern is called the Chicago, Fox Lake and Lake Geneva Railroad Company. The incorporators and first board of directors are George M. Seward, Sidney F. Mallette, Lewis E. Starr, Maurice B. Louis and Harry Y. Yaryan.

The Spokane and Inland Electric Railway Company will begin an extension of its road to Lewiston and Clarkston next spring, it is said. The route followed will be down the Steptoe Canyon, reaching the Snake River nine miles below Lewiston. From that point the road will parallel the Oregon Railway and Navigation Company's line up the river to the mouth of Dry Gulch, where it will cross the river at Clarkston, thence, by means of a high bridge, again cross the river to Lewiston.

POWER TRANSMISSION.

Joseph Dworack, an ingenious farmer living near Scotland, S. D., has a farm on a creek which has a good volume of water, and he decided to make use of the power the stream afforded. He accordingly built an undershot wheel that will develop 10 horsepower. The wheel is used to operate a corn grinder, circular saw and cream separator. The power is more than ample for this purpose, and it is the intention of Mr. Dworack to procure a generator and install an electric-light plant.

Articles of incorporation of the Fort Wayne (Ind.) Power Company have been filed. The directors are Frank H. Cutshall, Frederick H. Schmidt, Arthur Mohr, Frederick Scheiman and Samuel Morris, Jr. The company is formed to take over the feeder canal and waterpower recently purchased by the Fort Wayne and Wabash Valley Traction Company. It is said that the dam in St. Joe River at Robison Park will be rebuilt for this waterpower.

The Allen-Lantz navigability bill, which officially declares the Desplaines and Illinois rivers to be navigable, was passed by the Illinois Senate, as stated in the Western Electrician last week, without the emergency clause. This clause was attached in order at once to put a stop to the construction of a dam by a private company in the Desplaines River. The lower house did not concur in the action of the Senate, and now Governor Deneen will demand that the Senate pass the bill with the emergency clause. If this action is not taken it is said that the governor will institute legal proceedings to stop the work now in progress. The governor believes that the completion of the plant now in course of construction would be a menace to the proposed deep-waterway project, and will try to keep all obstructions out of the river.

The largest steam electric plant in the South will be constructed by the Southern Power Company at Spartanburg, S. C., developing 50,000 horsepower. This plant will cost approximately $2,000,000, and will be built in sections according to the needs, work to be started late in 1908. The company, with its $10,000,000 capital, and the 300 cotton mills as possible customers, proposes to supply power all the year regardless of the flow of streams, and the Spartanburg steam plant is designed to fill in any deficiency that may be experienced in the three or four months of comparatively dry weather sometimes known. There are 10 power sites on the Catawba River, two of which have been developed, and two are under process of development, and when the 10 are completed various estimates put the resulting horsepower at from 200,000 to 250,000. About 100,000 is now finished or under way.

RADIO-TELEGRAPHY.

An Ashland (Wis.) concern is planning the erection of a wireless-telegraph system to connect Ashland and Madeline Island in the Apostle group. It is expected to have two stations in working order early next spring. The promoters of the plan also have in view the establishment of a life-saving station on one of the islands.

The German government's new wireless telegraph station at Tsingtau, China, is on top of the Diederichs Hill, 328 feet high, next to the signal station. The square-towered building of the signal station as well as the nearby mast of the wireless apparatus are easily recognized a long distance out at sea. The system in use is telefunken, of Slaby-Arco, with a mast and counterweight, the distance of activity being about 100 nautical miles. The direction of the main wave activity is southeast; however, the directions from east to south are fully free. The station is the property of the Kiaochow government and is used to communicate with men-of-war of the German navy, but will be thrown open for general public use before long on conditions which have not as yet been determined.

PUBLICATIONS.

The Jeffrey Manufacturing Company of Columbus, Ohio, has just issued catalogue D, which illustrates and goes exhaustively into the subject of coal and ash-handling machinery for power plants. This is a subject of much importance to operators of central stations and industrial establishments, to whom the new catalogue should prove of interest.

The Sandusky Foundry and Machine Company of Sandusky, Ohio, has just issued a well-illustrated catalogue showing and describing in detail the company's line of single-acting triplex pumps and other paper-mill specialties. This catalogue does not go into the subject of high-pressure machines and double-acting machines made by this company.

The Cutler-Hammer Clutch Company of Milwaukee is about to issue a handsome and well-illustrated booklet on "Lifting Magnets," advance copies of which have been received. After several years of quiet preparation the company is now in readiness to fill orders for lifting magnets, and this new and interesting publication tells all about these twentieth-century devices.

The November bargain sheet showing the complete stock of the Gregory Electric Company is larger than ever. The works of this pioneer electrical bargain house are located at the corner of Sixteenth and Lincoln streets, Chicago, where a large stock of machines, apparatus and repairs can be found. A new price list on Excelsior carbon brushes has just been issued.

The Dean Electric Company of Elyria, Ohio, manufacturer of modern telephones and telephone apparatus has just issued a booklet entitled "An Independent Telephone Plant." In it the personnel and product of this enterprising company are given attention, also the events which led up to the establishing of this thriving industry. The booklet will be of interest to all telephone men.

The Century Electric Company of St. Louis, having confined its efforts to the manufacture of single-phase motors only, feels that it has been successful in developing this type of machine to the highest point of quality, and as a result it has several times been necessary to increase the factory equipment to meet the demand. The company has just issued bulletin No. 9, covering Century single-phase self-starting alternating-current motors, which will be of interest to those in need of standard or special-design motors.

Chase-Shawmut Company, Newburyport, Mass., has recently issued bulletin and price list No. 101, descriptive of the company's stage-lighting appliances. It is convenient in form and clear in its information and will be found of distinct service to all interested in these matters. The bulletin is a continuation of a series of bulletins this company is now getting out, bulletin No. 100 having recently been issued, covering National Electrical Code fuses, cut-outs and fittings, railway cut-out boxes, pocket test lamps, etc.

SOCIETIES AND SCHOOLS.

The November meeting of the Central Electric Railway Association will be held in the Claypool Hotel, Indianapolis, on November 21st. Among the papers to be read is one by Albert Herrick of New York on the subject of "The Analysis of the Cost and Methods of Electric-railway Maintenance."

Vol. XXV. of the Transactions of the American Institute of Electrical Engineers has just been published in the usual substantial book form. The book contains the papers read at the various Institute meetings during the year 1906, together with the discussions. Lists of officers, members and other information are given.

November meetings of committees of the National Fire Protection Association will be held at the New York office of the association, 29 West Thirty-ninth Street, as follows: Executive committee, November 19th; committee on automatic sprinklers, November 20th; committee on devices and materials, November 21st and 22d.

MISCELLANEOUS.

The St. Louis (Mo.) Electric Heating Company has been incorporated with a capital stock of $10,000.

The Sewerage Commission, Charleston, S. C., has decided to install an electric pump as an experiment in lieu of the compressed-air pump. The system may be eventually extended over the entire city.

The fine Pittsburg (Kan.) shops of the Kansas City Southern Railway Company, designed and constructed by The Arnold Company, have recently been completed and are up-to-date in every way.

Black Bros. of Beatrice, Neb., have increased the size of their flumes and waterwheels in their flour mill in order to take care of the new electric plant, which will be used for lighting the mill and bleaching the flour.

Electric horse clippers are giving excellent service in stables in New York and elsewhere. Two horses can be clipped at the same time, and the cost of operation is said to amount to about one cent per horse. The electric groomer is in every way as satisfactory as the clipper. A satiny gloss is put upon a horse's coat in a fraction of the time required to do it by hand.

TRADE NEWS.

A neat leather and metal watch fob, being a representation of a cluster of eight incandescent lamps—the Buckeye kind—is issued as a souvenir by the Buckeye Electric Company of Cleveland.

The Illinois Battery Company of Freeport, Ill., has been incorporated with a capital of $10,000, the purpose being to manufacture and sell electrical devices. The incorporators are W. F. Bergman, J. G. Finkbiner and D. N. Byers.

W. H. Fowler of Pella, Iowa, writes that he is about to install an electric-lighting plant and will be in the market for a complete installation consisting of engines and boilers, a 60-kilowatt dynamo and a 100-kilowatt dynamo, and an incandescent lighting outfit for streets.

BUSINESS.

The Douglas Electric Construction Company of New Orleans has been incorporated with a capital of $25,000, by Roydan R. Douglas and others.

James S. Barron & Co., 200-206 West Broadway, New York, call attention to the H-P rustless cable hanger for telephone and telegraph cables. This hanger, made in one piece entirely of zinc, is quickly applied and holds fast. There are no loose parts to set up electrolytic action, rust out and allow the cable to get loose. A wrap of 1¼-inch tape affords insulation, protection against mechanical injury and insures a rigid grip of cable.

Chas. A. Stevens & Brothers, the well-known dry-goods firm on State Street, Chicago, have placed an order for Nernst lamps for the lighting of their second and third floors. The Board of Education of Chicago has contracted with the Nernst Lamp Company for 288 three-glower lamps and fixtures for the lighting of the assembly halls of the various school buildings. Armour & Co. have contracted with the Nernst Lamp Company for 1,042 glower units of Nernst lamps for the lighting of the new administration building at the Union Stock Yards, Chicago.

Concerning the injunction secured by the General Electric Company against the city of Nashville preventing the use of certain electric generators manufactured by the Bullock Electric Manufacturing Company, Allis-Chalmers Company says that some of the reports appearing in the press were misleading, and it states the case as follows: "A motion for preliminary injunction was filed by the General Electric Company against the city of Nashville, alleging infringement of the Parcelle patent. This patent, which has but a few months more to run, covers very specifically a mechanical device for fastening the laminated pole-pieces of a dynamo-electric machine in position on the frame. This construction was employed in a few machines manufactured several years ago by the Bullock Electric Manufacturing Company, before its affiliation with Allis-Chalmers Company, but has since been abandoned for a better device. The city of Nashville was given 60 days from the date of the court's order within which to make the necessary changes to avoid infringement. The simple changes required were readily made by Allis-Chalmers Company, within the time specified, in such a manner that the operation of the plant was not interfered with."

ILLUSTRATED ELECTRICAL PATENT RECORD.

Issued (United States Patent Office) November 5, 1907.

869,873. Insulator. Duncan M. Bass, Fackler, Ala. Application filed June 17, 1907.

This insulator comprises a bracket with longitudinal slits and open spaces into which the slits extend, wire-holding members in the bracket, and a cap for closing the end of the bracket and restricting the slits.

869,914. Electric Arc Lamp. George M. Lane, Lanoka, N. J., assignor of one-third to Orian F. Lane and one-third to Daniel S. Holmes, Forked River, N. J. Application filed March 24, 1905.

The part of the lamp patented is a plate with an opening for the movable electrode that has a ring surrounding the opening, within which is a sleeve provided with slots at diametrically opposite points. At the inner ends of the slots are pivoted dogs with their ends notched to snugly receive the movable electrodes.

869,934. Dynamo-electric Machinery. Charles A. Parsons and John H. Armstrong, Newcastle-upon-Tyne, England; said Armstrong assignor to said Parsons. Application filed February 10, 1906.

A construction for field poles is covered, which provides means for fixing the winding to the pole pieces comprising grooves in the face of the pole pieces parallel to the axis of the machine, flanged elements of magnetic material fitting into the grooves, projections on these elements, clamping pieces fitting over the projections, and means for attaching the clamping pieces to the machine.

869,943. Alternating-current Motor Controller. August Sundh, Yonkers, N. Y., assignor to the Otis Elevator Company, Jersey City, N. J. Application filed December 18, 1905.

The rotor of the induction motor has a set of sectional resistances connected to it in starting. Electromagnetic switches that are restrained by dash pots are arranged to cut out the starting resistances step by step so as to produce a uniform acceleration of the motor.

869,955. Switch for Trolley Wires. Frank M. Zimmerman, Aurora, Ill. Application filed October 23, 1905.

This switch for main and divergent trolley wires has suspended switchblades movable laterally and in the same direction at their lower edges. The trolley wheel closes one of these blades to the main wire when going in either direction.

869,970. Railway Signal and Safety Appliance. Charles J. Kintner, New York, N. Y. Application filed August 10, 1905. Renewed January 18, 1907.

The semaphore arm has one danger and two clear positions, indicating whether the switch is set for main or side track. A reversible electric motor operates the arm and is controlled by track circuits. Controlling devices are carried by a car or train that are actuated so as to stop the train when the signal is in danger position.

869,973. Telephone-supporting Apparatus. William B. Lehmkuhl, Cambridge, Mass. Application filed May 9, 1906.

This is a support for a desk telephone and consists of two arms pivoted together, one of them having a ratchet wheel and the other a pawl co-operating therewith. When pushed out of the way the arms stand vertical. The telephone is pivotally mounted on the end of the moving arm.

870,012. Electromagnetic Press. John P. Buckley, New York, N. Y. Application filed April 19, 1907.

A shaping press has a stationary die carrying electromagnets, a counterbalanced movable die carrying armatures for the magnets, and electromagnetic means for bringing the movable die into the field of the electromagnets.

870,015. Storage Battery. Joseph C. Cook and Edward Sokal, Buffalo, N. Y.; said Sokal assignor to said Cook. Application filed May 10, 1905.

This plate for storage batteries has a large number of closely arranged pinlike projections forming a relatively large superficial area. Paste is applied to the base of the projections and this paste is formed by the Faure process. When the plate is put in service the superficial exposed area is formed by the Planté action.

870,024. Apparatus for Producing Perforated Strips. Thomas A. Edison Llewellyn Park, Orange, N. J., assignor to the Edison Storage Battery Company, West Orange, N. J. Application filed March 24, 1905.

This machine consists of a pair of co-operating perforating rolls, between which a strip of material of greater width than the rolls is fed. This strip is pressed against a guide and run between cutting edges that separate the perforated and unperforated parts, which are then separately wound on reels.

870,029. System of Motor Control. Jay H. Hall, Cleveland, Ohio, assignor to the Electric Controller and Supply Company, Cleveland, Ohio. Application filed March 19, 1906.

The system comprises a motor, a main magnetically operated switch and a magnetically controlled reversing mechanism therefor, a master controller, a connecting wire from the master controller to the reversing mechanism, and means whereby the circuit through this wire is broken on the closure of the main switch and remains broken as long as the main switch is closed and remains closed as long as the main switch is open.

870,035. Dynamo-electric Machine. Dugald C. Jackson, Madison, Wis. Application filed December 22, 1902.

The armature of an alternating-current motor has a short-circuited and a commutated winding, the latter being connected to a commutator comprising an integral ring conductor of high resistance. Brushes engaging the commutator connect to an auxiliary field winding.

870,042. Resistance-adjusting Device. Hector P. MacLagan, Chicago, Ill., assignor to the National Rheostat Company, Chicago, Ill. Application filed October 11, 1905.

A cylindrical mounting block has secured to it a cylindrical shell upon which is wound continuously a resistance winding to form transverse coils whose upper edges are disposed to form a circular contact edge. A rotating contact lever, pivoted at the center, engages the contact edges of the resistance coils.

870,068. Fire Alarm. Robert M. Whipple, Mayfield, Idaho. Application filed June 19, 1907.

A tube has a bulb at its base and both contain a conducting liquid, such as mercury. A terminal projects into the bulb and another extends to near the upper surface of the liquid. Abnormal heating expands the liquid and thus closes an alarm circuit.

870,078. Electric Switching Apparatus and Controlling Apparatus Therefor. Alfred Blackmore, Kensington, London, England. Application filed April 2, 1906.

A local circuit containing in series a relay and electromagnetic tripping devices can be closed from a number of positions so as to operate these devices simultaneously and thus cause a motor to open or close any desired main switch.

870,080. Trolley Wheel. Charles P. Bostian and Homer C. Bostian, Milton, Pa., assignors of one-third to Harry R. Frick, Milton, Pa. Application filed July 15, 1907.

The trolley harp has a base and two side plates, one of which is hinged to the base and held in position by a latch. These plates support the axle of the trolley wheel in ball bearings. The wheel has teeth for engaging the wire to remove ice and sleet therefrom and a ratchet to engage a pawl on the harp so as to prevent rotation of the wheel.

870,102. Electric Signaling Apparatus. Felix B. Herzog, New York, N. Y. Application filed July 12, 1889.

This is a call-box telegraph which has a call-answering signal, an electromagnet energized only when the signal is moved to inoperative position and adapted to hold the signal inoperative until released, when the magnet is de-energized, and means for moving the signal to inoperative position by the sending of calls.

870,115. Car Loader. Wilbur S. Mayers, Fairmont, W. Va., assignor to the Fairmont Box Car Loader Company, Fairmont, W. Va. Application filed October 9, 1905.

This machine is designed for loading coal into box cars. A rotary shovel mounted in a casing distributes the coal in the car. A shaft is provided for this shovel and one for adjusting the casing. A motor is connected to these shafts through controllable power-transmitting means.

870,139. Track Relay. John D. Taylor, Swissvale, Pa., assignor to the Union Switch and Signal Company, Swissvale, Pa. Application filed April 18, 1907.

A frequency relay contains an induction motor and a centrifugal device actuating a contact-making device for closing a signal circuit when the speed of rotation corresponds to the frequency of the track-circuit current.

870,141. Automatic Starting Device for Alternating-current Vapor Lamps. Carl H. Vom Baur, New York, N. Y. Application filed April 16, 1907.

This device provides a pair of auxiliary electrodes at one end of the tube, between which an arc is struck by the rocking of the tube, which is done by a magnet whose armature is mechanically connected to the tube. This electromagnet and the auxiliary arc are in circuit only at starting.

870,145. Electric Signaling System for Railways. Harry J. Warthen, Washington, D. C., assignor of one-third to Andrew J. Hurley and one-third to Walter A. Reiss, Washington, D. C. Application filed January 18, 1907.

This system comprises a third rail having resistances therein, a shoe on the train having contact therewith, differently colored lights on the engine, a recording device having similarly colored markers in circuit, one with each corresponding light, and an audible signal in circuit with the red light.

870,147. Multiple-unit Controlling System for Electric Locomotives or Motor Cars. Ragnar Wikander, Westeras, Sweden. Application filed January 5, 1907.

This system consists of transformers supplying the motor-units, a number of switches for regulating the voltages supplied to the motor-units from the transformers, a number of circuits controlling the switches, and means for changing the connections between the switches and the controlling circuits.

870,149. System of Electrical Distribution. Joseph L. Woodbridge, Philadelphia, Pa. Application filed April 19, 1905.

In this system an alternating-current source supplies energy for both alternating-current and direct-current distributing lines. The latter contain a storage battery and booster and they are connected to the source through a rotary converter. The booster controller is an induction machine with fixed primary and secondary windings, the first connected to the alternating-current supply and furnishing a rotary field, the second having a commutator about which brushes are revolved by a synchronous motor. One set of these brushes connects to the direct-current line and the other to the booster field.

870,150. System of Electrical Distribution. Joseph L. Woodbridge, Philadelphia, Pa. Application filed May 21, 1907.

This system provides apparatus for connecting and controlling a regulating storage battery to an alternating current circuit. The apparatus consists of a rotary converter, booster and two special exciters driven by a synchronous motor.

870,155. Electric Popcorn Machine. William H. Bean, Gadsden, Ala. Application filed November 26, 1906.

An electric heater is used for heating a pan. A motor is mounted on top of the casing and is geared to a vertical shaft carrying on its lower end a stirrer that operates in the pan.

870,166. Electric Clutch. Noah S. Harter, Waukegan, Ill., assignor to the American Steel and Wire Company, Worcester, Mass. Application filed June 25, 1907.

In this clutch the driving member carries friction straps adapted to engage the driven member. An electromagnetic coil is mounted in a stationary ring surrounding the driven shaft and actuates armatures which draw the friction straps so as to join the shafts.

870,168. Intercommunicating Telephone. William W. Henry, Wollaston, Mass., assignor to Samuel H. Couch, Boston, Mass. Application filed September 17, 1906.

This telephone comprises a bell movement, induction coil, receiver switch, a switch adapted to progressively close the talking and ringing circuits through the operation of a lever, and automatic locking means attached to the lever for maintaining the talking circuit.

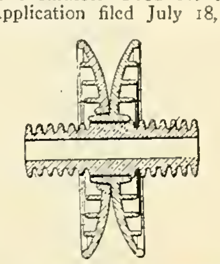
870,169. Apparatus for Making Rail Bonds. Albert B. Herrick, Ridgewood, N. J., assignor to the Electric Railway Improvement Company, Cleveland, Ohio. Application filed May 5, 1904.

A block is provided with a raised boss of substantially elliptical outline about which a conductor is adapted to be wound, and a transverse slot dividing the boss into two similar parts.

870,175. Car Loader. John H. Huhn, Fairmont, W. Va., assignor to the Fairmont Box Car Loader Company, Fairmont, W. Va. Application filed October 14, 1905.

This patent covers further details of the machine mentioned in No. 870,115 noted above. The motor is mounted on a carriage adapted to move forward and backward.

870,187. Wall Insulator. Fred M. Locke, Victor, N. Y. Application filed July 18, 1907.



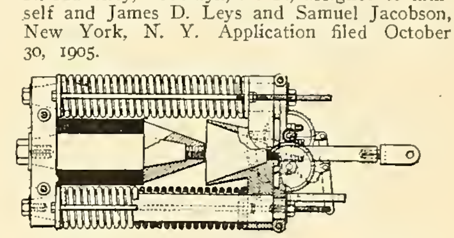
NO. 870,187.—WALL INSULATOR.

A wall insulator comprises an entrance tube and a pair of concavo-convex disks surrounding the tube and each provided with a series of concentric annular flanges projecting from their concave faces. (See cut.)

870,188. Brake for Vehicles. Joseph N. Mahoney, Brooklyn, N. Y., assignor to himself and James D. Leys and Samuel Jacobson, New York, N. Y. Application filed June 2, 1905.

An electric motor under the control of the motorman is arranged to increase the tension of the brake spring. Electromagnetic retaining devices maintain this increased tension. These devices are also controlled from the brake controller and when released permit the application of the brakes.

870,189. Brake for Power-driven Vehicles. Joseph N. Mahoney, Brooklyn, N. Y., assignor to himself and James D. Leys and Samuel Jacobson, New York, N. Y. Application filed October 30, 1905.



NO. 870,189.—BRAKE FOR POWER-DRIVEN VEHICLES.

This patent covers a brake similar to the previous one. The feature about these brakes is that they are applied by a spring and released by a motor acting on this spring. (See cut.)

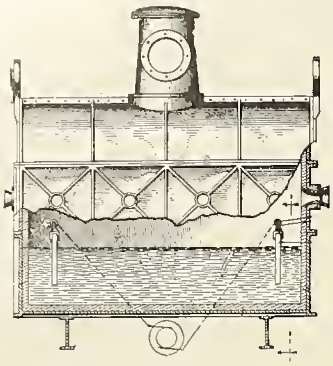
870,198. Electrical Horn. William E. Russell, Danbury, Conn. Application filed September 28, 1906.

The horn comprises a diaphragm, a magnet, a circuit-breaker and connections intermediate the diaphragm and circuit-breaker for imparting movements from the diaphragm to the breaker.

870,205. Engine Valve-setting Device. Robert E. Stephenson, Indianapolis, Ind. Application filed September 29, 1905.

A means for indicating the position of the valve of an engine consists of a recording instrument capable of producing a record on a part connected with the valve, electrically controlled means for actuating the recording instrument, and means operated by the piston for actuating the electrically controlled means at the ends of the stroke of the piston.

870,211. Evaporator. Edward Zaremba, Chicago, Ill. Application filed March 12, 1906.



NO. 870,211.—EVAPORATOR.

An apparatus for evaporating corrosive liquors comprises a suitable receptacle, a non-conducting, refractory lining therefor, non-corrodible electrodes which extend below the designed liquid level and electrical conductors connected to the electrodes and supported entirely above the liquor level. (See cut.)

870,214. Coin-counting, Registering and Bagging Machine. Charles S. Batdorf, Brooklyn, N. Y., assignor to the Universal Coinwrapping Machine Company. Application filed January 12, 1904.

There is in combination a coin conductor, means for advancing coins received therefrom, means for registering the advance of the coins, a motor circuit including a switch lever, a trip device on the register, and a connection from the switch lever having one end disposed in the range of action of the trip, means whereby the switch is operated to interrupt the motor circuit and stop the machine by the advance of a final coin of a predetermined number of coins.

870,232. Signaling Device for Railways. George S. Getchell, Los Angeles, Cal. Application filed January 24, 1907.

The signal consists of a series of track contacts adapted to be operated by passing trains and a number of groups of signals arranged along the track, each one of the contacts being connected to one signal in all the groups and the signals connected to each of the contacts being distinguishable from the signals connected to the other contacts.

870,233. Process of Manufacturing Reflector Incandescent Lamps. Howard Gilmore, Brookline, Mass. Application filed August 16, 1905. Renewed May 29, 1907.

This process applies to lamps with reflectors that are curled and inserted through the neck of the bulb. The successive steps are: Restoring reflector to normal position, inserting filament stem and connected parts through the neck and aperture in reflector, rotating bulb till stem drops into neck, leaving reflector and stem in position for securing in place.

870,253. Electric Compensator. Edmund O. Schweitzer, Chicago, Ill., assignor of one-half to John J. Schayer, Chicago, Ill. Original application filed December 14, 1903. Divided and this application filed November 2, 1904.

A temperature compensator for measuring instruments and similar circuits contains a conductor with negative temperature coefficient, which decreases in resistance while the copper portion increases in resistance with increased temperatures, thus maintaining the resultant resistance of the circuit constant.

870,262. Therapeutic Lamp. Julius B. Wantz, Chicago, Ill., assignor to the Victor Electric Company, Chicago, Ill. Application filed March 9, 1907.

A base plate has a number of openings into which are fitted hoods surrounding incandescent lamps. The inside of the base and the hoods are provided with a reflecting surface.

870,313. Dynamo-electric Machine. Mathias Pfatischer, Philadelphia, Pa., assignor to the Electro Dynamic Company, New York, N. Y. Application filed July 23, 1906.

An interpole shunt motor has only one winding for the entire set of commutating poles. This winding is in series with the armature and is placed in a coil concentric with the shaft and on the opposite end of the armature from the commutator end.

870,326. Electric Furnace. Frank J. Tone, Niagara Falls, N. Y. Application filed March 7, 1905. Renewed April 1, 1907.

This is a combined arc and resistance furnace, the resistance element of which is composed of shaped pieces of resistance material assembled to form a continuous self-sustaining electrical conductor.

870,328. Electric Signaling Mechanism. Jean F. Webb, Jr., Chicago, Ill., assignor to the Electric Signagraph and Semaphore Company, Chicago, Ill. Application filed May 31, 1907.

A step-by-step circuit controlling mechanism comprises operating magnets carried in a supporting frame, an armature pivotally mounted therein, a contact carrying disk and ratchet wheel mounted on a shaft, a pawl carried by the armature for engaging with the ratchet wheel, and an escapement wheel mounted on the haft.

870,341. Incandescent Lamp. Herman Boehm, Youngstown, Ohio. Application filed November 21, 1906.

An incandescent lamp bulb is of cylindrical formation throughout a portion of its length and throughout the remaining portion of its length flattened at opposite point, the flattened portion extending from one end of the bulb to and terminating at the cylindrical portion. Leading in wires are flattened against the flat sides of the bulb.

870,353. Circuit-closer. Theodore M. Foote, Allston, Mass. Application filed November 3, 1906.

A circuit closer comprises two similar toothed wheels secured together, one slightly in advance angularly of the other, the teeth of one wheel being composed of electrically non-conductive material and of the other wheel of electrically conductive material. A single contact piece is arranged to successively engage the teeth of both wheels.

870,368. Insulating Board or Slab. George Kelly, Hinsdale, Ill. Application filed June 22, 1906.

The method of manufacturing these insulating boards consists in applying to sheets having printers' ink thereon a solution of borax and water that cuts the grease in the ink, and afterward cementing the sheets together with liquid glass.

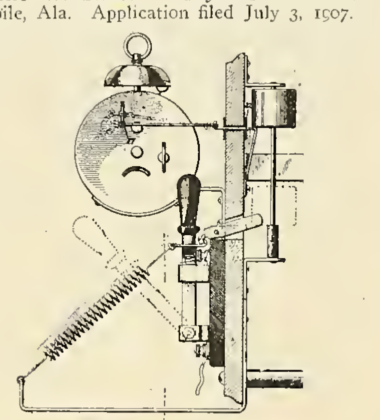
870,369. Sparking Plug for Internal-combustion Engines. Arthur E. Lamkin, Croydon, England. Application filed December 4, 1905.

This plug has a passage-way terminating at one end in a chamber that contains a check valve and holes for admitting air from within the chamber. A tubular conductor is mounted in the other end of the passage-way and bent on itself to bring its bore into direct alignment with another conductor insulated from the plug.

870,376. Contact Galvanometer. John W. Manley, New Barnet, England, assignor of one-half to the Electric Safety Appliances Company, Ltd. London, England. Application filed September 29, 1906.

A pair of conductors are twisted on each other and coiled around the field of play of a magnetized movable element. An electric circuit comprising a cut-out and a magnetized circuit closure is disposed in operative proximity to the magnetized movable element.

870,404. Time-controlled Electric Switch. John W. Wood, Mobile, Ala., assignor of two-thirds to Charles W. Stanton and James H. Zelnicker, Mobile, Ala. Application filed July 3, 1907.



NO. 870,404.—TIME-CONTROLLED SWITCH.

The winding key of an alarm clock is connected by a link to a spring latch which keeps a weight from falling. In its descent the weight strikes a lever, which holds a switch closed against the force of a spring and thus opens the switch. (See cut.)

870,423. Electrical Thermostatic Alarm. Joda Finch, Lyndhurst, N. J. Application filed February 26, 1907.

A shaft is mounted to one side of a thermostatic element in such a way that the latter can cause it to rotate and close an alarm circuit.

870,427. Train-controlling Apparatus. William Germiner, Pueblo, Colo., assignor of two-fifths to Marshall L. Brittain, Pueblo, Colo. Application filed April 2, 1907.

This apparatus includes a series of independent track circuits, normally open circuits carried by the locomotives and adapted to be closed in conjunction with each other and with any one of the track circuits, an electromagnet in each of the locomotive circuits and a bleed valve for the train pipe operated on the movement of the magnet's armature.

870,466. Electrical Signaling System for Railways. Harry L. Rider, Oil City, Pa. Application filed October 26, 1906.

This system provides signals and electric circuits therefor, track stop-plates electrically operated in conjunction with the signals, and a lever carried by the locomotive and adapted to act on a valve for applying the air brakes when the lever strikes any of the track stop-plates.

870,472. Traction Attachment for Moving Objects. George G. Schroeder, Washington, D. C., assignor to the Farm Motor Company. Application filed April 23, 1907.

An engine, a dynamo and a motor are mounted with their shafts aligned on a beam supported by a wheel. Storage batteries are placed along the side of the beam. The shafts of the machines are connected by clutches and gearing to the object to be moved.

870,473. Racing-game Apparatus. Gustav F. W. Schultze, Oakland, Cal., assignor to the Schultze Novelty Company. Application filed September 17, 1906.

In this machine there is in combination with a series of racing figures and the operating mechanism thereof means whereby the players may register a guess through the medium of a deposited token, and electrically controlled means for returning to the player the deposited token on the registered guess coinciding with the winning figure of the race.

870,486. Conducting-wire Support and Insulator. Harvey W. Wistner, Ogden, Utah. Application filed June 13, 1906.

The support has an opening, a portion of which is threaded. An insulator fits into this and has a corresponding threaded part. The insulator is split longitudinally into two parts, with a longitudinal groove for holding the wire in each part. One part also has a hole for a tie wire.

870,490. Combined Electric Connector and Switch. Stephen F. Burbank, Wilmington, N. C. Application filed January 24, 1906.

This connector consists of two pipe sections with a connector block in the end of each. These blocks consist of a central conducting plug and an annular conductor insulated from each other and from the pipe. The conductors have grooves and ribs for joining corresponding ones together.

870,495. Automatic Resoldering Device for Electrical Protective Apparatus. Frank B. Cook, Chicago, Ill. Original application filed March 8, 1906. Divided and this application filed May 11, 1907.

A repairing device for thermal protectors comprises two pairs of normally separated spring members, means for normally holding these pairs in this separated relation, and a thumb-piece adapted to be depressed whereby the contact between each pair of spring members is closed.

870,504. Mutoscope. Paul Frost, Berlin, Germany. Application filed January 25, 1907.

A phonograph is driven in unison with the views presented. An electric illuminating circuit containing differently colored lights is controlled by the rotating mutoscope picture drum.

870,505. Apparatus for Synchronizing Motors. Willard P. Gerrish, Cambridge, Mass., assignor of one-half to the Alvan Clark and Sons Corporation, Cambridge, Mass. Application filed January 23, 1905.

This apparatus has in combination a speed controlling electric circuit, means acting momentarily at regular intervals to change the circuit from a condition in which the speed of the motor is retarded to a condition in which the speed of the motor is accelerated, means for retaining the circuit in the last-mentioned condition, and means controlled by the motor for restoring the circuit during each interval to a condition in which the speed of the motor is retarded.

870,525. Advertising Device. Charles C. Bonnert, Baltimore, Md., assignor of one-half to Jerome I. Vogeler, Baltimore, Md. Application filed February 4, 1907.

A bottle has an opening in its bottom and rests on a stand having an annular recess. A socket is secured to the central raised portion of the stand and an electric globe is mounted in the socket so as to light up the bottle.

870,530. Individual Protector Unit. Frank B. Cook, Chicago, Ill. Original application filed January 18, 1906. Divided and this application filed February 11, 1907.

An individual protector comprises a sheet-metal base, insulating portions secured to one side of the base, spring members carried by the insulating portions and inserted through holes therein, and suitable fuses and lightning arresters held in place by the spring members.

REISSUE.

12,715. Electrical Attachment for Movable Objects. John R. Dawkins, Dallas, Tex. Application filed September 30, 1907. Original No. 855,389, dated May 28, 1907.

A ground-working device comprises a source of electrical energy, electrical connection between the source and the device and between the source and the ground thereby completing an electrical circuit to prevent the adhering of earthy substances to the device.

PATENTS THAT HAVE EXPIRED.

Following is a list of electrical patents (issued by the United States Patent Office) that expired November 11, 1907:

440,165. Multiplex Telegraphy. D. H. Keeley, Ottawa, Canada.
440,164. Telegraph Circuit. D. H. Keeley, Ottawa, Canada.
440,175. Secondary Battery. F. Marx, Berlin, Germany.
440,189. Electric-motor Truck and Gear. E. Peckham, New York, N. Y.
440,199. Induced Current Telegraph. A. M. Rosebrugh, Toronto, Canada.
440,210. Electrode for Secondary Batteries. E. B. Weed, Detroit, Mich.
440,213. Electric Switch. M. Wheless, Nashville, Tenn.
440,216. Secondary Battery Plate. A. E. Woolf, New York, N. Y.
440,224. Distribution of Electric Energy. S. Z. De Ferrenti, Hampstead, England.
440,241. Electric Actuating Mechanism for Clocks. H. T. Schlegel, Akron, O.
440,267. Process of Producing Porous Crystallized Metal Plates. C. Payen, Philadelphia, Pa.
440,268. Process of Producing Crystallized Metallic Lead Plates. C. Payen, Philadelphia, Pa.
440,269. Process of Producing Crystallized Lead Plates. C. Payen, Philadelphia, Pa.
440,270. Art of Producing Crystallized Metal Plates. C. Payen, Philadelphia, Pa.
440,271. Porous Crystallized Metal Plate. C. Payen, Philadelphia, Pa.
440,272. Method of Making Porous Crystallized Metal Plates. C. Payen, Philadelphia, Pa.
440,273. Process of Making Porous Crystallized Metal Plates. C. Payen, Philadelphia, Pa.
440,274, 440,275, 440,276 and 440,277. Processes of Producing Crystallized Metallic Lead Plates. C. Payen, Philadelphia, Pa.
440,290. Temperature Regulator for Electrical Measuring Instruments. E. Weston, Newark, N. J.
440,291. Index Controlling Device for Electrical Measuring Instruments. E. Weston, Newark, N. J.
440,303. Electric Switch. A. R. Bush, Boston, Mass.
440,326. System of Electrical Distribution. W. S. Richards, Natick, Mass.
440,362. Electric Railway. J. K. P. Nourse, Boston, Mass.
440,384. Adjustable Resistance for Electrical Circuits. C. Wirt, Orange, N. J.
440,420. Galvanic Battery. W. Cohlman, Philadelphia, Pa.
440,425. Current Collector for Dynamo Electric Machines. W. K. Freeman, Brooklyn, N. Y.
440,502 and 440,503. Electric Switch and Signal Mechanism. J. Ramsey, Jr., and F. C. Weir, Cincinnati, O.

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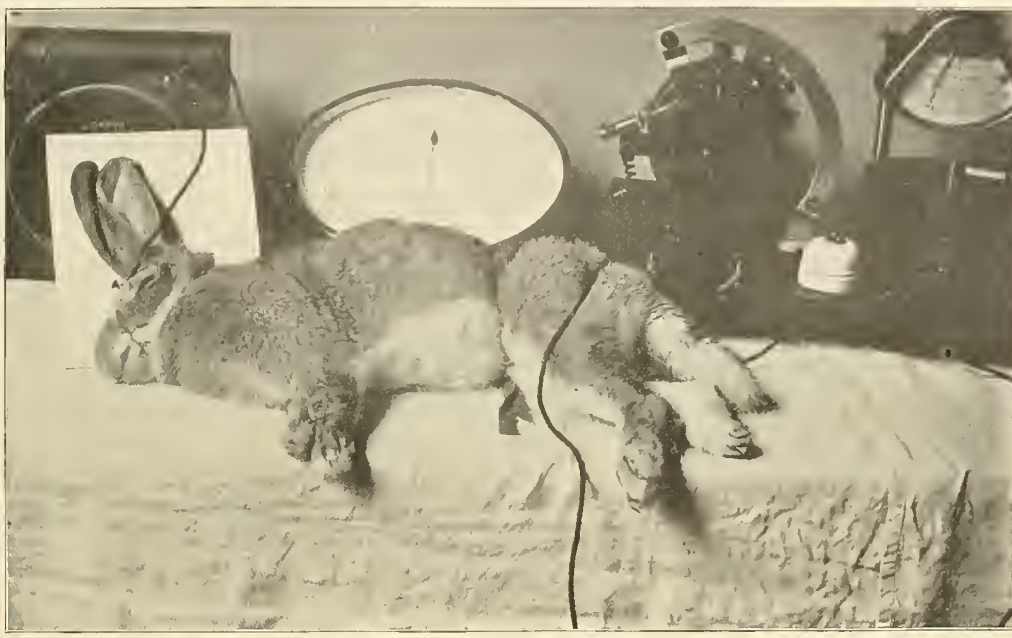
Electric Sleep and Resuscitation from Electric Shock.

By Dr. Alfred Gradenwitz.

Owing to the obvious drawbacks inherent to the familiar processes of anæsthesia, endeavors have been made to replace them by a more harmless kind of insensibility. Mention may be made of the observation made a few years ago by a Swiss physician, Professor Redard, that rays of blue light, when allowed to act on the eye for a short time, will cause a suspension of sensitiveness to pain. This phenomenon has been utilized especially in connection with dental operations.

Another more promising process has been developed by Professor Leduc of Nantes. This consists of submitting the body of the patient to the action of a peculiar kind of electric current, namely, a low-tension direct current, interrupted and re-established at frequent intervals. This current is readily utilized for the production of local anæsthesia, and good results have been obtained, there being no objectionable after-effects. Most interesting observations have been made also by producing with its aid a general insensibility of the body, or, in Leduc's term, "electric sleep." While only local electric anæsthesia can at the present moment be used for the purpose of performing surgical operations, the phenomena brought out by the investigations are extremely interesting from the scientific point of view.



A RABBIT TAKING A QUIET ELECTRIC NAP.

A systematic research of electric sleep has been recently conducted at Professor Leduc's laboratory by Dr. Louisa G. Robinovitch, when the remarkable fact was observed that "electrocuted" animals can be restored to life by the rhythmical application of electric currents. Before describing this experiment, which the writer recently had an opportunity of witnessing, a short abstract of Dr. Robinovitch's researches will be given.

The current used for producing electric sleep is direct current interrupted at frequent intervals, the most advantageous rhythm being 110 interruptions per second. This frequent interruption is produced by a special apparatus designed by Leduc. (See Fig. 1 on the next page.)

On a horizontal axis rotated by a small electric motor there is mounted an insulated wheel carrying an armature of metal pieces, forming intermittent contacts at the surface of the rim. On the latter there are sliding two brushes (A) and (B), the circuit being closed only when the two brushes are simultaneously in contact with the metallic armature. One of these brushes (B) can be shifted alongside the rim so as to be in contact with the metallic armature only during, say, one-half, one-quarter, one one-hundredth or even a smaller fraction of the time during which the fixed brush (A) is in contact with the same armature.

When in the position (B′) the movable brush will allow the current to pass during half the time of rotation of the wheel, and in the position (B) will allow no current to pass. Between these extreme positions there is a series of intermediary stages, each of which corresponds to a given period.

Dr. Robinovitch recommends using the current supplied by a storage battery, while another battery is used to actuate the motor of the interrupter. The negative terminal (cathode) of the circuit should be applied to the head of the animal, as with the anode at its head the respiration of the subject is greatly accelerated, while its temperature will rise to objectionable figures. It is preferable not to submit the animal suddenly to the whole of the dose of current required to produce electric sleep, as in this case, at the moment the current is completed, a rather considerable disturbance of respiration and of cardiac functions is nearly always produced.

The pupils of the animal when in the state of electric sleep are not dilated as during epilepsy; on the contrary, they are contracted to some extent. The temperature of the body will drop somewhat below the normal figure, while the rhythm of respirations differs only slightly from the normal. There is nearly always an increase in arterial pressure observed during electric sleep as in the case of other anæsthesia.

Professor Leduc has submitted himself several times to the suspension of cerebral functions designated as electric sleep. A large electrode constituted by wadding impregnated with a solution of sodium chloride and a metal plate was placed on his forehead and strung round his head. This frontal electrode formed the cathode. Another electrode of considerable dimensions prepared in the same manner was fixed to the abdomen by means of an elastic tape. The current passing 100 times per second (during one-tenth the time of suspension) was established gradually. The sensation produced by the excitation of surface nerves, although disagreeable, could be readily withstood and was appeased as time went on, like the sensation due to an ordinary direct current. In fact, after passing through a maximum the sensation was found to diminish in spite of an increase in the electromotive force. The face was red and there were slight convulsions of its muscles, as well as of the neck and even the forearm, and fibrillar tremors were observed, followed up by a pricking feeling at the finger tips and even in the feet. The inhibition due to the electric current first affected the centers of speech, after which the motive centers are completely inhibited, the subject being unable to respond to even the most painful excitations or to communicate with the experimenters.

While the current was at its maximum Leduc heard as in a dream the conversation of those standing by his side and had perfect consciousness of his inability to move and to communicate with his colleagues. He still felt any contacts and pinching of the forearm, but all his feelings were deadened, as though the member in question had gone to sleep. The most painful impression was to watch the gradual dissociation and disappearance of all faculties, these impressions being similar to those felt during a nightmare. However, Leduc was still able to regret the premature discontinuance of these experiments, the latter being stopped before perfect insensibility was produced. The awakening was instantaneous and no after-effects other than a feeling of special well being was stated.

It is interesting to observe the production of complete electric anæsthesia or electric sleep in animals, and this experiment was recently demonstrated to the writer. After the current has been completed the subject (usually a rabbit) seems to manifest some surprise, raising its ears, and soon becomes restless. As the intensity of the current augments the rabbit tries to escape, but it does not cry nor does it seem to suffer. The animal next passes through some slight convulsions, manifested by tremor in the legs and the face, while its neck becomes rigid; it then falls on its side. The rigidity gradually disappears, and after some slight efforts to lift its head the rabbit closes its eyes and seems to be asleep. Apart from very slight tremulations in the fore legs and in the muscles of the face it is now perfectly calm, both its respiration and cardiac beatings continuing regularly. The electromotive force required for producing this state is generally from five to six volts, with a current intensity of one milliampere. The animal may remain in this state as long as desired; in fact, for many hours.

If, instead of this low potential, a higher electric pressure, say 55 volts, be applied to the animal for a very short period (say four seconds), the circuit being opened immediately afterward, some very curious phenomena, resembling an attack of epilepsy, are produced.

In fact, a few seconds after the circuit has been opened the subject will exhibit tonical convulsions, while foam appears at its mouth; the animal grinds its teeth and sometimes gives off slight cries. A clonical phase then ensues, and these convulsions, occurring at regular intervals, are followed up by a stage of coma lasting from a few minutes to half an hour. This experimental epilepsy thus is seen to be strictly analogous to pathological epilepsy. The respiration and cardiac beatings do not seem to be influenced to any material degree by the passage of the "epileptic" current, the effect of which is limited to an alteration of the nervous system giving rise to a subsequent epileptic crisis.

If then a Leduc current of 12 to 15 volts pressure be allowed to act on a rabbit during half a minute or a minute a real electrocution of the animal can be produced, and the rupture of the current does not suffice to restore it to normal conditions as in the case of electric sleep. On the contrary, the cardiac beatings are found to have ceased entirely and respiration has been likewise discontinued. These two symptoms have been so far regarded as characteristic of what is termed physiological death, and no resuscitation of a subject in this state had so far been on record. However, Miss Robinovitch in most cases does succeed in restoring these animals to life by applying a rhythmical succession of current impulses, the rhythm corresponding to that of respiration so as to produce a process analogous to artificial respiration.

These phenomena are represented in tracing Fig. 2, which shows (in the upper part of the figure) the curve of respiration and (in the lower part) the curve of blood pressure.

Beginning from the left the short initial portions are characteristic of the normal stage before the electrocuting current is applied, each indentation

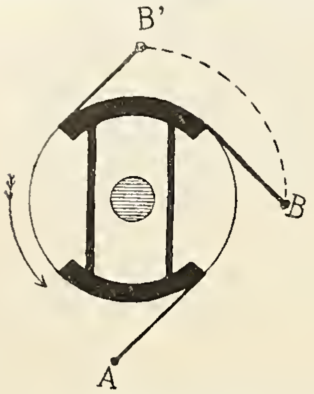


FIG. 1. CURRENT INTERRUPTER USED IN PRODUCING ELECTRIC SLEEP.

corresponding to a complete inspiration and expiration.

As soon as the electrocuting current is completed a violent respiration (shown by a sudden rise in the curve) takes place, after which respiration ceases entirely. The convulsions to which the animal is subjected likewise disappear after a few seconds, and the animal is lifeless not only as to its outward appearance but as well according to the records of the apparatus registering respiration and cardiac beatings; the blood pressure drops rapidly as in the case of the natural extinction of life.

The right-hand halves of the curve are representative of the result when current impulses were allowed to act on the body of the animal. After a number of artificial respiratory motions (interrupted by short pauses made to watch the effect of the process) spontaneous respiration finally commences, and after one or two minutes the animal is definitely restored to life. Though its body seems to be temporarily affected to some degree by this trying experiment, it can be submitted to it over and over again without suffering any apparent harm.

The experiments made by Dr. Robinovitch strikingly illustrate the mode of death in death from electric shock. Respiration is suspended while the heart beats still continue to be recorded. In a series of experiments on electrocution the heart continued to beat after death, and even after the chest had been cut open and the heart laid bare. In one case the heart continued to beat for over half an hour after the autopsy, but certainly these beats were *a vide*, the left auricle and ventricle being empty of blood.

Electrocuted animals have in many cases been brought back to life by rhythmic excitations with the same potential that had caused death. It is obviously of the highest importance that these applications should be instituted without great delay after the opening of the circuit. In other cases the current used to resuscitate the animal was different from that used for electrocuting.

As regards a possible practical utilization of these striking results it may be said that in cases of accidental electrocution or shocks with electric currents of a potential of up to 2,000 volts, it would seem feasible to restore the victim to life by the aid of current impulses of a rhythm corresponding to that of respiration. If the Leduc interrupter be not available, an ordinary small mercury interrupter could be used in its place to produce the intermittence of the current. The point of importance obviously is that this treatment should be applied as promptly as possible. The method is particularly applicable in places where direct current is available; in other places the alternating current must first be changed to direct current.

Another and perhaps more valuable application of the process would be to restore persons that have succumbed from syncope during chloroform or ether anæsthesia. Though a careful examination of the condition of the heart is made by any conscientious physician before chloroform or ether is applied, cases of death under the anæsthetic are still, unfortunately, not unknown. By preparing everything for the application of electric impulses before the operation is begun the life of the patient may be warranted in nearly all cases.

As regards the theoretical interest of these experiments they may be said to show that the extinction of life is a quite gradual process and that the physiological phases of it may by a convenient treatment still be remedied. Death thus would seem to be definite only when chemical alterations in the body have taken place.

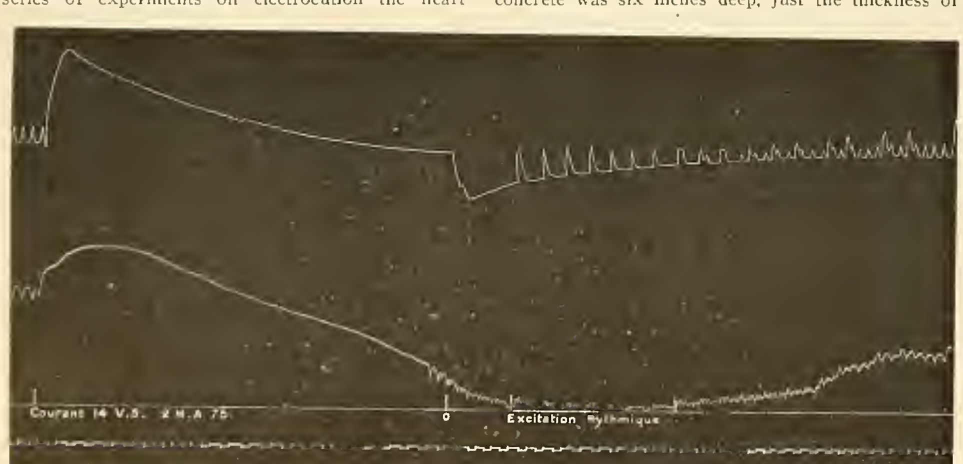


FIG. 2. DIAGRAM ILLUSTRATING RHYTHMIC APPLICATION OF CURRENT TO ANIMAL APPARENTLY DEAD FROM ELECTRIC SHOCK.

Life of Timber Imbedded in Concrete.

[From the Question Box of the American Street and Interurban Railway Engineering Association.]

What is the life of ties or timbers imbedded in concrete?

ANSWERS.

Fort Wayne and Wabash Valley Traction Company, Fort Wayne, Ind.: I have dug up concrete ties as good as the day they were put down after being imbedded in concrete 10 years.

Anonymous: The Cleveland Electric Railway Company recently had occasion to remove several miles of track that had been laid with different kinds of wooden ties imbedded in 10 inches of broken stone concrete (four inches under the ties). The track had been down for years. Under exactly the same conditions the white oak ties were found in excellent state of preservation; the chestnut ties were so far gone that they split badly when removed from the concrete with crow bars; the red and black oak ties were absolutely decayed beyond further use.

George W. Knox, Green Bay Traction Company, Green Bay, Wis.: Eighteen to 25 years.

Fred G. Simmons, Milwaukee Electric Railway and Light Company: Cedar ties in Wisconsin imbedded in concrete for 12 years are nearly all being used in new work.

H. R. Fothergill, Greenville Traction Company, Greenville, S. C.: If waterproof, 15 years.

Anonymous: The first time that tracks were laid on concrete base on this system was in 1892. The concrete was six inches deep, just the thickness of the ties, and at the same grade, so that there was no concrete under or on top of them. In 1898 new rails were laid on the same ties, which were found in perfect condition. In 1906 these tracks had to be taken up on account of the building of a tunnel and the ties were found in good condition, and if they had not had to be disturbed would have lasted for a number of years more. So really the experience of this company has not been sufficiently long to show what the life of ties would be even when only partially imbedded in concrete.

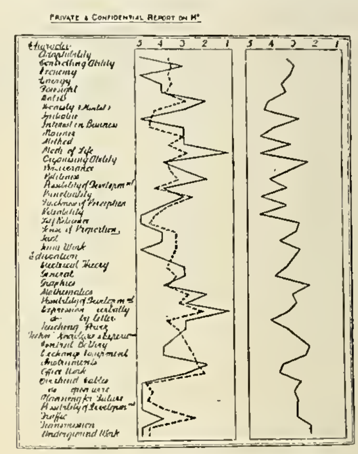
C. C. Collins, Columbus Railway and Light Company, Columbus, Ohio: Have had white oak in six years and it is in good condition.

Plotting the Human Equation.

The following interesting passage occurred in an address on "The New Technology" recently delivered in England by Prof. Alfred Schwartz, chairman of the East Lancashire Branch of the Association of Teachers in Technical Institutes, as reported in the London Electrician:

In any industrial undertaking properly trained men are more necessary than either money or machinery; we are, therefore, concerned in the schools with the most important element in the combination requisite for success, viz., men. The keynote of the work of a school must be training, and knowledge should not be emphasized as distinguished from training. The aim of the school should be to impart a thorough understanding of the principles underlying the branch of technology concerned, to inculcate habits of accurate observation and logical thought, and to train the student in the lines of thought and modes of attack employed in mathematics, physics, chemistry, engineering or other technological subjects and in the interpretation of results.

We have, however, to do something more than this—we have to build up, as far as may be, the character of our students. We must stimulate their imagination, foster their self-reliance, encourage them to sustained and concentrated effort, insist on integrity, not only with people, but also with facts. Our students should be made to realize the



PLOTTING THE HUMAN EQUATION.

importance of tact, of the ability to lead, and to follow loyally, the necessity of a good manner and address, the value of clear expression both in writing and in speech, and, above all, the quickening power of enthusiasm and devotion. Let us not quail before so formidable a task. Emerson has said that the mind that is parallel with the laws of nature will be strong with their strength. May it be so with us, and may we by precept and example ever strive to be worthy of the charge committed to our care.

As an example of the commercial importance of this aspect of a man's training, I cannot do better than direct your attention to the interesting and valuable character curves employed by my friend, Mr. John Scott, the district manager of the National Telephone Company in Manchester. (See diagram.)

The full black line shows in this case the man's own opinion of himself. The dotted line represents the mean of the opinions of six colleagues. The right-hand curve represents five opinions of another man and is in the form in which these curves are employed. The following values are taken: 5 excellent, 4 very good, 3 good, 2 fair, 1 indifferent. The ideal character would, of course, be represented by a line on the left-hand side, straight but for a kink or two to make it tolerable.

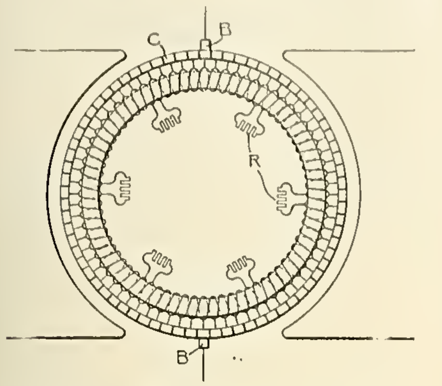
Shaving by Electricity.

A late application of electricity makes it possible for a man to get a genuine "electric" shave. He can heat the water in an electric water heater, step up to a mirror lighted by electric lamps, and lather his face, connect his new electric safety razor to a lamp socket or other outlet and mow his beard in a jiffy, finishing with a massage by an electric vibrator. The entire operation only takes a few minutes.

The electric safety razor, which now furnishes the missing link in this electric chain, is the invention of Isaac N. Brigham of Melrose Park, Ill. The razor itself is not unlike other safety razors in appearance, except that it has what looks like an incandescent-lamp socket for its handle. This houses a miniature electric motor which drives a mechanism giving a reciprocating motion to the razor blade. The entire device is compact and therefore not of excessive weight.

To Prevent Sparking in Alternating-current Commutator Motors.

Marius C. A. Latour of Paris has invented an improved armature winding for alternating-current motors of the commutator type to prevent sparking at high speeds. He provides a number of separate windings and connects equipotential points on these windings to each other through suitable



ARMATURE WINDING TO PREVENT SPARKING.

current-controlling devices, using brushes of a width insufficient to bridge adjacent segments connected to the same winding. Resistances are inserted in the connections between the windings. With such an arrangement the resistances serve to prevent any heavy short-circuit currents from flowing at starting, while at high speeds (since the windings are connected in parallel at several points) only a portion of one of the windings is open-circuited when a commutator segment leaves a brush.

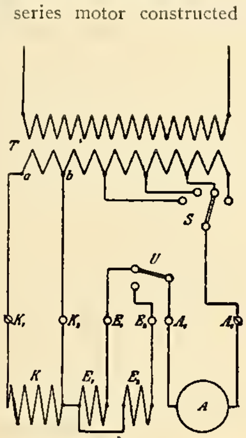
In place of resistances permanently connected to the windings other current-controlling devices, such as switches, may be employed.

In the diagram a Gramme ring armature provided with two separate windings is shown. The two windings are connected to alternate segments of a commutator (C). The commutator brushes (B) (B) are of such a width that they do not bridge two adjacent segments connected to the same winding. The two armature windings are connected to each other at a number of equipotential points by non-inductive resistances (R). It will be seen that whatever short-circuit currents may flow, due to the brush bridging two adjacent segments connected, respectively, to the two windings, they must pass through one of the resistances, and these resistances may be of sufficient size to keep the short-circuit currents within such limits that sparking is practically eliminated and the efficiency of the machine is not affected. When a commutator segment leaves a brush, only so much of the winding to which that segment is connected is open-circuited as lies between the segment and the nearest cross connections. It is declared that with such an arrangement the commutation is much better than when the entire circuit of one of the windings is broken every time a commutator segment leaves a brush.

The invention is patented in this country.

Simplification in Single-phase Motor Design.

In a paper recently read before the Verband Deutscher Elektrotechniker in Hamburg, Germany, R. Richter described a rather interesting improvement in single-phase motor design. The account is summarized in Science Abstracts of London. In the original series motor constructed by the Siemens-Schuckert Works the stator was provided with four distinct windings: (1) an exciting winding; (2) a distributed compensating winding; (3) a series and (4) a shunt auxiliary winding, these latter surrounding a single tooth which was used as a reversing pole. The construction of the stator in the most recent type of motor has been greatly simplified, with a reduction in the size and weight of the stator, by combining the four windings just enumerated into a single wave winding. The connections of the new motor are shown diagrammatically in the accompanying drawing, (T) being the transformer supplying current to the motor, (A) the armature, (E_1) and (E_2) those sections of the wave winding which serve as the exciting windings. Only one of these windings is in use at a time, depending on the direction of rotation. The reversing switch is shown at (U); (K) is that section of the field winding which serves the double purpose of a compensating winding and of the windings (3) and (4) enumerated above. The substitution of a single for four distinct windings, besides being a great constructional simplification, leads to reduced copper losses and a simpler form of reversing switch.



SINGLE-PHASE MOTOR DESIGN.

A New Type of Selenium Cell.

Inasmuch as the selenium cell has come to be used to a considerable extent for scientific investigations and also for some industrial purposes, wherein it is desired to use a device electrically sensitive to light rays, improved and more sensitive forms of the cell are of considerable interest.

One of the latest types of selenium cell is that covered by a patent granted to William J. Hammer of New York city on September 17, 1907. This cell can be made in a number of ways, but only the form preferred by the inventor will be described. Fig. 1 is a longitudinal section of this cell and Fig. 2 a perspective view of one having a larger inner portion.

A tube (A) of fused quartz is coated with a thin layer of aluminum, (B) which becomes one electrode of the cell. Upon this layer is coated the selenium (C) by first heating it till it becomes viscous or of the consistency of putty. While the selenium is still soft the tube is rolled between two pieces of plate glass, using a moderate pressure to compact the material to a uniform density and thickness, the outer surface being thereby also polished until it is smooth and glazed in appearance. Finally this outer surface of the selenium is covered with an extremely thin coating of aluminum (D), which forms the other electrode. This outer aluminum film is substantially transparent. The inner quartz tube thus becomes the cell proper and is sealed into an outer quartz tube (K) and into a regular Edison lamp socket having the terminals (E) and (E'). The wires (F) connect these terminals with the two aluminum electrodes. The air from the bulb (K) is exhausted.

The advantages of this construction are said to be many. In the several forms of cell which have become familiar and which have been used in practice, it has been customary to coat the selenium, sometimes with a binding material, upon a metallic support, usually a wire, and to insert the wire in the desired electric circuit. This not only gives rise to difficulties due to the variability of the contact resistance when the cell is inserted or withdrawn from the circuit, and to the variations due to the want of permanence in the cell from its disintegration by the differing expansions of the support and the selenium, but it is also less responsive to light effects on account of the light-sensitive substance being shunted by the metallic support. In the cell described these difficulties are substantially eliminated, since the support is a good insulator and the metallic connections are of such a character that substantial differences of expansion do not occur, while the selenium is included in series in the circuit.

Since the specific resistance of selenium is very large, a smaller amount of this material may be used in this way and still the cell will be more sensitive than where it is included in shunt with a metallic support, which carries a large part of the current without change from varying illumination, leaving only a small portion to pass through the selenium. This makes the change of current not a direct function of the whole flow, but only of the small part of it passing through the selenium. Obviously when in series the entire current flow passes through the light-sensitive substance, thus making the change due to the action of the light a direct function of the current and the illumination, greatly increasing the sensitiveness as well as the accuracy of the cell.

The inclosure of the operating parts of the cell in a vacuum is thought to be of great advantage. It prevents the formation of oxides and acids, particularly of selenic acid, which may be generated by the contact of the selenium with damp air, while subjected to an electric current, especially as selenium is somewhat hygroscopic. As the selenium is also spongy or porous in its granular condition, exhausing the inclosure completely removes any air or gas which may be occluded in the pores. In fact, the use of this material in the

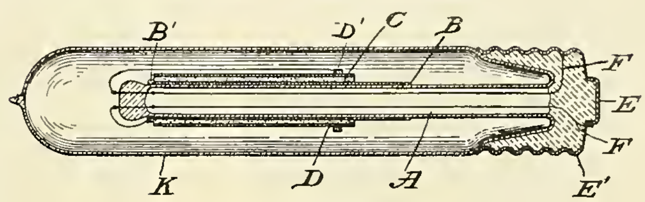


Fig. 1. Longitudinal Section.

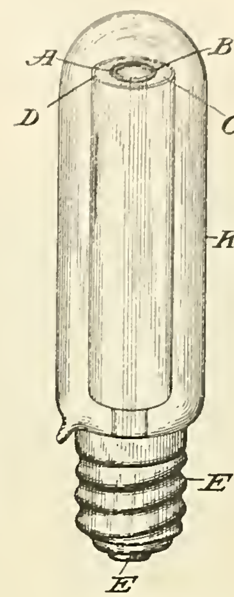


Fig. 2. Perspective View.

A NEW SELENIUM CELL.

open air explains many failures of previous experimenters which it is possible to avoid by sealing it in a vacuum.

There are several forms of radiation which are practically shut off by the passage through glass of the luminous rays containing them, though their loss is hard to detect while ordinary light rays are present; some of them are contained in nearly all light, and in order to make a just comparison between any two sources of illumination they should be included in the measurements, since many of them affect the eye as strongly as light vibrations. The various forms of radiation of exceedingly high rates of vibration, such as cathode, ultra-violet and other similar rays (the nature of which is not yet well understood, but which appear to differ in form from visible light rays), pass readily through quartz, yet are almost wholly shut off by glass. Many of these rays are found in the radiations from the mercury arc lamp, for example, which it is impossible to use with safety, when enclosed only in a tube of fused quartz, since the exposure of the operator to its action for even a few seconds under such conditions results in very serious trouble, leading sometimes to total blindness, and also sometimes affecting the brain.

Several forms of selenium cell have heretofore been enclosed in glass bulbs, but this cuts off the short wave lengths of the ultra-violet light, as glass is more or less opaque to them. The quartz envelope here used, however, allows from 60 per cent. to practically all of these short wave lengths to pass, and, as it is the violet end of the spectrum and not the yellow or red heat ray end which affects the electrical resistance of selenium, the sensibility of this new type of cell is therefore exceptionally high. The entire construction of this cell is of such a nature as to make it convenient to handle, thus largely eliminating the delicate manipulation necessary with previous forms of cell. Another advantage it possesses is that it gives permanence to the characteristics of the cell, since the selenium and its electrodes are protected from the action of moisture or other chemical effects of the air.

Design of Brackets and Ceiling Fixtures.[1]

By V. R. Lansingh and C. W. Heck.

In designing the lighting of any building, there are three necessary things to be taken into consideration: First, the effect of the light on the eye, by which is meant the necessity of cutting out of the field of vision all bright sources of light, and also the question of the color of the illuminant used; second, the artistic treatment; third, the treatment from the standpoint of economy and good illumination. It is needless to say that it is possible in most cases to combine all three requirements, but too often only one of these requirements is taken into consideration. In some recent examinations of the eyes of school children over 30 per cent. were found with defective vision. Therefore the first-named requirement must be emphatically insisted upon. The use of unshaded lamps has become entirely undefendable. The architect and illuminating engineer should sacrifice artistic effect and economy rather than sacrifice the eyes.

It is a not uncommon fault today, with the illuminating engineer, to devote almost his entire atten-

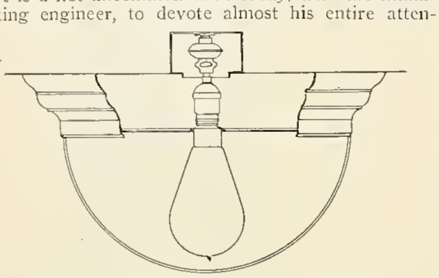


FIG. 1. MOUNTING OF SINGLE LAMP IN BOWL AND SHALLOW HOLDER.

tion to the design of economical and satisfactory illumination, and neglect, to a large extent, the artistic treatment. On the other hand, the architect neglects, to a large extent, the question of good and also efficient illumination and regards the problem almost entirely from an artistic standpoint. With the fixture dealer, this is still more pronounced, as it is very rare indeed to find one who appreciates the necessity of treating the question of satisfactory and economical illumination from any standpoint other than the artistic, neglecting the economical side almost entirely, and also the effect of bare sources of light in the field of vision. This applies especially to the placing of lamps at 45 degrees on chandeliers hung fairly low and equipped with open shades, so that the bare filament of the lamp is exposed.

It is the object of this paper to point out some methods of obtaining satisfactory illumination, without in any way sacrificing the artistic requirements, which are rightfully insisted upon as necessary, by both the architect and the fixture designer. It is the aim of the authors to endeavor to show that the two requirements are not incompatible. They endeavor to point out certain general principles of design which can be carried out and the fixture afterward made as elaborate or as simple as one desires.

No radical changes in fixture design are neces-

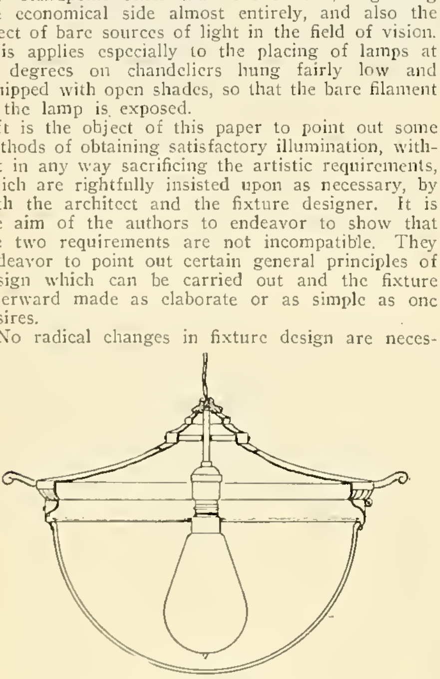


FIG. 2. MOUNTING OF SINGLE-LAMP AND ASBESTOS REFLECTOR.

sary. It should be the use of common sense in fixture equipment rather than revolutionary departures from present fixture design that should be called for. The use of proper glassware is often all that is needed to make an otherwise satisfactory fixture an efficient one.

Ceiling Fixtures.

In the past it has become customary, in order to get a given amount of light in a ceiling hemisphere, to mount several arms carrying lamps which are usually placed either horizontally or inclined at a slight angle. No provision whatever has ever been made to catch the upward rays of light, which, as is well known, are practically one-half of the entire light given by the lamps. Owing to the introduction of large efficient lamps made with Gem, tantalum, or tungsten filaments, it is often desirable to use one large lamp placed vertically and equipped with an efficient reflector, instead of a number of smaller lamps. In the case of outlet boxes, which are largely used in this class of work, it has been customary to extend a piece of pipe down considerably below the bottom of the box, which with the insulating joint and socket, would prevent the use of this method of mounting. Fig. 1 suggests

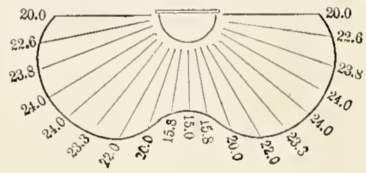


FIG. 3. PHOTOMETRIC CURVE OF BOWL WITH 50-CANDLE-POWER LAMP.

how it is either possible to cut the pipe off short, or, in the case of purely electric outlets, to use a fixture stud, as has been done in this case, obtaining thereby the advantage of using a high-candlepower lamp without the use of an extremely deep holder. The bowl or hemisphere shown can be of any form of glass which will properly diffuse the light, and a reflector can be used to greatly increase the efficiency of the unit.

One advantage of using a single lamp, rather than a cluster of lamps, is the uniform illumination of the surface of the hemisphere, whereas with a cluster of lamps, unless the bowl is made of dense opal or prismatic glass, there are almost always one or more spots of light which materially rob the fixture of its artistic qualities. Holders are usually too shallow to permit the use of reflectors when more than one lamp is used.

Fig. 2 shows a cross-section of a ceiling bowl wherein the light is directed downward by means of a white asbestos reflector placed at the top of the bowl and on a line with the base of the lamp. While not as efficient as the use of a prismatic reflector, it is greatly to be preferred to nothing at all.

In Figs. 3 and 4 is shown the distribution of light without and with a reflector inside the bowl.

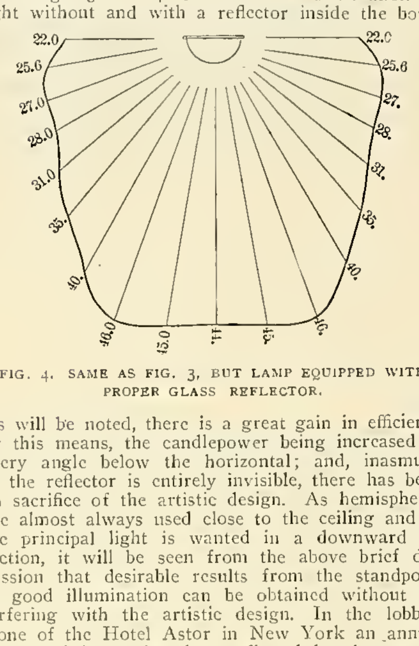


FIG. 4. SAME AS FIG. 3, BUT LAMP EQUIPPED WITH PROPER GLASS REFLECTOR.

As will be noted, there is a great gain in efficiency by this means, the candlepower being increased at every angle below the horizontal; and, inasmuch as the reflector is entirely invisible, there has been no sacrifice of the artistic design. As hemispheres are almost always used close to the ceiling and as the principal light is wanted in a downward direction, it will be seen from the above brief discussion that desirable results from the standpoint of good illumination can be obtained without interfering with the artistic design. In the lobbies alone of the Hotel Astor in New York an annual saving of $1,100 has been effected by the use of reflectors in old ceiling bowls. Even in the case of lamps placed at an angle, as it is found necessary in some cases, the use of a white asbestos reflector through which the lamps project and which is placed close to the lamps themselves, will be found a very material benefit.

Fig. 5 shows a sketch of a fixture used largely by the United States government in different departments. This sketch shows a 12-inch ball with an eight-inch holder, permitting the use of a large high-efficiency lamp with an efficient Holophane reflector inside, which, properly placed, increases the efficiency over 50 per cent. and is entirely invisible from the outside.

A very satisfactory fixture is one equipped with a white opal reflector with a deep fringe hiding the lamp from the eye and giving good economy. A similar satisfactory ceiling fixture is equipped with a reflector ball, the top being a prismatic reflector and the bottom of ground glass. It is possible with a ball of this kind to obtain practically any desired distribution. If the lamp is placed high in the ball or within the prismatic part, a concentrated form of distribution is obtained, while if placed low a wide distribution results. It is, therefore, possible to obtain with such a device both artistic results and almost any desired distribution.

In ceiling clusters, such as those used for the main lighting in the rooms of the Engineering Societies Building in New York, good results may be obtained. These fixtures are close to the ceiling and the lamps placed at an angle of about 45 degrees, with the proper style of Holophane reflector. This gives a good illumination over the entire room and, inasmuch as the fixture is close to the ceiling, the objectionable feature of having the lamps visible is minimized. The use of frosted tip lamps in such a fixture is highly desirable. In a fixture of this kind, it is essential to use a concentrating form of reflector, in order to get the desired distribution. If a globe or shade giving a broad distribution were used, the useful illumination would be materially reduced.

A very efficient fixture is one like a very short chandelier in which the lamps hang straight downward and are equipped with reflectors similar to those just mentioned. Owing to the height at which the lamps are placed, they are practically never in the field of vision. This undoubtedly is one of

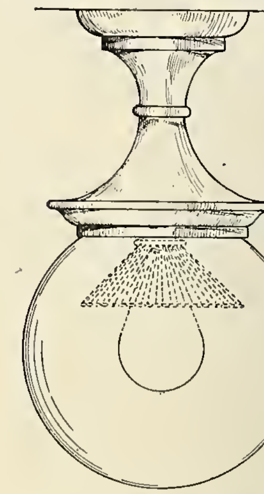


FIG. 5. CEILING BALL, SHOWING METHOD OF MOUNTING.

the most economical methods of lighting rooms of moderate size that has yet been devised.

Brackets.

Lantern type brackets can usually be made more efficient and artistic by hanging the lamp downward instead of upright. The glass sides should be frosted to prevent a view of the bare lamp. This is preferable to using a frosted lamp with clear glass sides. By using a glass bottom plate and a reflector over the lamp a 10-candlepower lamp will give better results than a 16-candlepower without these features.

For bracket lighting, it is often customary to place the lamps at an angle of 45 degrees and equip them with some form of diffusing shade, giving a broad distribution of light. That this generally is an error is clear from Fig. 6, which shows such a bracket, pointing at an angle of 45 degrees, equipped with a common type of ground-glass shade. The photometric curve of this shade is also shown. It should be noted that a large percentage of the

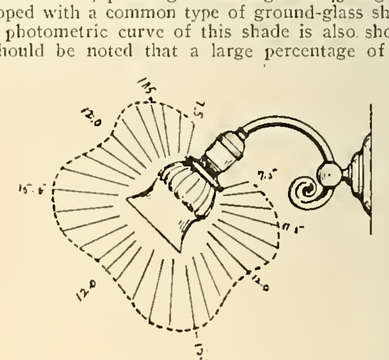


FIG. 6. BRACKET WITH GROUND-GLASS SHADE, WITH PHOTOMETRIC CURVE.

light is thrown upward, and that the light from the tip of the lamp is not materially increased, although it was evidently the intention of the designer to have the tip candlepower the highest. In brackets at such an angle where it is the desire to obtain the strongest illumination from the tip of the lamp, it is evident that a concentrating shade, either of opal or prismatic glass, should be used, rather than that shown.

A double swinging bracket can often be employed to good advantage both with the lamp upright and pendant. The arms of such a bracket can be made as short or as long as desirable. With one of these placed on each side of a dresser, it is possible to obtain good results. In such lighting it would be preferable to place such a bracket with the lamp pointing upward rather than downward, inasmuch as the light which escapes from the open part of the globe will be largely reflected from the ceiling,

1. From a paper bearing the title "Fixture Design from the Standpoint of an Illuminating Engineer," presented before the Chicago Section of the Illuminating Engineering Society, November 14, 1907. Mr. Lansingh is manager of the Holophane Company, and Mr. Heck is a fixture designer.

generally light in color, but lost to a large extent when thrown against the floor.

The above sketches and suggestions are only meant to point out in a rough and crude way how it lies in the power of the fixture designer to combine the artistic requirements of fixture design without sacrificing the requirements of the illuminating engineer; namely, to give good illumination at the lowest cost. As has been stated, the function of the engineer is to do with 50 cents what the other man takes a dollar for, and if our fixture houses would bear this fact in mind and put a little engineering knowledge or what might be even called common sense into their design, it would go a long way toward overcoming our present failings.

DISCUSSION.

F. F. Skeel of the Crouse-Hinds Company stated that manufacturers for a long time were tied to gas fixtures; hence, when electric fixtures were called for, they started out on the same lines without any special regard for distribution of light, efficiency of the system, convenience in switching and other points that have been brought out recently.

Pierce Anderson of D. H. Burnham & Co. considered the subject from the viewpoint of the architect. In regard to design, it should be noted that the fixtures must harmonize with the style of the room, and the suitability of any particular design can be judged by whether it adds to or mars the architectural effect of the room. The ideal type of illumination eliminates the fixtures entirely, for the low-hanging fixtures generally detract from the architectural features. An interesting experiment in indirect lighting was the illumination of the great Washington terminal station, in which it was first attempted to light from above the great skylight. Flaming arcs and standard arcs were tried with unsatisfactory results. Finally it was decided to use 220 standard arcs concealed in a cornice and reflecting their light from the upper portion of the room. This was supplemented by a few brackets and lights placed in the benches for reading and also for times when full intensity was not desired. A second smaller room was finally lighted by using arcs suspended from above in full view.

E. W. Lloyd of the Commonwealth Edison Company spoke briefly of the various uses of ceiling-bowl units and of their good points for many installations where a low or moderate intensity of general illumination was desired.

A. L. Eustice of the Nernst Lamp Company remarked that, for artistic effect for use on ceilings of medium height, there is no fixture more pleasing than the ceiling bowl, for it presents only a glass hemisphere and a narrow spinning directly against the ceiling. It had, however, never got beyond the sphere of low-intensity illumination when used with incandescent lamps, unless placed too close together to present a pleasing appearance. Recently the effect has been attained for high-intensity and high-efficiency illumination by the adaptation of the Nernst lamp to this fixture, so that a ceiling bowl that would hold perhaps only three incandescent lamps is made to contain a multiple-glower Nernst, the distribution of which can be varied by the use of different types of glassware.

T. Lescher of D. H. Burnham & Co. said that the vital point to the architect was the design of the fixture. Too often the fixture was not in scale with the architecture, and in general there was too much fixture. The common error of placing lamps at 45 degrees in fixtures was an illustration of the fact that the architects need to be educated to the points of efficient illumination, for they are too busy to fish out the information themselves.

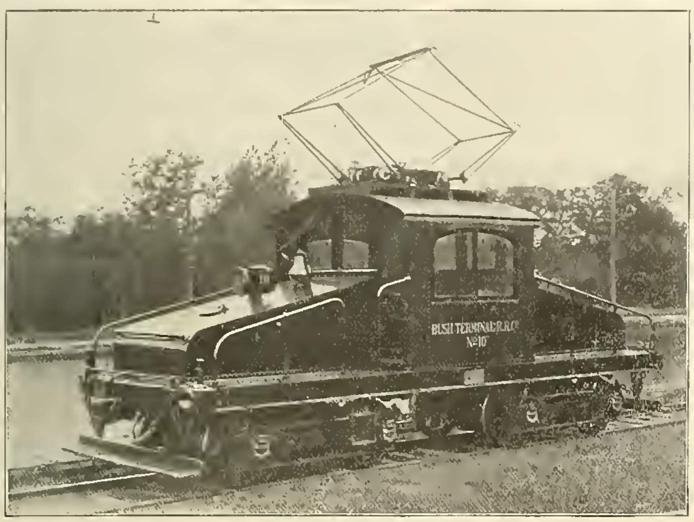
A. V. Von Holst, architect, added that the architect's chief troubles were in building of unusual architecture and size, such as railroad depots, theaters, churches. He suggested that a competent illuminating engineer be selected to meet the architects and take them to various buildings and give a practical demonstration of the good points and defects of existing practice.

Mr. Lansingh, in concluding the discussion, gave a brief description of a new idea in efficient ceiling lighting by using a bowl built into the ceiling with a ground-glass plate over the aperture, so that it was strictly a concealed system. He also made the point that as it is customary to wash windows to let the light in, why should it not be equally good practice to clean the artificial sources so as to let the light out?

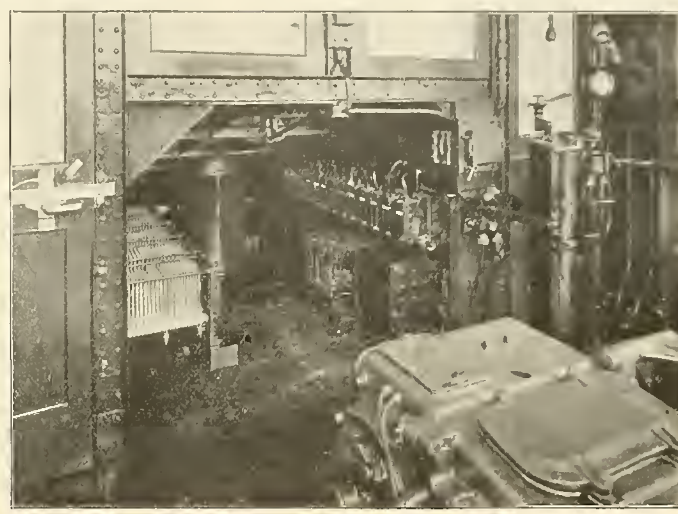
A New Electric Switching Locomotive.

The Bush Terminal Company employs for switching purposes around its extensive docks and warehouses in South Brooklyn a number of steam locomotives and one electric locomotive. This latter was built by the General Electric Company about three years ago and has given such satisfaction in the way of tonnage capacity, ease of control and low cost of maintenance that the Terminal company has recently given an order for a second electric locomotive.

The new machine has just been jointly completed by the General Electric Company and American Locomotive Company, and the two illustrations presented herewith give exterior and interor views of the locomotive.



View of Locomotive on Test Track.



Interior of Locomotive.

A NEW ELECTRIC SWITCHING LOCOMOTIVE.

While the truck is a bar-frame equalized design, the construction adopted differs from that ordinarily used on electric motor trucks and follows rather a type which has been used with a good deal of success for the tender and guiding trucks of steam locomotives. The bolsters are carried rigidly on the side frame and the weight of the frame and bolster is transmitted to the equalizers through one semi-elliptic spring on each side instead of through bolster springs and helical side springs, as is the customary construction in the so-called M. C. B. equalized truck. This produces a simple substantial form of truck suitable for locomotive service and having a low cost of maintenance in such service.

The driving axles are six inches in diameter, of forged steel, with 36-inch fused steel-tired wheels. Each truck is equipped with two GE-55-A (90 horsepower) two-turn motors, with a gear ratio of 52 to 21. These motors with this gearing will give at their one-hour rating a tractive effort of 3,000 pounds per motor, or 12,000 pounds per locomotive, at a speed of approximately 18 miles an hour.

The cab is built of sheet steel, supported by a framework of small angles, and consists of a main operating cab with sloping end cabs, with narrow side platforms extending from the main cab to the ends of the locomotive. The floor of the locomotive is three-eighth-inch sheet steel, but the floor of the main operating cab is covered with a three-quarter-inch wood covering.

One picture shows the arrangement of apparatus in the cab. The locomotive is equipped for both straight and automatic air, and in the center of the main cab is a CP-23 air compressor having a capacity of 50 cubic feet per minute and supplying air for the brakes. In the operating engineer's corner is located a C-6 master controller and the valves and handles for operating the combined straight and automatic air. In the end cabs are located a sand box, air drum, contactors and rheostats. As the locomotive is to be used solely for switching service it is supplied with a pantagraph trolley instead of the ordinary wheel trolley, thereby obviating the necessity of the frequent reversal of the trolley which would be necessitated in such service.

The locomotive is equipped with bell, whistle and headlights. The headlights are supplied with 32-candlepower incandescent lamps, and gauge lamps for illumination of the instruments are wired on the headlight circuit and controlled with the same switches.

The principal dimensions of the locomotive are as follows:

Length over bumpers........................29 feet
Height over cab....................11 feet 9 inches
Length of rigid wheel base..........6 feet 6 inches
Track gauge.......................4 feet 8½ inches
Weight on drivers...................80,000 pounds

Transatlantic "Wireless" and the Cable Companies.

At the meeting of the Western Telegraph Company last week, says the London correspondent of the Western Electrician writing on November 8th, Sir John Wolfe Barry, the chairman, expressed himself in very outspoken terms regarding the influence of radio-telegraphy upon the present business of the submarine cable companies. He referred to the uncertainty of transmission, owing to the possibility of interference, and the fact that messages could not be sent and received simultaneously. His own opinion and that of the technical advisers of the company was that the fundamental difficulties of wireless telegraphy for such long distances had yet to be overcome. As an adjunct to submarine telegraphy, Sir John said wireless had a good future. In fact the Western Telegraph Company, in conjunction with its lease from the Portuguese government, is installing an outfit in a locality where a cable presents certain difficulties.

So far as the public can ascertain, adds the correspondent, the wireless service across the Atlantic is not making exceptional headway. One sees an odd message in the papers now and again, but anything like a regular news service does not yet appear to have been instituted.

Uniform Accounting.

The committee on uniform accounting of the National Electric Light Association has laid out its work for the year. It is in conference with a similar committee from the American Street and Interurban Railway Accountants' Association, and the two committees have reached an agreement on those subjects in which they had a common interest. The chairman of the accounting committee met with the Public Service Commission of the Second District of the State of New York at Albany on October 23d, and further meetings were arranged for at which the form of report required by the Public Service Commission of Gas and Electric Light Companies will be discussed. As an outcome of these various meetings and conferences it is expected that a uniform classification of accounts, so far as practicable, considering the difference in the character of the various lines of business, may be accomplished.

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CORRESPONDENCE relating to electricity or any of its practical applications is cordially invited, and the co-operation of all electrical thinkers and workers earnestly desired. Clear, concise, well written articles are especially welcome; and communications, views, news items, local newspaper clippings, or any information likely to interest electricians, will be thankfully received and cheerfully acknowledged.

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CONTENTS OF THIS NUMBER.

DEPARTMENTS.

PLATINUM, it seems, is laboring under the scientific suspicion of not being an element. An article that has just appeared in the Chemiker Zeitung announces that Dr. Theodore Grosse, a German chemist, has succeeded, through a combination of physical and chemical reactions, in decomposing platinum. Heretofore this metal always has been regarded as an element. The announcement is of great interest in the realm of theoretical chemistry and, if verified, places the discovery in the same rank as Sir William Ramsey's recent degradation (to a slight extent) of copper into lithium. It will probably have little or no effect on the industrial uses of platinum.

A CURIOUS LAMENT comes from an English gas paper as quoted in the London Electrical Review. The complaint is voiced in these touching words: "Electrical engineering ranks in polite society as an occupation fit for the sons of gentlemen. Who cares anything about the gas engineer?" And again: "Gas has been practically boycotted . . . . by most of the usual agencies for circulating information and also by many of the official organizations for the cultivation of knowledge. When the subject of engineering is mentioned in high scientific circles, the gas variety is ignored. The platform and the press agree in leaving the gas industry and its followers and services in contemptuous obscurity." This is certainly very sad, but apparently it cannot be helped. Gas is gas, and electricity is electricity, and there you are!

NOW THAT the President of the United States has lent his powerful aid, the financial situation, already on the mend, has assumed a much more cheerful aspect. Mr. Roosevelt has announced the forthcoming issue of $50,000,000 in Panama Canal bonds and also of $100,000,000 (or as much of that amount as the secretary of the treasury may find necessary) in government notes bearing three per cent. interest. This procedure will ease the situation greatly by adding to the actual stock of money and also by coaxing currency from its hiding places. The news of the president's intention has had much to do in restoring confidence, and electrical men, as well as all other good citizens, will help in the good work by doing all that they can, both by precept and example, to bring about a complete return of normal business activity.

AN INTERESTING EXAMPLE of the ability of a small electric motor to replace a much larger steam plant is shown in a woodyard in East Boston. In this yard a 35-horsepower engine was in service on intermittent work, the large capacity being required to insure a full supply of power at any single time. The engine was replaced by a 7.5-horsepower motor, which was attached to the ceiling, saving valuable floor space formerly occupied by the engine. This motor drives economically and efficiently a wood-splitting machine and two heavy saws, and the owner has found the change of power economical and satisfactory. Doubtless too large an engine was originally installed in this plant for the work in hand, but the ease with which the motor does the work and its larger relative overload capacity than that of an engine for the particular work under consideration form a striking indication of the economy of electric power over steam in such intermittent service.

SUBSIDIES to interurban railroads are valid in Indiana. The Supreme Court of that state in a recent decision held that the word "railroad" used in the law relating to subsidies includes interurban electric roads as well as steam roads, and that the act of 1903 declaring that a large body of legislation concerning railroads "shall be extended to and held to include every kind of street railroad or interurban street railroad by whatsoever power its vehicles are to be or are transported," is constitutional. Accordingly, the court held that the grant of a $25,000 subsidy by an affirmative vote of the taxpayers of Wayne Township, Kosciusko County, to the Winona Interurban Railroad Company, was a valid grant and that the officers of the county could not be legally enjoined from collecting the subsidy tax. Now that the Supreme Court, as well as the Indiana Railroad Commission, has decided that a tax in aid of interurban railway construction is valid, it is hoped that the work of constructing a number of lines already promoted will go forward with considerable rapidity.

ONE POSSIBILITY of the new tantalum lamp not widely known seems to exist in the switchboard lighting of telephone exchanges. As pointed out by Mr. Thomas Lambert of the Chicago Telephone Company in a recent paper, the telephone men have been trying for some time to get the manufacturers of the tantalum lamp to make a light constructed of this filament which shall be in a continuous line, in shape something similar to the Cooper Hewitt light. A difficulty in the production of the tantalum light has been the excessive length of the filament necessary, but in this switchboard lighting the length of filament would be an advantage rather than a disadvantage if the lamp can be constructed in such manner. The long filament might also be used to advantage for other purposes, as counter and showcase illumination.

ELECTRIC SLEEP is a phenomenon of great interest, and Dr. Gradenwitz's carefully written article on the subject in this issue will be read with attention. There seems to be a possibility that surgical operations, especially of a minor character, may be performed while the subject is rendered insensible by the application of the unusual kind of current with which Professor Leduc has conducted his experiments. More important, however, is the hope that by the use of the Leduc current persons apparently killed by electric shock, or who succumb as the result of the administration of ordinary anæsthetics, may be restored to life. The author notes that "electrocuted" animals in many cases have been brought back to life by rhythmic excitations with the same potential that had caused the apparent death. Again, he declares that, in case of anæsthesia by chloroform or ether, "by preparing everything for the application of electric impulses before the operation is begun, the life of the patient may be warranted in nearly all cases." Experiments having such an end as these are certainly of importance, and it is to be hoped that they will be continued. One pleasing feature of this investigation is that a systematic and useful investigation of electric sleep has been made at Professor Leduc's laboratory at Nantes by a woman of science—Dr. Louisa G. Robinovitch.

AS A PART of a recent paper before the Western Society of Engineers on "The Present Status of the Producer-gas Power Plant in the United States," Prof. R. H. Fernald of Washington University, St. Louis, gave an account of the results he found by visiting 34 producer-gas power plants in various states during the summer of 1906. He found that power plants of this character were not well adapted for intermittent service, and there was also some trouble from clinkering in the producer. On the whole, however, his verdict was a decidedly favorable one. He made the following deductions from his visits:

1. The plants as a whole are giving remarkable satisfaction considering the very brief period of development that has passed since the introduction of this type of power.

2. The most serious difficulty seems to arise from the lack of competent operators to run the plants rather than from inherent troubles with the plants themselves.

3. Incompetent salesmen are undoubtedly to blame for serious misrepresentations and misunderstandings.

4. The policy of some manufacturers of entirely neglecting plants after they are installed and paid for has not been farsighted, nor has the failure to give the purchaser of a plant, or the operator, full information regarding the construction and methods of operating.

Professor Fernald concludes that the situation as a whole at the present time seems to be very favorable for the producer-gas plant, both as to cost of installation, operation and maintenance, and as to reliability. With the additional impetus given by the demonstration at the government fuel-testing plant that the bituminous coals, lignites, and peats can be utilized with great economy in these plants, the increase in the introduction of this form of power within the next few years may surpass even the most sanguine hopes of the manufacturers.

Corn Products Company Plans a Big Plant.

The Corn Products Refining Company is preparing for the construction of a large plant at Summit, Ill., on the banks of the Chicago Drainage Canal, which will include an interesting electric power plant. Already some work is in progress, and early next spring the plant, which is to cost about $5,000,000, will be pushed to completion. In addition to its own land, the company has leased 14 acres with a large frontage on the Drainage Canal. This, with the numerous railroads touching the canal, will give excellent shipping facilities.

Plans for the power house are being prepared. Contrary to what might be expected, the convenient electric power of the Sanitary District at Lockport will not be utilized in this case. In the various processes of the new manufacturing and refining plant large quantities of steam are required. It therefore has been planned to utilize the exhaust steam of a steam-generating power plant in the factory. Cross-compound non-condensing engines will be direct-connected to three-phase alternators. Several large units of this type will be installed. It is estimated that with this use of the exhaust current can be produced very cheaply.

The present financial depression will not affect this project, it is said, as all arrangements have been made for the purchase of machinery this winter and completing the work on buildings next spring. Grain storage tanks with a capacity of 1,000,000 bushels and storage buildings capable of taking care of 10,000 tons of gluten feed are being built. The grinding capacity will be 50,000 bushels a day, and 750 men will be employed. About 20 miles of railroad track will be constructed on the property, the total in and out loaded-car movement to be about 125 cars a day.

Improving Operation on the Chicago City Railway.

With the plan of having passengers pay their fare as they enter the car, when the new cars of this type are put in operation on the South Side, the Chicago City Railway will begin a system of improved operating methods. The dispatcher will be kept in touch with the movements of cars by a telephone system, boxes to be set up at intervals along the line. The boxes will also be equipped with an automatic alarm by which the dispatcher can call in case he wishes to change orders.

A new book of instructions has been issued for the trainmen, and passengers are requested to cooperate with the crews in bringing about better service. When a car is carrying more than 80 passengers the conductor will stand in the entrance passageway and request passengers to take the next car. Only the passengers taken on just before the car is fully loaded will be permitted to remain on the rear platform. The front door will not be used except for exit. Conductors will be provided with a change carrier containing $15, but the company limits the size of the bill which the conductor is required to change to $2. The front platform will be kept closed while the car is in operation, and the doors to the interior of the car will be self-closing, thus eliminating extreme drafts.

Trainmen will be required to present a neat appearance, as they will be relieved of the necessity of sweeping out their own cars at the end of each run, and modern toilet conveniences will be provided at the terminals.

Elaborate Underground Plans for Chicago.

Active work on elaborate underground development may be begun in Chicago within a year. City officials for some time have recognized the great need of a better sewer system and the necessity of a high-pressure water system in the downtown district. With this work, should a new system be built, would be closely allied the construction of the proposed street-railway subways between Twelfth Street and the river. At this time, also, the Chicago Heat, Power and Refrigeration Company is said to be about to apply for a franchise to distribute steam heat, steam power and refrigeration fluid through pipes radiating from a central plant on the south branch of the river. That all these projects, involving probably $100,000,000, may be carried out with the least interference with business, it is said that plans will be laid before the City Council in the near future, which, if accepted, will give Chicago the most complete system of underground facilities in the world. To the proposed plans may also be added the freight tunnels of the Illinois Tunnel Company, which are being extended daily. The Chicago Heat, Power and Refrigeration Company is said to have already secured a site for its plant from which it proposes to distribute steam at high pressure to a distance of two miles. Among the men connected with the company are ex-City Treasurer Fred W. Blocki and ex-Alderman William Brennan.

Annual Report of North Shore Electric Company.

President Samuel Insull of the North Shore Electric Company, which operates in suburban areas lying about the city of Chicago, has presented the annual report of the directors for the year ended September 30, 1907. The annual meeting will be held on November 25th.

The earnings and expenses for the year were as follows:

Gross earnings	$665,890.30
Expenses (including taxes and rentals)	431,437.27
Earnings for the year	$234,453.03
Charges against earnings:	
Interest on bonds	$107,689.89
Balance	$126,763.14

The growth of the company's business during the year, necessitating further enlargement of its distribution system, as well as the construction of additional sub-stations, has called for an increase in the capital stock of $750,000, and in the outstanding first-mortgage bonds of $604,000.

"Your directors are pleased to report," says Mr. Insull, "that of the underlying bonds shown in the last annual report those which existed against the property acquired from the Calumet Lighting Company, amounting to $200,000, have been paid off and canceled.

"The results of the operation of the new generating stations at Maywood and Blue Island are very satisfactory, although neither has been in operation for a sufficient length of time to enable the company to secure the full benefit of its construction.

"The completion of the new Waukegan station was unexpectedly delayed on account of inability to secure machinery, but it will be put into service during the current year, one of the turbo-generators having already been shipped.

"The operation of the contracts for furnishing power to street and interurban electric railways, which the company has recently made, is proving very satisfactory, and there is reason to expect that this branch of the company's business will grow to large proportions.

"Your directors have deemed it wise to make a reduction of 10 per cent., effective October 1, 1907, in the rates charged for residential lighting, and hope that the increase in the company's business will enable them in the future to make still further reductions."

The capital stock of the company is $3,250,000; outstanding bonds $3,039,000 (including $385,000 on properties taken over); total assets, $7,036,107; surplus, $104,123.

On September 30th of the years named the company had connected business, exclusive of railway power business, in 16-candlepower-lamp equivalents as follows: 1907, 225,061; 1906, 184,804; 1905, 116,401; 1904, 93,004; 1903, 65,247. It has nine generating stations, located at Grove Street, Evanston; Clarke Street, Evanston; Water Street, Waukegan; Spring Street, Waukegan; Maywood; Blue Island; Harvey; Chicago Heights, and Highland Park. There are also sub-stations at Libertyville, La Grange and Park Ridge. The directors of the company are Samuel Insull (president), Edward P. Russell, Charles H. Randle, Frank J. Baker (vice-president), William A. Fox, Charles F. Spalding and Louis A. Ferguson. Fred W. Insull is secretary and treasurer.

Proposals for City Lighting.

The Board of Public Works of Lafayette, Ind., has employed Prof. J. W. Esterline of Purdue University to prepare specifications upon which to invite bids for a lighting service in the city for 10 years. Bids will be received until December 20th. The old contract expires the first of next August. The avowed object in letting the contract so far ahead is to give any successful bidder time to construct and equip a lighting plant before the expiration of the old contract. Bids will be received on seven distinct proposals. A copy of the specifications will be furnished upon application to the Board of Public Works.

No More Municipal Lighting for Washington, Ind.

As a long-sought and much-desired relief the City Council of Washington, Ind., has voted to sell the municipal electric-light plant to the highest bidder on December 16th. The city bought the plant several years ago for $75,000 and has been operating it at a considerable loss ever since. A proposition to remodel and rehabilitate the plant was recently voted down by the people, who thus declared that they wanted no more municipal lighting in Washington.

Telegraph and Telephone Properties in Iowa.

The report of the eighth annual assessment of telegraph and telephone properties in the state of Iowa as fixed by the executive council of the state gives the mileage, number of instruments, assessment per mile and total assessment of each company in the state, as of July 12, 1907.

In addition to the American District Telegraph Company, four telegraph companies do business in the state: Chicago, Milwaukee and St. Paul Railroad Company, 40 instruments; Mason City and Fort Dodge Railroad Company Telegraphs, 48 instruments; Postal Telegraph-cable Company, 206 instruments; Western Union Telegraph Company, 4,320 instruments. The total telegraph-pole mileage is 9,357.13, and the total assessment on telegraph property $663,756.93. Of the total mileage, 7,730.92 miles represents that of the Western Union company and 1,232.45 miles that of the Postal.

The commercial telephone companies are divided into four classes, viz., toll lines, exchanges (meaning strictly local village or city systems), mixed companies (including toll lines, exchanges and farm lines) and rural lines. The total miles of telephone-pole lines in the state is 66,039.39, and the number of instruments of all classes is 257,433, the instruments being distributed as follows: Toll lines, 2,117; exchanges, 13,753; mixed lines, 193,964; rural lines, 49,634. Of the mixed-line instruments, 2,035 are toll instruments, 81,919 exchange instruments and 110,010 rural instruments.

There are 11 toll-line companies in the state operating 1,272.56 miles of pole lines, of which 887.14 miles belong to the American Telephone and Telegraph Company.

The local-exchange companies number 104, with a total of 13,753 instruments. Of these companies the Mississippi Valley Telephone Company is the largest, having four exchanges and 1,619 instruments. The Dubuque Telephone Company is next with 1,300 instruments.

There are 330 mixed companies, of which the Iowa Telephone Company of Des Moines is the largest, operating 39,486 city and rural instruments and 1,008 toll instruments. The Sioux City Telephone Company is second in size, with 2,749 instruments. The total pole-miles of the mixed companies is 40,088.43.

The rural lines take the lead as to the number of companies, there being about 2,500 district companies, with 49,634 instruments and 23,948.57 miles of pole lines.

The total assessment on telephone properties in the state is $2,344,156.89, divided as follows: Toll lines, $76,122.30; exchanges, $138,820.28; mixed lines, $1,834,596.48; rural lines, $294,617.83.

Alleviation of Pain by Light.

Experiments are in progress at the New York Skin and Cancer Hospital for the alleviation of pain by the use of intense light. So far the physicians are unwilling to express any definite opinions as to its efficacy, and content themselves by saying that their hospital tries every device which promises to be of assistance in curing or alleviating cancer. The results with the "light cure," however, have been sufficiently satisfactory to induce them to continue the experiments.

The patient is subjected to what is known as the lucidescent light. It is the ordinary electric light of 500 candlepower, focused by parabolic reflectors on two spots. It is turned upon the seat of pain for 15 or 20 minutes at a time, and much care has to be taken to prevent the burning of the flesh. The treatment is repeated two or three times at intervals of three or four hours, and in many cases the pain is reduced or driven away for several hours afterward.

So far the hospital physicians say they cannot explain in what way the light acts. They do not think it has any therapeutic value aside from the relief of pain, but they find it very useful for that. One of them said that he had tried it upon himself for a raging toothache, and had found it drove the pain away for several hours.—New York Times.

The Next N. E. L. A. Convention.

At a meeting of the executive committee of the National Electric Light Association held in New York last month invitations for the 1908 convention were received from Atlantic City, St. Paul, Detroit and Chicago. The matter was held over until the January meeting. It is not unlikely that one of the western cities named will be chosen.

Electric Heating.[1]

Your committee on electric heating, in considering its report to be submitted at this meeting, has concluded that the members are more generally interested in the commercial progress of electrical heating apparatus than in any other features, and consequently has not introduced any results of economy tests or information of that character. The committee assumes that the information which is most acceptable is that bearing on the attention which the various member companies are giving to the development of this class of business and the success which they are meeting with, and the increase in income which may be expected as a result of spending time and money for the general introduction of heating apparatus. General information has been obtained from the member companies through the medium of question lists sent out. Seventy-five sets of questions were sent out and replies were received to 57.

Question 1. What is your company doing in the matter of exploiting electric heating and cooking devices?

Forty-seven companies were more or less enthusiastic and are doing what they can in a variety of ways to promote the sale and use of heating apparatus. Twenty-four are both advertising and demonstrating its use; 11 are demonstrating alone and 5 advertising alone; 25 employ special canvassers, and 7 put out apparatus on trial. A great majority of the replies emphasize the desirability of suitable display rooms.

Question 2. Have you conducted a flatiron campaign, or one on any particular piece or pieces of apparatus? If so, please advise the committee as to particulars and results.

Forty-four have conducted iron campaigns, which seem to have been in most cases successful, the general plan having been to deliver the irons at the houses of customers for trial covering periods ranging from 5 to 30 days. The information is not sufficiently complete to give any average figures as to the number of irons which should be placed in a given community per 1,000 inhabitants, but several report the number of irons placed over 1,000, and the results of these campaigns seem to have been generally satisfactory to the companies.

Question 3. What do you estimate the annual kilowatt-hour consumption of the following pieces of apparatus in the average household? For instance, one company reports that it finds that a flatiron in the average house consumes six kilowatt-hours per month: Flatiron, chafing dish, percolator, heating disk, radiator, water cup.

Twenty-seven answered as to flatirons, and of this number 80 per cent. placed the annual consumption between 60 and 84 kilowatt-hours, an average of slightly over 72 kilowatt-hours per year. Fourteen answered as to the percolator, but the estimates varied materially, 50 per cent. placing the annual consumption at between 50 and 90 kilowatt-hours per year, with an average of about 65, which would be a fair average of all answers. The answers regarding other pieces were so meager as not to give any very satisfactory information, with the possible exception of the radiator, on which the estimates ran from 300 to 400 kilowatt-hours per year. One company reported results of the use of an experimental electric kitchen with which all of the meals for three grown people were prepared. This showed an average consumption of 195 kilowatt-hours per month. Another reports the cooking bill of a family of three at $4.50 per month and a family of five at $7 per month average, the electricity being charged for at five cents per kilowatt-hour.

Question 4. Do you employ special solicitors in the sale and exploitation of this kind of apparatus, and if so, are they men or women, and on what basis and how much do you pay them?

Twenty-five companies employ special solicitors for the sale and exploitation of heating apparatus, a considerable percentage employing women for this purpose. Some of the reports as to wages paid indicate an average of from $55 to $80 per month for the men, some paying straight salary and others combined salary and commission. Eight companies reporting on the salaries of women pay from $9 to $16 per week, the average being apparently $11 or $12.

Question 5. Are you of the opinion that the sales of heating apparatus from all sources have increased in your territory during the past year?

Thirty-eight answered "yes," many of them indicating that the increase is very considerable. Nine report not much, if any, increase, and the balance fail to answer.

Question 6. Have any special methods of building up good business in the heating field come to your attention?

In answer to this question we have the following:

Demonstration at the company's office.
Demonstration at customer's residence.
Special solicitors.
Sale of apparatus at cost and on the installment plan.
Free trial.
Advertising.
Special rates.
As premiums for newspaper subscriptions.
Interest architects, builders, and the company's agents.

Question 7. Have you any theories as to how this business may be developed?

The answers to this question bring out no other suggestions than those indicated by the answers to question 6.

Question 8. Have any instances of fires being started by this kind of apparatus come to your attention, and if so, please give details?

A very considerable number of companies appear to have had experience with fires started by heating apparatus, but the majority of these cases seem to have been the result of careless use. This, however, may argue that the manufacturing companies should pay more attention to the development of automatic devices for shutting off the current. A number of fires were caused by bed covers being ignited from heating pads, the inference being that defective connections were responsible. Thirteen companies report specific instances of fires.

Question 9. Are you taking any steps in the way of running special circuits in new buildings or advising that they be run, or in advertising to architects and builders the desirability of providing separate circuits for heating devices, looking in a general way to procuring this class of business in future on power or special rates?

Eighteen companies reported advertising to architects and builders; 18 others are doing absolutely nothing; 9 fail to answer, and scattering ones are making slight efforts to educate the public in this manner.

Question 10. Please give briefly any information on this subject not brought out by these questions which you think will be of interest to the association through this report.

There were many interesting bits of information brought out under this question, but few which throw any great amount of light on the subject. One company reported information obtained from one dozen kitchen outfits, each doing the entire household cooking where it was installed, which showed the average cost was between $1.50 and $2 per month per person, at a rate of five cents per kilowatt-hour.

In general the answers to these questions indicate that there has been substantial progress made in the introduction of this class of apparatus during the last two years; that while the flatiron is still the favorite, other apparatus is selling well; that women solicitors are very successful in introducing the apparatus, and that with proper pushing a great deal can be put out from which a handsome income can be obtained, without making special rates. The replies of several companies would indicate that vigorous exploiting of this apparatus for two or three years should easily result in the sale of from one-half to one kilowatt of energy per annum per inhabitant at the regular retail rates.

1. A report presented to the Association of Edison Illuminating Companies at the convention at Hot Springs, Va., of September 10-12, 1907. The committee making it consisted of John F. Gilchrist, Chicago (chairman); I. D. Israel of Philadelphia, W. W. Freeman of Brooklyn, A. A. Pope of New York, Charles H. Herrick of Boston and George Eastman (engineer) of Chicago.

OBITUARY.

Edward J. Wilcoxen of Rochester, N. Y., died on November 4th from an operation for appendicitis. Since leaving the steam-road field in 1899 he had been connected, in various capacities, with electric-railway work, and at the time of his death was general superintendent of the Rochester Railway Company. Mr. Wilcoxen was 36 years old.

Charles D. Wyman, who was managing director of all the properties of the Stone and Webster corporation in the Puget Sound region, died suddenly in Montana on November 10th while traveling in a railroad train from Boston to Seattle. He was a native of Wisconsin, and since going to Boston seven years ago had been connected with Stone & Webster, being in charge of the interests on the Pacific Coast.

The death is recorded of Jefferson S. Polk, president of the Des Moines City Railway Company of Des Moines, Iowa. Mr. Polk organized this company and was a prominent business man of Des Moines. He was prominent in the development of steam and electric railways in Iowa and was a pioneer in interurban electric-railway building. With his son, H. H. Polk, and Mr. George B. Hippie he organized the Interurban Railway Company, which has been built to several cities from Des Moines and is still extending its lines. Mr. Polk was born in Kentucky in 1830.

Storm Bull, professor of steam engineering in the University of Wisconsin, died on November 18th after an illness of six weeks from cancer of the stomach. He was a nephew of Ole Bull, the famous violinist, and was born in Norway on October 20, 1856, and was graduated from the Federal Polytechnic Institution in Zurich, Switzerland, in 1877. After filling several positions in Norway, Mr. Bull came to America and joined the University of Wisconsin faculty. In 1891 he was promoted to the position of professor of steam engineering. He was elected mayor of Madison for one year in 1901. Professor Bull stood high in his profession and was greatly esteemed by his colleagues and the students at Wisconsin. He had been a member of the American Society of Mechanical Engineers since 1890. His premature death is greatly regretted.

Charles H. Seitz, formerly general manager of the Michigan Telephone Company at Detroit, died recently at St. Lukes Hospital, Chicago, from pneumonia. For a year Mr. Seitz had been in the employment of the Chicago Telephone Company. He was born in Detroit in 1866 and left a widow and one son.

Rules for Outline Lighting.

By W. H. Blood, Jr.

Today there are in the National Electrical Code no rules specifically covering outline lighting. The tendency of all lighting companies is toward a greater use of this form of lighting and advertising. The suggested rules in reference to sign lighting, which were endorsed at the last meeting of the Underwriters but which have not as yet been made a part of the Code, do not cover outline lighting. The committee on signs believes that this matter is not within its jurisdiction and declines to report on it at the next conference.

If this form of lighting comes under the head of "outside" work, which seems natural, the wires "must be provided with petticoat insulators" and "must not be less than a foot apart," etc. Construction of this form is an impossibility if applied to outline or open-sign lighting. As a matter of fact, wiring contractors and lighting companies throughout the country do not know what the various inspectors of the Underwriters will pass, and the Underwriters themselves admit that there are no rules covering the case and they have no suggestions to offer.

In the city of Boston what may be called "freak" construction has been in use for about 18 years and with highly satisfactory results. A metal skeleton socket (a little brass casting with a screw thread on the inside of it) is screwed directly upon a wooden strip by two lugs, and adjoining sockets are connected by bare copper wire. Into the woodwork, through the center opening of the socket, a third screw is placed, which forms the contact for the tip of the lamp when it is screwed into the socket. These screws are connected by bare wires, and all connections are soldered. The wires, screws and sockets all lie upon the woodwork and have no insulation whatever. The woodwork is generally painted, and the socket and wiring may be also. The only requirements made by the inspection department are that the sockets shall be mounted upon wooden strips, not upon the building itself, and that they shall be kept away from fire-escapes, awnings, etc. This construction has been used upon the Edison 110-220-volt, three-wire system, the neutral of which is grounded; it is approved for 110-volt alternating-current circuit as well, but no installations have as yet been made in Boston on these circuits.

Such construction as this is at variance with all established rules in the Code, yet the Underwriters admit that it has given no trouble in Boston, and they allow its use. The wire department of the city of Boston goes so far as to approve its use for outline lighting and open-sign work; in fact, it is claimed that this construction is preferable to that using a standard porcelain socket, as the open socket provides no place for water or moisture to collect and cause short-circuits.

The proof of the pudding is generally in the eating, and as this construction has been used with success for 18 years in Boston, it may be advisable to have it extended for general use throughout the country.

Electric-lighting companies above all else desire safe construction, but at the same time cheap construction that is safe is in great demand. An outlet that costs but 50 cents to wire up will use as much current as one that costs $2.50, and an installation costing $50 is much more liable to be put in than one costing $250.

If this form of construction is desirable, let us adopt it; if it is not, let us have approved some form that is. Suggestions in reference to this type of wiring will be gladly received by the writer, and if there seems to be a demand for a definite rule for the Code, a draft embodying such suggestions will be prepared and presented to the Underwriters prior to their next conference.—N. E. L. A. Bulletin.

Steam Turbines in Japan.

In the development of Japan the progressive natives of that country were among the first to anticipate that the turbine engine was to rank among the foremost power producers of the age, and as a consequence many American turbine engines have been installed in that country. A total of 69 units, aggregating 60,000 horsepower capacity, of the Curtis type of turbo-generator, manufactured by the General Electric Company of Schenectady, N. Y., have been installed in Japan. The 69 machines, ranging in size from 25 to 1,000 kilowatts in capacity, are distributed among 28 establishments of various kinds.

ELEMENTS OF ELECTRICAL ENGINEERING.

By Geo. R. Metcalfe.

XLIII.—Electric Railways.

Alternating-current Railway Systems.

All which has been said heretofore in regard to electric railways refers entirely to direct-current railways, which, until recently, were the only kind in use. Within the last two or three years, however, alternating-current motors have been applied to railway cars and locomotives, so there are now a number of roads using alternating current throughout. The desirability of alternating current for traction work has long been apparent, but until recently no alternating-current motor having characteristics suitable for street-railway work was available.

The use of alternating current for electric-railway work was the natural outgrowth of the increase in the length of the roads to be equipped and the weight of the cars or trains operated. It has already been explained that where the length of a road exceeded a very few miles the cost of copper for transmitting the necessary current at 500 volts became prohibitive, and therefore the long-distance distribution was made by means of high-tension alternating current, which was converted to direct current in rotary-converter sub-stations, located at frequent intervals along the line.

While this system was entirely adequate for roads of considerable length, upon which only single cars were operated at long intervals, the rotary-converter sub-stations have always been objectionable from a financial point of view, although they have proved entirely satisfactory as far as operation was concerned.

It will be apparent, however, upon consideration, that if long, heavy trains running at frequent intervals were required on a road instead of the single cars at long intervals, the 500-volt direct-current system could not be used, as not only the sub-station machinery would have to be multiplied many times, but the trolley wire could not carry sufficient current to operate these heavy trains. In this case the cost of copper and the additional sub-station machinery constitute limiting economic factors, and the only method remaining of handling the large amounts of power required for this class of service is to increase the voltage and reduce the amperes correspondingly.

It would be, of course, possible to increase the direct-current voltage to a certain extent, and systems using 1,000 or 1,200 volts have been advocated, and are being exploited at the present time. It is not believed by anyone that voltages much above these would be feasible for direct-current motors, on account of the difficulty of commutation, so that, at the outside, a voltage of not more than two or three times the ordinary direct-current voltage would be feasable.

On the other hand, 6,600 volts and 11,000 volts alternating current are not only feasible, but are in actual operation, and there seems to be no reason why even these figures should not be considerably exceeded wherever the conditions make still higher voltages desirable.

If electricity is to be applied to long-distance heavy railroad work it can only be done by vastly increasing the voltages heretofore used, otherwise the cost of installation would be prohibitive. Furthermore, as it is impossible to increase the direct-current voltage on the motors more than two or three times the present figure, while alternating-current voltages may be increased 20 times this amount or more, the latter system is adapted to a field of railroad work which is far beyond the limits of the direct-current system.

Polyphase versus Single-phase.

The next question which arises is, what kind of alternating-current motor is best adapted to railway service? There are two alternating-current systems in use, one of which has been chiefly developed in Europe, while the other originated in this country. These two systems are the polyphase and the single-phase.

The polyphase induction motor is in use in a number of European railways and is operating successfully, especially on mountain roads, but its adoption in this country has never been seriously considered for several reasons. In the first place, the polyphase induction motor is essentially a constant speed motor, and is therefore not well suited to ordinary traction conditions requiring continual changes of speed. The polyphase induction motor has only one economical speed, and any reduction in this speed involves a corresponding loss in efficiency.

In order to provide an economical half speed it is the practice to connect two polyphase induction motors in concatenation; that is, the primary winding of the second motor, instead of being connected to the line, is connected to the rotor circuit of the first motor. When the two motors are thus connected in tandem, so to speak, the synchronous speed, which is the economical running speed, is one-half the normal speed of the motors running on full voltage.

In equipments of this kind it is the usual practice to use four motors, two for full-speed running and two for connection in concatenation for half speed and less. When running above half speed two of the motors are idle, and their added weight causes considerable increase in the energy consumption of the car at full speed. Concatenation also adds largely to the weight of the electrical apparatus on the car.

Another reason for not adopting the polyphase system in this country is the objection to the use of double overhead-trolley wires and double trolleys. With the three-phase system, using the tracks for one circuit, two overhead conductors are necessary, and if the tracks are not used as conductors three trolley wires are required. With the very high voltages required for long lines it is a very difficult and expensive matter to construct the overhead trolleys and maintain a suitable insulation between them.

While double overhead-trolley lines are in use in a few places in the United States, there is only 500 volts between the wires, and no special difficulty exists in insulating them, but where there are several thousand volts difference of potential the question of effective insulation becomes very much more difficult.

One of the chief advantages claimed for the polyphase traction system is the ability of the motors to act as generators when the car is descending a grade and thus to restore energy to the overhead lines. The advantage of this action is evidently confined to mountain roads or roads having heavy grades, in which case some economy in current consumption probably results from this restoration of energy to the system. The actual value of this action is, however, rather questionable, at least under ordinary conditions of operation, and the absence of figures on the results of operation tends to the belief that this theoretical advantage is not realized to any considerable extent in practice, except under very special conditions.

[To be continued.]

Note.—This series of articles, intended to survey, briefly, the whole field of applied electricity for light, power and heat, was begun in the Western Electrician of February 2, 1907.

QUESTIONS AND ANSWERS.

Currents in the Neutral of a Combined Direct and Alternating-current Distributing System.

F. C. S., Chicago: We have an alternating-current generator running at 440 volts, three-phase. From this the current is led to a bank of transformers connected in delta on the primary side and in star on the secondary. The three main leads from these secondaries connect with a rotary converter giving 220 volts on the direct-current side. For lighting the three-wire system is used, the lamps being connected between a neutral wire and either one of the 220-volt mains. This neutral, however, is not connected to the rotary, but to the neutral point of the transformer secondaries. What I want to know is what kind of current this neutral wire carries and how does it work in harmony with the direct-current side of the rotary converter?

Answer.

If the system is balanced, there is no current in the neutral wire. If one side of the direct-current system is loaded heavier than the other, a direct current flows in the neutral equal in value to the difference between the currents in the outside mains. If the other side becomes more heavily loaded, the current in the neutral reverses. Should the balance of load fluctuate from side to side, an alternating current would flow in the neutral, but it would never have the frequency of the alternating-current supply. The action of the neutral wire connected as it is to the neutral point of the transformer secondaries, is exactly the same as in the neutral of a three-wire generator. The secondaries here take the place of the "balancing" transformers in the latter case. This action was clearly explained in the article by B. T. McCormick on "Three-wire Direct-current Generator" in the Western Electrician of October 5, 1907.

Grounding Telephone Lightning Arrester.

B. H. S., Belleville, Pa.: Is there any danger in connecting a ground wire from a telephone lightning arrester to water pipe in the cellar?

Answer.

There is no danger from such grounds. Water pipes usually make very good grounds and are capable of dissipating a lightning charge very rapidly. The telephone lightning arrester ground wire is not in contact with any circuit and only becomes charged when a lightning discharge jumps across the arrester gap and flows to ground. This action is instantaneous and does no damage to wires or pipes, the quantity of lightning charge conveyed by telephone lines being usually quite small.

Rental Charges for Pole Lines.

In a recent "Question Box" of the N. E. L. A. Bulletin are the following answers to a request for information as to pole-line rentals:

A. L. Black: Rental for pole space is based with us in the case of infrequent connections, such as messenger-call signals, automatic fire alarm, burglar alarm, etc., on the number of attachments, the price usually being 50 cents per attachment, although in some cases it has been reduced to 35 cents.

Where our poles are used for carrying lighting or power wires we base the charge on the number of wires in use and the size of the pole, the schedule being so arranged as to try to secure from the tenant one-half the cost of construction and maintenance for the use of the pole, no matter how many wires are attached.

The size of the wires is limited in the case of messenger wires to about No. 10, and in the case of lighting or power wires to No. 0000.

Details of charges are as follows:

(A) For a pole classified as a 35-foot pole, the price per tie per year shall be the quotient of $2.75 divided by the total number of ties of both parties hereto on the said pole, provided that the price to be paid by the party of the second part shall not be less, in any event, than 92 cents per year.

(Clauses B, C and D the same as A, except substitute: For a 40-foot pole, $3.70 and $1.25; for a 50-foot pole, $4.60 and $1.53; for a 60-foot pole, $6.88 and $2.29.—Editor of Bulletin.)

(E) For a pole exceeding 60 feet, the price to be paid shall be calculated on the same basis.

Poles used for transformers shall be paid for at the same rate.

T. O. Ripley: We have an agreement with the telephone companies of this vicinity on an attachment basis, which is governed by the size of wire.

Below is given the basis of the yearly charges for attachments.

A count is taken every six months by a party made up of representatives of each company.

Rate per Attachment per Pole per Annum.

Single conductors, below and including No. 4 B. and S. gauge	$0.10
Single conductors, between sizes Nos. 3 B. and S. and 00, inclusive	0.20
Single conductors, between No. 000 B. and S. and 500,000 circular mils, inclusive	0.30
No. 12 B. & S. twisted pairs	0.10
Five-pair cable	0.10
Ten-pair cable	0.20
Fifteen-pair cable	0.30
Twenty-pair cable	0.40
Thirty-pair cable	0.60
Sixty-pair cable	1.20
One-hundred-and-twenty-pair cable	2.40
Two-hundred-pair cable	4.00
Lamp-bracket attachment and rigging, including all necessary appurtenances	0.10
Arcs, including all necessary appurtenances	0.50
Converter or transformer, 30 lights	0.50
Converter or transformer, over 30 lights (to 50, inclusive)	0.75
Converter or transformer, over 50 lights	1.00
Break arms not used for street lights otherwise specified	0.10
Cable boxes, ten to two-hundred-pair cable	1.00
Switch on pole or in box on pole	0.10

W. M. Bell: Our arrangement with the telegraph company is for the use of one attachment (one six-pin cross-arm to conform to their arms) carrying four wires. Sizes of wires stated. Rental, 50 cents per attachment (one cross-arm) per year.

With the telephone company, price and conditions are the same.

BOOK TABLE.

BRAKES FOR TRAMWAY CARS. By Henry M. Sayers. London: "The Electrician" Printing and Publishing Company. 1907. Pp. 76, with 14 illustrations. Price, $1.50.

This book is an expansion of a series of articles that appeared in the Electrician and created favorable comment from traction authorities. The author clearly explains the general principles of braking and shows how the condition of rails, wheels and brake shoes affects the results. The different types of brakes are briefly described in the following order: Hand, air, "momentum," rheostatic, electric and "regenerative" electric wheel brakes, mechanical and magnetic track brakes, magnetic combined wheel and track brake. Adjustment, maintenance and general conclusions as to choice and use of brakes are then considered. A rather long report on a typical accident due to improper braking is given, and also a set of constants and formulæ useful in calculations of brake problems.

The book is well written, but deals too exclusively with the present British practice in this line. The comparatively large number of recent electric-railway accidents, particularly on hilly lines, in England, forces the conclusion that the brakes in general use there are far from being always reliable. A more exhaustive treatment of air brakes would therefore have given the book a greater value than it now has, although this value should not be underestimated.

STANDARD POLYPHASE APPARATUS AND SYSTEMS. By Maurice A. Oudin, M. S., member A. I. E. E. Fifth edition, revised and enlarged. New York: D. Van Nostrand Company. 1907. Pp. 369, with 207 illustrations. Price, $3.

In this latest edition this well-known work has been brought up to date. The frequent revisions the book has received since it first appeared eight years ago illustrate the author's desire to have it keep pace with recent developments in polyphase practice. This fact, coupled with the clear and simple style and the absence of a mathematical treatment, has made the book a popular reference work on this important subject.

The topics principally affected by this latest revision are generators, induction motors, rotary converters, switchboards, lightning protection and line construction. The single-phase railway motor receives attention and is compared with its polyphase rival. The mercury-arc rectifier is described in its commercial form. A feature of the new edition is the increased number of illustrations and the substitution of pictures of the latest types of apparatus for many previously shown. The number of pages has been further increased; compared with the first edition, there has been an increase in this respect of about 50 per cent.

POWER STATIONS AND TRANSMISSION. By George C. Shaad, E. E. Chicago: American School of Correspondence. 1907. Pp. (6½ by 9½ inches), 155, with 95 illustrations.

This is one of a new series of practical handbooks based upon the lesson pamphlets supplied to correspondence students. The text is prepared in a simple descriptive manner for those who want a concise and readily understandable treatment of engineering topics. This particular volume is in two parts. Part I—power stations—deals in successive sections with the location of station and selection of system: steam plants; hydraulic and gas-engine plants; electrical equipment of stations; buildings, records and management. Part II—power transmission—treats of conductors; distribution systems; transmission lines, overhead and underground construction.

The apparatus used in the different parts of a power station is not described with any detail, the reader being assumed to be already familiar with it from previous study. The author attempts chiefly to show upon what factors the choice of particular types of apparatus depends. The second part is more descriptive than the first and contains a large number of tables and sample calculations. As a whole the book is a fair work of reference for those it is intended to reach. Division into chapters would give it a more customary book form, and consecutive numbering of the pages throughout, instead of into two parts, would avoid some confusion.

No Other Electrical Journal More Generally Read.

A gentleman connected with one of the electrical societies, answering a request for information, says: "We realize the importance of keeping the organization as much as possible in the public eye, and we know of no better way than for the Western Electrician to publish the news, for there is no more generally read electrical journal in the country."

Directors of the Jamestown Exposition at a meeting in Norfolk, Va., on November 14th, adopted a committee report favorable to keeping the exposition open next year, provided $200,000 can be raised by popular subscription.

Milwaukee Lifting Magnets.

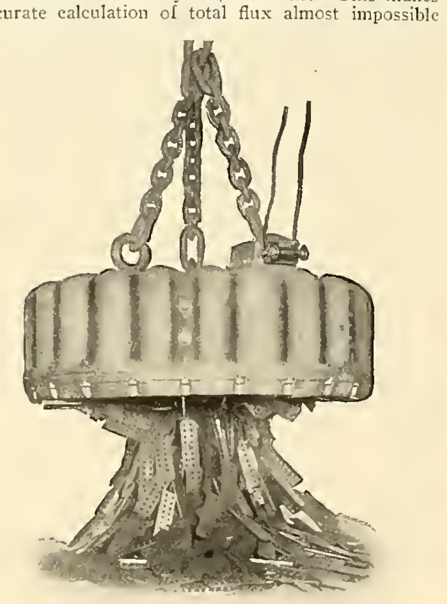
Although the laws governing electromagnets have been well known for years, the manufacture of lifting magnets for commercial purposes is still in its infancy, to reanimate a well-known phrase. The number of commercial magnets actually in use in the United States today is relatively small, taking into consideration the large number of plants in this country which could profitably employ lifting magnets for handling various forms of raw metals and finished parts entering into the products of their manufacture. This condition is doubtless in a large part due to the fact that the advantages of lifting magnets are not generally realized, for it is worthy of note that no concern that has given the lifting magnet a fair trial has returned to the old method of handling iron and steel.

Wherever pig-iron, metal plates, tubes, rails, beams, scrap or heavy castings of iron or steel are handled lifting magnets can be advantageously employed. The saving in time in adjusting hoisting tackle to the object to be raised is of itself oftentimes sufficient to justify the installation of a lifting magnet, while in the case of pig-iron, plates, rails and scrap the practical advantages of lifting magnets are still more obvious, owing to the large number of pieces that can be handled at a single lift, and to the fact that the objects so handled need not be piled beforehand. All that is necessary in work of this sort is to lower the magnet onto the objects to be handled, switch on the current and lift. A further advantage of lifting magnets is found in the fact that metal too hot to be touched with the fingers, can be handled as easily as cold metal.

Various forms of material require various forms of magnets. The construction of magnets for handling plates or material of a similar nature, affording opportunity to secure an intimate magnet contact, is a comparatively simple problem. In such cases the principal care of the designer will be to provide means for securely anchoring and properly insulating the magnetizing coil. Calculations as to the lifting capacity of such a magnet can be made with considerable accuracy, as the total flux is easily figured.

Magnets for handling billets, rails, etc., laid in piles, are, as a rule, operated in pairs. Such material usually comes in 50-foot lengths and is most conveniently handled by two magnets placed about 18 or 20 feet apart on a balancing bar to which the crane hook is attached.

Magnets for handling pig-iron, scraps, etc., present the greatest difficulties in design. Such magnets are expected to handle a wide range of material, varying in form, in magnetic permeability, and often encountered in irregular piles, hence the reluctance of the magnetic circuit, and consequently the total flux will vary with each lift. This makes accurate calculation of total flux almost impossible



MAGNET PICKING UP STEEL STAMPINGS.

and experience absolutely essential to the production of a thoroughly good magnet.

By a "good magnet" is meant one which will lift, in proportion to its own weight, the greatest possible amount of material. The weight of the magnet itself must be considered as dead weight, and the aim of the manufacturer, therefore, is to construct a magnet that shall combine the minimum of weight with the maximum of lifting capacity.

Other things being equal, the larger the magnet the greater its lifting capacity, and just here is the crux of the magnet problem, for only the most intimate knowledge of electromagnetism, combined with practical experience in building lifting magnets, will enable one to know the exact point at which any further saving in weight will be accompanied by a more than corresponding decrease in efficiency.

Another point must be borne in mind. While it is true that the weight of the magnet itself must be considered as dead weight, still it may sometimes happen that, as between two magnets, the heavier may actually be the more economical of the two. The material handled by lifting magnets

HANDLING MACHINE-CAST PIGS WITH LIFTING MAGNET.

is seldom simply hoisted—it is hoisted and conveyed. While the power required to hoist is directly proportional to the load on the crane hook, this does not hold true with regard to conveyance, for the weight of the crane itself forms so large a proportion of the total load to be moved along the track, that a larger dead weight, which, lifting more, will reduce the number of trips made by the crane, may show a marked saving, both in time and current consumption.

The engineers of the Cutler-Hammer Clutch Company of Milwaukee, who for more than ten years have devoted themselves to problems involving electric and magnetic control, have, after several years of work, devised a lifting magnet which, it is declared, marks a distinct step in advance in this industry. The magnet recently placed on the market by this company embodies

LIFTING A 5,500-POUND "SKULL."

several new features, and under competitive tests has developed a lifting capacity showing an efficiency perhaps never before attained.

In the design of this magnet the magnetic attraction of the inner pole has been purposely made stronger than that of the outer pole. The practical effect of this concentration of the magnetic flux on the inner pole is that in handling iron pigs or similar material the various pieces constituting the load are released by the outer pole first, when the current is switched off, and are drawn toward the center of the magnet by the superior attractions of the inner pole, thus enabling the operator to deposit the load within an area scarcely exceeding in extent the diameter of the magnet itself.

Every prospective purchaser of a lifting magnet naturally wants to know the amount of current consumed, that he may calculate intelligently the saving that may be reasonably expected in handling material with this labor-saving device.

The following data, obtained during the test of a 52-inch Cutler-Hammer magnet at the plant of the Youngstown (Ohio) Sheet and Tube Works, throw light on this point:

Total weight of pig-iron unloaded from steel gondola car	109,350 pounds
Weight of average lift	785 "
Number of trips required to empty gondola	139
Current on magnet	1 hr. 15 min.
Current off magnet	50 min.
Total time consumed	2 hrs. 5 min.
Current required	30 amp. at 220 v.

From the foregoing figures the cost of operation is easily figured, the cost of current per kilowatt-hour being known. Thirty amperes at 220 volts corresponds to a power consumption of 6,600 watts which was required for one hour and 15 minutes. This gives a total power consumption of 8.25 kilowatt-hours, which at three cents per kilowatt-hour gives a total of a little less than 25 cents—cost of current for energizing magnet during the period required to unload 54 tons of pig-iron.

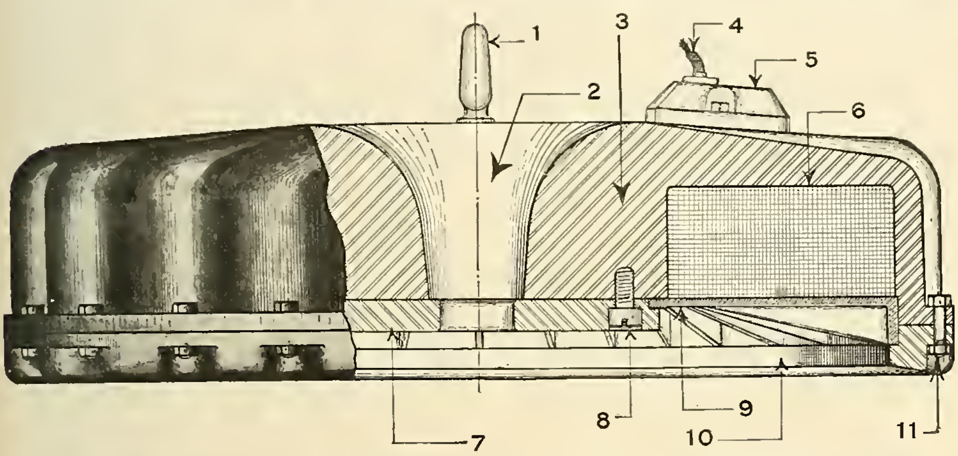
It is believed that the excellent performance of the Cutler-Hammer magnet under test is due to better coil construction, securing greater magnetic flux with equal weight of copper; better proportioning of the magnetic circuit, insuring deeper penetration of the flux into the material to be lifted, and in no small measure to the careful attention given to the important question of heat radiation.

In reference to the shape of the magnet it is to be remarked that while a concave-faced magnet is admirably adapted for handling pig-iron, it is not well suited for lifting ingots, or other long objects with plane surfaces, owing to the fact that the inner pole cannot come in contact with the object to be lifted. By means of the auxiliary pole-piece, however, this difficulty is overcome.

That the commercial applications of magnetism are not limited to lifting magnets is indicated by the fact that the Cutler-Hammer Clutch Company has built for the Maryland Steel Company two specially designed magnets, used for separating iron from coal. These magnets are in use at Sparrows Point, Md.

In the ordinary run-of-mine coal pieces of iron, such as spikes, cable-pins, broken pick heads, etc., frequently find their way into the chutes, with disastrous results to the coal-crushing machinery. To avoid such mishaps magnets are now employed. At the plant of the Maryland Steel Company the run-of-mine coal is carried about 25 feet above the ground level by means of a conveyor, and allowed to pass down the chute, from which it is discharged into a second chute. The magnets are placed back of an opening between the first and second chutes and cause any pieces of iron which may be mixed with the coal to be deflected sufficiently to prevent them from passing into the chute which feeds the coal into the crushers.

Many of the foregoing facts are obtained from the new illustrated booklet of 32 pages on "Lifting Magnets" issued by the Cutler-Hammer Clutch Company of Milwaukee, Wis. This booklet contains a number of full-page illustrations showing lifting magnets handling pig-iron, steel stampings, castings, scrap and other material, together with diagrams, data on current consumption, information on lifting capacity of magnets, etc. A new cable take-up device is also pictured and described and reference is made to the Cutler-Hammer system of control, by which the strong inductive reaction, or "kick" which occurs when the circuit is suddenly opened on a magnet coil, is automatically shunted to a discharge resistance, thus protecting the magnet insulation by dissipating the energy of the induced voltage outside of the coil itself.



1. One of three eye-bolts.
2. Central flue.
3. Magnet body.
4. Cable.
5. Terminal box.
6. Coil.
7. Inner pole-shoe.
8. One of several screws fastening inner pole-shoe to magnet body.
9. Coil body shield (brass).
10. Outer (removable) pole-shoe.
11. One of the through bolts fastening outer pole-shoe to magnet body.

DETAILS OF CUTLER-HAMMER LIFTING MAGNET.

Grounded Neutral on the High-tension System of the Interborough Rapid Transit Company.[1]

By George I. Rhodes.

The chief circumstance which led to the grounding of the neutral of the Interborough Rapid Transit Company's high-tension system was the serious nature of cable burn-outs. As a rule the detectors gave indication of a ground on one leg of the system from five to thirty minutes before the circuit breaker opened, but on account of the large number of feeders connected it was practically impossible to isolate the damaged feeder before the short-circuit occurred. In a total of 12 operating burn-outs the grounded cable was located but twice in time to prevent trouble.

During the period between the first grounding of the cable and the final short-circuit the system was operating under abnormal potential conditions, the two ungrounded phases operating at full delta potential of 11,000 volts above the ground. Undoubtedly the potential between phases was raised to a certain extent by the increased charging current, due to unbalanced potential conditions. The presence of abnormal potentials during this period of ground was evidenced by static discharges in the power and sub-stations that could hardly be accounted for by the operation of two legs at 11,000 volts above the ground potential.

The charging current which flowed to ground through the fault before the short-circuit between phases was large enough seriously to injure the insulation of all three conductors, so that when the burn-out occurred it was so severe that the oil switches usually opened with considerable violence. Surges were started which at times caused other burn-outs to follow, in one instance causing a very disastrous shut-down.[2] The cable itself was always considerably burned, all three legs being grounded and usually burned off. At times the conductors were blown apart several inches. With the faults in this condition it was quite impossible to locate them by the bridge method, and it was necessary to open a great many manholes before locating the trouble.

In view of the fact that one phase of a cable almost invariably grounded some time before short-circuiting, it was decided to ground the neutral through a resistance of proper magnitude to allow sufficient current to flow to remove the grounded feeder without affecting the system in any other way. It is obvious that with only two feeders to a sub-station, a ground on one of them will open the circuit-breakers of both, and that the certainty of continuous operation of the sub-station increases with the number of feeders.

The scheme of grounding the neutral as originally proposed was as follows: The neutral point of each generator was connected to a common or neutral bus-bar through a disconnecting switch and a current transformer. The transformer operated a relay on the main switch of the generator. The neutral bus-bar was grounded through a resistance of about six ohms in each power station, making about three ohms' resistance between the neutral and ground of the combined system. In case of a ground the maximum possible current was 1,000 amperes per rheostat, all of which was generated by the grounded generator. The relays on the feeder switches were set to operate instantaneously at 300 amperes, and the generator relays at about 900 amperes after five seconds. Under these conditions it was to be expected that a ground on a cable would instantly remove it from service before any other disturbance could result.

The neutral rheostats were of the iron grid type, having a resistance of about six ohms and a reactance at 25 cycles of about 0.3 ohm. They were made up in 16-series sections, each insulated from the others and from the ground by porcelain insulators. Each section was made up of six series groups of cast iron grids connected two parallel and 12 series per group. Each grid was made up of 10 bars 0.25 inch by 0.75 inch by 6 inch, and two bars 0.25 inch by 0.75 inch by 4 inches. A number of extra grids were used to adjust the resistance to the required value. The rheostat will carry 1,000 amperes for two minutes, a capacity far in excess of anything that would be required in service.

With the scheme as above outlined, very serious trouble was encountered from the triple-frequency cross-currents in the neutral connections. These neutral currents fluctuated very rapidly from nothing to one-half full-load current per generator. Upon synchronizing there was a very large rush of current in the neutral, so large in fact that with four generators running it was very difficult to synchronize a fifth with its neutral grounded.[1] These cross-currents had such serious effects on the operation of the system that the scheme of grounding the neutral was delayed for a time to allow making some experiments.

An oscillographic study of the neutral currents was made and has been described fully.[2] The records proved without a doubt that the currents were caused by irregularities in the angular velocity of the prime movers and unequal excitations of the generators. It was found that the insertion of resistance in the neutral connections of the generators would reduce the currents to a safe value. This, however, was undesirable on account of the variable resistance in the ground circuit, depending on the number of generators in operation. Furthermore, resistances of sufficient magnitude and capacity would have occupied too much space to be used in these power stations.

It was finally decided that full protection could be obtained by connecting but one line generator at a time to the neutral bus-bar in each power station. The transformers in the neutral connections were also disconnected from the relays on the main generator switch. Even with but one generator grounded in each power station, the interchange of current through the neutral rheostats, and the tie-line between the stations, is at times large enough to make it undesirable to open the neutral disconnecting switch of a live generator.

The Interborough Rapid Transit Company's system was operated for about three and one-half years without a grounded neutral, in which time about 160 miles of cable was operated for three years and 340 miles for one-half year. Since grounding the neutral the system has been in operation for two years with about 340 miles of cable.

Previously to grounding the neutral there were 12 distinct operating burn-outs, and since then there have been 16. It appears from this fact that grounding the neutral has had no material effect on the number of burn-outs. This is as was expected.

Of the 12 burn-outs occurring previously to the grounding of the system, four shut down the power station; one other shut down two sub-stations, and four more shut down one sub-station. Of the other three which did not shut down the sub-station, two were isolated in time to prevent a short-circuit. In all of these cases there were five or six cables to a sub-station. During most of this period only the Seventy-fourth Street power station was in operation, so that there were no tie-line troubles.

Of the 16 burn-outs that have occurred since grounding the neutral, not one has caused a shut-down of either power station; eight have shut down the sub-station fed by the cable, two have caused one other feeder to open, and six have caused no disturbance other than the opening of the switches of the feeder in trouble. In three of the cases in which the sub-station was shut down the tie-line between the power stations opened, but without disturbing the operation of either. Of the eight burn-outs which shut down the sub-station, three were stations having three feeders each, one having four feeders, two having five feeders, and two having six feeders. Of the other eight burn-outs which did not shut down the sub-station, two were sub-stations having three feeders each, two having four feeders, two having five feeders, one having six feeders, and one having seven feeders.

Previously to the grounding of the neutral the switches operated with explosive violence on the short-circuiting of a cable, at times throwing oil and burning the contacts. Under present operating conditions, however, the switches always open very quietly, so quietly in most cases that it was necessary to install a tell-tale to indicate when there had been abnormal current through the neutral rheostats.

Before grounding the system, in all burn-outs the cable was so badly injured that it was impossible to make any bridge test, and it was necessary to

1. A paper presented at the meeting of the American Institute of Electrical Engineers in New York, October 11, 1907. The author is assistant engineer of the Interborough Rapid Transit Company, New York city.

2. See paper on "High Power Surges in Electric Distribution Systems of Great Magnitude," by C. P. Steinmetz, Transactions A. I. E. E., 1905, also discussion on same.

1. "Experience with a Grounded Neutral on a High-tension Plant," C. W. Ricker, Electric Journal, September, 1906.

2. "Neutral Currents of a Three-phase Grounded System," Electric Journal, July, 1907.

open a great many manholes before locating the trouble. Of the 16 burn-outs that have occurred since the grounding of the neutral, 14 of them were in such condition that the fault could easily be located by the Murray loop method. In most of these cases but one leg was grounded. In the two cases where all three legs were grounded, making the bridge test impossible, the burn-out was the result of very severe mechanical injury. Locations of the fault are always made to within a duct length, even on the longest cables, of more than 45,000 feet. The saving in time effected by this accurate predetermination of the trouble by the bridge method is an important factor in the time necessary to restore a sub-station to normal conditions of operation.

It is probable that something would be gained by increasing the resistance between the neutral and ground. When the scheme was first contemplated it was planned to ground the neutral through six ohms, there being at that time but one power station. Now with two stations in parallel the effective grounding is through but three ohms, making the possible ground current twice that originally planned for. There is no doubt but that with the resistance as first decided upon there would have been fewer sub-station shut-downs.

From the above data it is seen that grounding the neutral of this system through a series resistance has been quite successful. It has greatly reduced the disturbance from cable burn-outs and the time necessary to restore an injured cable to service.

Local Organizations of the American Institute of Electrical Engineers.[1]

By Paul Spencer.

There are at present a total of 33 local organizations included under the head of branches, university branches and student meetings. Of these 17 are organized in connection with educational institutions, reaching the student membership; the remaining 16 are located in cities as centers of electrical interest for the members and associates in their territory. There have been but few additions or changes during the year in the above number of local organizations. The University Branch at the University of Illinois, having the number of members and associates required by the by-laws, has, by action of the board of directors, been made a branch.

Student meetings have also, by the approval of the board, been organized as follows:

University of Maine, December 26, 1906.

Montana Agricultural College, March 29, 1907.

The question of the adoption of a student pin and the design for such a pin were submitted to the board of directors and approved. These pins are now in the process of manufacture and will be available at the beginning of the next term for students desiring them.

The work done by the branches themselves in the holding of engineering meetings and in the presentation and discussions of papers has undoubtedly been more successful this year than ever before. The following table of statistics will show to some extent the activities in this direction during the year:

	No of Meetings Since Sept. 1906.	Average Attendance.	No. of Original Papers.
Atlanta	..	...	..
Baltimore	7	45	7
Boston	7	117	6
Chicago	5	95	5
Cincinnati	5	20	4
Columbus	7	15	1
Minnesota	10	40	12
Pittsburg	7	73	4
Pittsfield	6	27	3
Philadelphia	7	73	12
San Francisco	..	...	..
Schenectady	28	275	18
Seattle	5	17	3
St. Louis	7	25	5
Toronto	3	28	..
Washington, D. C	4	44	..
Cornell University	8	130	4
Iowa State College	13	25	10
Lehigh University	8	40	20
Purdue University	12	100	7
Syracuse University	12	20	9
University of Wisconsin	6	60	5
University of Illinois	8	62	2
Worcester Poly Institute	7	46	11
Armour Institute	9	30	..
Ohio State University	1	18	..
Pennsylvania State College	..	...	..
University of Arkansas	12	30	..
University of Colorado	..	...	..
University of Michigan	..	...	..
University of Missouri	10	20	..
Washington University	3	8	..

It is evident from the above table that the branches are carrying out the work which was the idea of their foundation. They have practically all been in existence for three or four years; the first flush of enthusiasm that may have existed at their formation has had time to cool; the leaders who were responsible for the starting of a branch have, in most cases, passed on the work to other hands, and the fact that the work continues to flourish and the interest remains unabated shows that the branch movement has passed a formative period and has settled down to a working basis.

It is noticeable from the table that the meetings have been held with regularity and that the attendance has been large. The average attendance in percentage of the available membership will compare very favorably with that of the New York meetings. It is also noticeable that more attention has been given to the presentation of original matter and less to the consideration of the New York papers than in former years.

The committee has been much impressed with the activity of the university branches and student meetings. Their work differs essentially from that of the regular branches in that it is largely educational. Their function is to assist in the development of younger men and to bring them into touch with the Institute at the threshold of their careers. How well they are doing this work and the importance of encouraging it can be estimated from the number of young men who are being reached in this way. The statistics speak for themselves.

Cornell shows an average attendance at its meetings of 130, with a maximum of 225; Purdue, an average of 100, a maximum of 265; Wisconsin, average 60, maximum 175.

In fact, virtually all of the university branches show that the students of the Institute are taking an active interest in the work. The following quotation from a letter received from Professor Esty of Lehigh University expresses very well the general situation at these oreganizations:

"Our year just closing has been the most successful in our history. I regard the social feature of our monthly meetings as a most important element in stimulating interest. We are training our students to become active and useful future members of the Institute. Local organizations of this kind certainly pay enormous dividends on the investment."

Letters were sent to the branches asking for an expression of opinion as to the year's work and as to future prospects. In answer to the question, "Has the current year been successful and shown a healthful increase in interest and activity?" the reply has almost invariably been an emphatic "Yes." Judging from the reasons given in these replies, this success has been due to the following causes and in about the order of importance as stated:

1. To an enthusiastic and hard working set of men at the head of the branch.

2. To the consideration of original papers of local interest instead of a rehash of the New York papers.

3. To the increased recognition of the branches by the Institute.

4. To the development of a certain amount of social features.

The replies to the question, "What is most needed to further the interest of the local organizations?" have shown a remarkable unanimity. Some say that a larger appropriation from the Institute funds is required to permit an expansion of the work, the hiring of better meeting quarters and an increase of social features. Practically all are united in saying that there is needed a greater co-operation between the branches and the Institute. All believe that occasional visits to the branches by officers and prominent members of the Institute would increase the enthusiasm of the branches themselves and would strengthen the bond between them and the Institute.

The above digest of the replies of the branches to these two important questions which are in effect, "How has success been attained in the past?" and "How can it be continued and increased in the future?" would seem to indicate that there is necessarily a development along two lines:

1. In order that the work done by the branches can be of any value at all, either to themselves or to the Institute, they must be encouraged to develop as strong local societies.

2. In order that these local centers may be part and parcel of the Institute and may add strength rather than weakness to it, there must at the same time be developed a spirit of unity and co-operation between these scattered and distant organizations and the main body of the Institute.

The first line of development is largely in the hands of the branches themselves; they must justify their existence by their results. The clauses in reference to the local organizations in the revised constitution are very broad in their features and will permit any branch to work along the lines best suited to its locality. The following would seem to be some of the conditions bearing on the possibility of local success:

There should first of all be a large enough membership in the territory properly belonging to a branch to enable the work to be carried on without its being necessary to depend on two or three enthusiasts. The present by-laws require ten members and associates as the minimum number for the formation of a branch. This number we believe to be too low and would recommend that it be increased to at least 25. This, of course, does not apply to university branches or student meetings. Their formation should in the future, as heretofore, be encouraged in any institution of recognized standing.

Branches should take their work seriously, and should organize with officers and committees chosen with that end in view. It is particularly important that officers for the ensuing year should be selected before the summer vacation, so that they may be ready to take hold vigorously with the opening of the work in the autumn.

As definite a programme as possible should be laid out early in the year. It may be more or less tentative and changed as the year progresses, but a plan to work by will both lessen the burden of the work and insure more interesting meetings.

Younger men should be encouraged to take a prominent part, so that they can be fitted to become officers of the branches, bringing in new ideas and relieving those who have been carrying on the work.

The consideration of original papers will be found necessary in order to keep up the interest.

Social features and visits of prominent engineers will also add very much to the interest of the work, but are largely a matter of expense.

The expense question is always a difficult one to handle. The funds of the Institute are limited, and on account of the number of branches it is difficult to appropriate for each branch a sum sufficiently large to satisfy all of its requirements. The necessary expenses for engineering meetings, such as the rent for a hall, the cost of sending out notices and of a stenographer at the meetings, should be met from the Institute funds. To a certain extent we believe it would be wise for the Institute to bear the expense in connection with visiting engineers. The expense of social features should be paid out of local funds and not charged against the Institute.

In order to strengthen the bond of unity and co-operation between the branches and the Institute there should certainly be continued the liberal attitude which has been shown by the administration this year. The publication of meritorious branch papers in the Proceedings will help along these lines. The larger publicity to Branch affairs which has been given in this year's Proceedings has undoubtedly been of great assistance in strengthening the branch work. The branches can be further made to feel that they are an integral part of the Institute, if they are asked to assist, as far as possible, in the work of the Institute. They should be represented on committees, and with due regard to the possibility of assembling a working quorum they should be represented on the board of directors. Personal visits to the branches on the part of officers and prominent members would be most helpful in bringing about this feeling of co-operation.

In conclusion we would bring to the attention of the Institute at large, and especially to any members who may have any doubts as to the wisdom of encouraging the branch work, the fact that this work can be no longer considered as in an experimental or temporary stage. The wisdom of starting the branch movement is no longer a proper question for debate; the branches are here with an immense possibility for useful work. It is not conceivable that this work, started in the broadest spirit of the greatest good to the entire membership of the Institute, can be allowed to languish through a lack of appreciation of its possibilities or through a lack of co-operation either on the part of the branches themselves or on the part of the main body of the Institute.

1. Report (slightly abridged) of committee on local organizations presented to the board of directors of the American Institute of Electrical Engineers on May 21, 1907. Mr Spencer is chairman of the committee.

"Wireless" in Central America.

It is reported that the extensive system of wireless-telegraph stations being installed by the United Fruit Company to connect New Orleans with the different countries of Central America will be in operation within the next nine months. Already four of the stations have been put up, and are in working order, and two of the ships, the Preston and Ellis, have been equipped with the instruments. The four points now being used are Port Limon, Costa Rica; Bluefields, Nicaragua; Rama, Nicaragua, and Bocas, Panama. The International system for the sending of messages is at present being used on land, while the De Forest is employed on the ships. Just at present Mr. Musgrave, who is in charge of the work, is engaged in putting up the tower for the station on Swan Island, an American possession off the Honduras coast. Other points to be touched at are Cape San Antonio, Cuba; the mouth of the Mississippi River and New Orleans. In addition, every important ship owned by the United Fruit Company will be equipped, making constant communication with all vessels and stations in which the company is interested.

Electric-railway Assessment in Illinois.

The 31 electric railways of the state of Illinois, with a mileage aggregating 889 miles, are assessed $7,852,520, an increase of nearly a million dollars over the equalized assessment of last year. The rapid growth of electric roads is indicated in this assessment, which shows the total amount assessed against electric roads is about one-thirteenth of the total equalized assessment against the steam railroads.

The use of the guillotine or of electricity in killing animals for food in place of the methods now in use was advocated in a paper read by Henry Bergh of New York before the American Humane Association in Boston on November 13th. It was the second of a three days' conference which was held there by the association.

Graphite.

Although this country consumes about 35 per cent. of the world's total output of graphite, it furnishes but 20 per cent. of it. The amount imported into the United States in 1906, chiefly from Ceylon, was valued at $1,554,212, and the value of the domestic production was only $340,230.

The purest graphite is carbon with 0.05 to 0.20 per cent. of hydrogen, but the commercial grades of crystalline graphite contain clayey impurities, even the best, such as some of that from Ceylon, comprising as high as 15 per cent. of ash.

The distinction between crystalline and noncrystalline or amorphous graphite is not easily defined. Some of the graphite that is termed amorphous differs from crystalline graphite only in the microscopic size of the flakes; on the other hand, amorphous graphite may be more closely related to anthracite coal than to crystalline graphite. An instance of this is seen in the Rhode Island deposit, which was formerly known and reported as anthracite coal, but which now furnishes commercial graphite.

The chemical composition of graphite makes it a highly refractory material of exceptional value in the steel and other industries, and it finds its widest use in the manufacture of crucibles, muffles, brazing boxes, stirrers and other articles designed to be exposed to high temperatures. Its softness and black streak fit it for the use that has given it the name graphite; and the perfect cleavage, purity and softness of the flake graphite especially adapt it for use as a lubricant. The high electroconductivity of the mineral also gives it value for certain electrical supplies.

The use of graphite in the manufacture of pencils is probably both its oldest and its best-known application, yet the percentage of the mineral used for this purpose is not large, being undoubtedly less than 10 per cent. of the world's production, and one authority even estimates it as low as four per cent. Much flake graphite is also used in the manufacture of paint, stove polish and electrotyper's powder.

According to the statistics of production for 1906, reported by George Otis Smith, of the United States Geological Survey, in an advance chapter from "Mineral Resources of the United States, Calendar Year 1906," an output of crystalline graphite was reported in the states of Pennsylvania, New York and Alabama. The graphite produced in Alabama, Georgia, Michigan, Wisconsin, Colorado, Rhode Island, Nevada and North Carolina has generally been classed as amorphous, but the material shows extreme variations in purity, ranging from the high grade, essentially crystalline graphite of Colorado and Alabama, to the impure graphite schists mined in Georgia.

The production of artificial graphite has steadily increased since 1897, the year of its introduction, and the quantity manufactured in 1906—5,074,757 pounds, valued at $337,204—is the largest yet reported. The use of this product is being rapidly extended, and it probably comes into competition with the natural graphite in many lines of manufacture, especially in the electrical trade, but for some purposes it seems certain that nothing can take the place of the natural mineral, and the production of crystalline graphite will doubtless continue to increase.

Presidents of the Institute.

Reviewing the 25 years to which the American Institute of Electrical Engineers has attained, at a branch meeting in Schenectady recently, Mr. T. C. Martin of New York, senior surviving past-president of the Institute, noted that of the 19 presidents one never attended a single meeting, 15 were engineers of distinction, and the names of 17 are attached to important inventions. Eight of the 19 were teachers and three have been journalists, while seven were natives of foreign countries. Mr. Martin paid a deserved tribute to the great value of the work of Secretary R. W. Pope.

Referring to the library and the gift of one past-president, Mr. Martin, said: "The joint library in the new Engineering Building given us by Mr. Carnegie is one of the best evidences of the good that flows already from the creation of the new home. There we have what is probably, even now in the earlier stages of organization, the best collection of engineering literature in the world. It is constantly securing valuable accessions, and students more and more frequent it. Together with the grand Public Library on the next street, now being finished, it will constitute the best center of scientific and literary investigation, through the printed word, to be found on this continent. When our past-president, Dr. Wheeler, with generous impulse, gave us the Latimer Clark Library, he little thought that from such a nucleus, or so soon, would come in reality both the building and the splendid larger library it now enshrines. We Electricals are, indeed, not as appreciative as we ought to be of what has come through Dr. Wheeler's initiative and liberal gift—a critical event in Institute history determining all the future."

Canadian Telephone Notes.

At Veregin, Sask., the Doukhobor Telephone Company has been incorporated for the purpose of building a telephone system in the Doukhobor communes scattered throughout Saskatchewan. Peter Veregin is superintendent.

At a special meeting of the telephone committee of the City Council of Calgary, Alberta, it was decided to take up the question of automatic telephones. It was further decided that the committee should have plans drawn up of the proposed civic system.

The Central Telephone Company of Bridgewater, Nova Scotia, has disposed of its lines to the Nova Scotia Independent Telephone Company. The line consisted of 90 miles of wire, which will be thoroughly overhauled. The company had a long distance line connecting Bridgewater and Middleton, Nova Scotia.

At Creston, British Columbia, an Independent telephone company is being organized to build a local and rural system. The town clerk can give details.

The Drumbo Rural Telephone Company of Drumbo, Ontario, is having surveys made for rural lines to run to Gobles, Eastwood and Princeton, with local exchanges in each of these villages. An extension to Cathcart is also being discussed. At the recent general meeting of the company officers were elected, with F. J. Daniel as president.

The city electrician of Victoria, B. C., under instructions from the City Council, has prepared an estimate of the cost of putting all telephone and telegraph wires underground within the city limits and places the cost at $17,000 a mile.

A number of ratepayers are arranging for the installation of a telephone system at Acton, Ont. If the scheme materializes, lines will be built to Speyside, Limehouse, Ospringe, Knatchbull, Silver Creek, Ballinaford and Crewson's Corners. T. T. Moore of Acton is interested.

Work on the government telephone system in Winnipeg, Man., has been proceeding very rapidly, although the general public has not been aware that more than a start had been made. Already 400,000 feet of conduit has been laid and about half of this amount will be laid in the spring to complete the conduit work. These conduits have been built in the principal streets, while poles have been erected in the lanes in the outskirts. The foundation work of the central exchange has been completed and the building will be rushed to completion in the spring.

In a speech recently made by the Hon. W. H. Cushing, minister of public works for Alberta, he said: "We hope to have every city, town, village and hamlet on the government lines before many years have passed. Then we are going to make a feature of the rural lines that will enable the farmers to have telephones in their homes, so that they can keep in touch with the outside world. Manitoba has already started construction on a government system, and Saskatchewan is arranging the preliminaries to such an end. Then there will be three government-owned telephone systems in Western Canada, and I have no doubt connections will be made between the three." R

Indiana Telephone Items.

The City Council of Seymour has granted a 20-year franchise to the Citizens' Mutual Telephone Company, a local corporation, operating a system in the farming district of Jackson County. The Seymour Home Telephone Company has occupied the Seymour field alone for several years, and, owing to the failure of the rural company to secure a connection with the Seymour exchange, a controversy arose, resulting in the securing of the franchise just issued by the council. A new exchange will be built in Seymour.

The Interstate Telephone Company of Odon has been taken over by its new owner, William Wilgus of Lafayette, who recently purchased the plant, valued at $20,000.

The controversy between the city administration and the Home Telephone Company of Fort Wayne broke out in a new place when the company filed an application during the last week for permission to lay a conduit in Columbia Avenue through the residence suburb known as Lakeside. Mayor Hosey at once asked the telephone company to file a personal bond, not being satisfied with the bond offered by the Federal Surety Company last February. On Wednesday morning, under instructions from the city, the McBride Construction Company began the work of stringing the wires for the distributing system of the municipal lighting plant on the top cross-arms of a score or more of the poles of the telephone company, thus bringing the controversy up to an acute stage. According to the latest report, the company has filed a written protest and a notice that it would hold the city liable for any damage inflicted to the system, and this is to constitute the opposition which the Home Telephone Company has adopted instead of removing the light wires strung upon the company's poles. Because of the complications and the probable far-reaching results to the telephone company in case the light wires should cripple the service of the telephone company, it is believed that the warring interests may yet find a common ground upon which to reach a satisfactory agreement out of court. S

Telephone Rates in New Orleans and Memphis.

A decision of some importance has been rendered at New Orleans in the United States Circuit Court, the decision being against the Cumberland Telephone Company in its injunction proceeding against the Louisiana Railroad Commission to restrain the commission from fixing certain rates. In view of a recent proposition of the company to increase its rates, it is said that in New Orleans four separate movements have been started in opposition, notwithstanding the company's efforts to bring about a satisfactory adjustment of the issue. The Board of Trade has had appointed a committee of five to look into the reasons for the proposed increase. The Progressive Union has set afoot a similar inquiry. Attorneys are preparing a liberally signed petition to the Railroad Commission asking that it revoke its ruling to the effect that the company may make special contracts with patrons of special lines. Subscribers not affected by the proposed increase have started a campaign on their own hook. The disagreement is concerning charges for private-branch exchanges, and the company has offered to submit the question to five members of the Board of Trade, producing books and evidence to show that the existing rates on private-branch exchanges are not reasonably profitable.

In Memphis the Cumberland Telephone Company has secured an injunction restraining the city from enforcing an ordinance reducing the telephone rates, the company being placed under a $5,000 bond, however, to protect the city from any possible loss by reason of the action. The fight has been in progress for some time, and the court, in granting the injunction, stated that the bill charges that the proposed rates would not permit of a reasonable income, and that therefore they would be confiscatory.

GENERAL TELEPHONE NEWS

The Clinton (Okla.) Mutual Telephone Company has been incorporated with a capital stock of $5,000.

The Southwestern Telegraph and Telephone Company of Dallas, Tex., has accepted a franchise in El Paso, Tex.

The Southern Telephone and Telegraph Company is said to have sold the local exchange at Hot Springs, Ark., to the Southwestern Telegraph and Telephone Company.

President Frank L. Beam has fixed December 3d as the date for holding the Eighth District meeting of the Ohio Independent Telephone Association. Final arrangements have been made for the meeting at Toledo.

The Chicago Telephone Company has already conferred with President Schneider of the Board of Education relative to the details of installing free telephones in all the public-school buildings of Chicago under the new ordinance. The company is ready to begin installation.

The Independent telephone franchise owned by Jesse Warden of McKinney, Tex., has been sold to Dallas capitalists, it being their purpose to establish an Independent telephone system in Dallas also, with long-distance connections. The company has recently secured franchises at several other towns.

The Southern Bell Company is pushing the development of the rural telephone through the South wherever the territory to be covered is sufficiently promising to warrant the outlay. Preparations are being made to build a number of these lines out from Salisbury, N. C., to reach the country sections in Rowan and adjoining counties.

Meetings of the directors of the Strowger Automatic Telephone Exchange and the Automatic Electric Company of Chicago were held a few days ago, and arrangements were made by which the Automatic Electric Company will take over the Strowger interests, putting an end to litigation between the two companies. A stockholders' meeting is to be held on December 19th at the offices in the Rookery Building for the purpose of approving the plan.

The Omaha News says that lower telephone rates and a general improvement of the entire system in Omaha and South Omaha, Neb., are contemplated by the Nebraska Telephone Company, to go into effect not later than next January 1st. Permission has been asked from the State Railway Commission to allow a reduction on business telephones in Omaha from $48 to $42 a year, with the privilege of $1 a month reduction if bills are paid by the 10th of each month. Corresponding reductions will be made on the residence telephones, including those on two-party lines. The four-party lines will be put on two-party connections with the same rate as charged now for the two-party lines.

CORRESPONDENCE.

Continental Europe.

Paris, November 5.—The central-energy system is now to be adopted in the main telephone exchange of Paris, and the work of making the necessary changes has been going on for some time past. This improvement is one which is much needed, as up to the present the working of the system was far from satisfactory and gave rise to continual complaints from the subscribers. Not long since the subscribers' league was formed for the purpose of defending their interest, and this no doubt had an influence upon the decision which the government department made as to carrying out some improvements in the service. It is to be hoped that in the near future Paris will have a telephone system which will work as well as those in Berlin and other large cities of the Continent.

The city of Antwerp had its telephone exchange completely destroyed by a fire which occurred on the 29th of October. The exchange was located in the second story of a large building near the Cathedral, and the fire was caused by the furnace placed in the basement. Sparks from the chimney fell upon the roof, burning the supports of the wires, and the fire soon broke out in the second story containing the exchange. Notwithstanding the efforts of the firemen the destruction of the apparatus was complete, and the loss is estimated at $200,000. Business affairs will suffer from the absence of telephone communication, and it will no doubt be some time before the service can be set working. This is estimated at three months at least.

As regards the second tunnel of the Simplon which it is proposed to build, the subject is now being actively considered by the Swiss government. Not long since, in the message which the Federal Council sent to the chambers in regard to this question, it declared that it approved the ideas of the railroad company as to completing the second tunnel, and it seems likely that the project will soon be approved by the government. A number of locomotives of an improved type are to be introduced on the present Simplon line before long. These are constructed after the experience which is now had as to the working of the road under the present conditions, and the first locomotive of the new series will soon commence running. It has eight driving wheels and can be run at four different speeds by coupling the motors. The use of four speeds instead of three, as at present, will be an improvement, and the new locomotives have several other new points.

While piercing the Lötschberg Tunnel a spring of cold water was met with not long since and measures will have to be taken to carry off the water, as was done in the Simplon, in order to continue the work. It will be remembered that the hot and cold springs caused a great difficulty in the latter tunnel.

The French government is carrying out a series of experiments in radio-telegraphy between the warships of the Mediterranean fleet under the control of a commission headed by Captain Ferrié and Lieutenant Jeance. Some new apparatus lately placed on the vessels will be tested. The vessels will be stationed at different points on the French and the Algerian coasts. At present there are four of the battleships in the trials, headed by the Jules Ferry.

At Namur, Belgium, is to be installed an electric-tramway system having a total length of 10 miles, and it will be owned by the National Traction Company. Not long since the company secured the concession from the government for the present system, and the work is to be finished according to the contract, on September 25, 1909. This will comprise three different lines of tramway, two of which start from the railroad depot. A. DE C.

Great Britain.

London, November 8.—A London daily paper which makes a feature of publishing as many photographs as can be conveniently crowded into its pages has purchased the rights of the Korn system of sending pictures by telegraph for England and Europe and also Canada, and a few days ago a demonstration of the system was given in the offices of the newspaper in question. Professor Korn gave a short lecture descriptive of the system, and the London-Paris wire was made use of for the purpose of sending and receiving messages. So far no photographs sent between the two points have been published, but a number of others have, which were transmitted along the land lines in Germany.

The smoke-nuisance prosecution against the Underground Electric Railways Company of London at the instance of the Westminster City Council has ended in a triumph for the former. The railway company put into the witness box a large amount of expert evidence to prove that the smoke complained of was not black, and that to this extent it did not come within the Public Health (London) Act, under which the prosecution was taking place, and further that the furnaces were constructed as scientifically as was possible. On this latter point the act gives the magistrate the power to decide in favor of the accused party if he is satisfied that no negligence has been guilty of either in the design of the furnaces or in the management. The magistrate found for the railway company, with $1,500 costs against the City Council.

The Board of Trade has at last definitely given its consent to the use of the G. B. surface-contact system by the London County Council. In a short time, therefore, there will be examples of all three systems of electric traction in London, viz., conduit, trolley and surface contact.

The Local Government Board has appointed a departmental committee to consider the whole question of the machinery and also the engineering staffs at poor-law institutions in this country. From the disclosures that have been made in connection with various inquiries of late some such step as this has been inevitable.

A large contract for electrical machinery has been given out by the Japanese naval authorities to the Lancashire Dynamo and Motor Company. The order is for the complete equipment of an electrical generating station of 3,000 kilowatts capacity, triple-expansion engines being adopted, and the size of the units being 1,000 kilowatts.

The amalgamation is announced between Messrs. Appleby's and the Temperley Transporter Company. Both these firms will be recognized as large makers of electric cranes, among other miscellaneous machinery.

Richardsons, Westgarth & Co., the large firm of turbine makers on the northeast coast, have under construction for the County of Durham Electric Power Company a 12,000-horsepower unit, the largest machine of its kind yet made in this country for central-station work.

The establishment of a professorship of engineering science at Oxford University has now been definitely decided. In the course of a discussion one speaker said that there was a very great demand for advanced teaching in the colonies, where, in the past, the lack of facilities had resulted in many Americans securing posts which ought to have been taken by British engineers. G.

Dominion of Canada.

Ottawa, November 16.—From present indications the city of St. Catharines, Ont., will obtain street lighting for the next five years at least at a price below $39.50 per night. That was the price agreed upon with the Stark company, but since the failure of the company to fulfill its contract the Lincoln, a subsidiary company of the Cataract Power Company of Hamilton, has been supplying light for $72. Now the Falls Power Company, a subsidiary of the Ontario Power Company, is negotiating with the City Council of St. Catharines and is said to be willing to pay the Stark company's debt and fulfill the contract at a better price than $39.50.

A joint deputation from the Council and Board of Trade of Owen Sound visited the plant of the Georgian Bay Power Company at Eugenia, Ont. The work of developing power there is so far advanced that offers for it can be considered. It is said that the company is offering Owen Sound 3,000 horsepower at $20 per horsepower per year on condition that the town build a transmission line. This is estimated to cost $60,000, as the right-of-way for the line has been bought already.

Everything will be in readiness for the city of Ottawa to take over its own lighting of the streets on December 20th. The alternating-series system of lighting instead of the direct-current system now used by the Ottawa Electric Company is being adopted.

Five million dollars is the estimate of the cost of the distribution plant for Niagara power for the city of Toronto, as prepared by the private firm of Smith, Kerry & Chace. This amount is higher than had been expected and is in excess of the estimate of the engineers of the Ontario Hydro-electric Power Commission, but this is due to the excellence of the plant which it has been thought Toronto should have. The estimates, it is understood, call for a very elaborate and complete plant.

Application has been made to the municipal councils of the Cobalt district by Hon. F. Latchford and J. W. Fitzpatrick of Ottawa, M. J. O'Brien of Renfrew and Judge C. M. Stone of Cleveland, Ohio, for a franchise to run an electric railway between Cobalt and Haileybury. The road will eventually run to New Liskeard.

It has been officially announced by the Hon. Adam Beck that the Ontario government will stand by the figures submitted by its power commission for transmission of electrical energy from Niagara Falls to the municipalities of the province. In respect to the criticism of the figures named in the report of the government commission the minister declared that not only would the government undertake to supply power at the prices submitted, but would pledge itself to bear any excess cost in the event of the rates being higher, provided that the municipalities fulfilled the terms of their contracts. W.

Winnipeg, November 16.—Several years ago the Winnipeg Electric Street Railroad Company received a franchise to build an electric railway through the municipality of St. Vital, Man. Time went on with the company doing nothing in the matter until last week, when the municipality decided to cancel the franchise and build a municipal line into Winnipeg, a distance of approximately 11 miles. The clerk is now obtaining the necessary data, and construction will be commenced as soon as the preliminaries have been arranged. J. P. Dumas, St. Vital, may be addressed.

Every employe of the British Columbia Electric Street Railroad Company who has served with the company for a year or more will receive $63. This is the bonus to employes declared by the company. In Vancouver alone $30,000 will be distributed. R. H. Sperling is general superintendent.

By a large majority the ratepayers of Strathcona, Alberta, voted in favor of granting an exclusive franchise to the Strathcona Radial Tramway Company, an organization which has been formed for the purpose of building an electric street-railway system in Strathcona. The company has already made application to lay tracks on certain streets in the sister city of Edmonton, and promises to commence construction as soon as the materials arrive.

Preliminary surveys have been completed for the damming of the Little Saskatchewan River at Minnedosa, Man., for the civic power system to be built by that town. The Dominion government has also given permission to utilize the waters of Clear Lake in connection with the development, and it is expected an active start on construction will be commenced within the next few weeks. E. O. Dennison, Minnedosa, may be addressed.

The electric furnaces at the plant of the Electro-metals, Ltd., Welland, Ont., have now been in operation for three weeks and the process is pronounced to be a success.

The City Council of Calgary, Alberta, has reduced the price of electric light by five per cent. This makes the price 11 1-5 cents per kilowatt-hour. R.

New York.

New York city, November 16.—The annual report which the Public Service Commission is required by law to make to the Legislature is now being prepared and its contents, it is stated, will show a remarkable amount of work accomplished by the commission in the four months of its existence. Improvements have been secured in the service rendered by the public-service corporations in the city, and the revelations of the investigation into the affairs of the Interborough-Metropolitan Company are well known. The Coney Island and Brooklyn Railroad Company has announced that it will pass two dividends for the purpose of providing the additional equipment required in the orders of the commission to that company.

Another final order of the commission approving the application of the Nassau Electric Railway Company for permission to extend its tracks to Livingston and other streets was settled within five days from the filing of the application, thus affording material relief for one of the most congested points of surface transportation in Brooklyn.

To the list of final orders might also be added another class relating to subway construction, matters which are still before the commission. Also as to the conditions of the streets after either surface or subway contracts have been fulfilled.

The commission has received approximately 550 complaints regarding transit in New York city. Such investigation has often resulted in the merger of a number of complaints into a single matter for consideration before the commission and a number of very valuable suggestions have been offered to the commission for the improvement of congested districts.

Another noteworthy problem solved by the commission is that of the building of the Fourth Avenue Subway at a cost of some $35,000,000, and the commission will within a week or so advertise for bids for the several sections. Under this commission the work of constructing the subway loop connecting the Manhattan ends of the Williamsburg and Brooklyn bridges is being rushed to the limit. Mention has already been made in the Western Electrician that the commission has engaged the services of two prominent engineers to conduct a most careful investigation of the properties under the control of the commission.

Among the duties devolved upon the Public Service Commission was that of the former state inspector of gas meters, whose office was abolished by the act creating the commission. During the month of October the commission averaged over 1,000 meters a day. The magnitude of this work may be appreciated when it is considered that each of these meters has been given an actual test to bring it within the percentage allowed by law, and instead of the brass tag used by the former department the commission now has adopted the method of scaling the meter by wax.

Considerable attention is being paid to the test in progress upon the seven-mile experimental line of the Pennsylvania Railroad at Franklinville, near Clayton, N. J. The track is specially constructed for the test and is arranged to record speed of train, impact of rails, effect of high speeds on rails, fishplates and ties, both on straight lines and curves. Both steam and electric locomotives are being tried. On Tuesday electric No. 19003 made 85 miles per hour. As the center of gravity in the steam locomotive is much higher than in the electric, it was not anticipated that this limit could be exceeded. Steam No. 6075, however, made the record of 89.4 miles per hour around the curve at Franklinville. Further trials will be made and it is expected that the electric will be driven up to nearly 100 miles per hour.

The public service commissioners made a tour of inspection of the electrified system of the New York Central Railroad last week. At first an investigation of the work at the terminal at Grand Central Station was made. In a special electric train the commissioners were then taken to Mount Vernon, where one of the electrified sections ends.

For the last month the Long Island Railroad Company has been assembling material at Auburndale on the North Shore Division with a view to double-tracking and electrifying this section. The railroad company has purchased considerable real estate and is laying additional tracks with the purpose of making Bayside a sub-terminal. This would bring the Bayside-Flushing section within 12 minutes of Long Island City. Power would be furnished from the company's plant near the terminal at Long Island City. It is planned to have this service in operation by next spring. E. H. S.

Michigan.

Detroit, November 16.—Attorney W. E. Baubie has petitioned the Detroit City Council for a 30-year franchise for the Detroit Traction Company. The provisions of the franchise are eight tickets for 25 cents at all hours, single fares 5 cents, universal transfers, with offer to exchange transfers with any other company; bond limit, $55,000 a mile, interest on bonds not to exceed five per cent.; stock not to exceed bond limit; cost of paving between tracks and for 6½ inches outside to be divided equally between company and city; municipal-ownership price to be fixed by arbitration; 25 miles of track to be built in 18 months and to build balance of 80 miles within three years; to take up Detroit United Railway routes as soon as franchises expire. Mr. Baubie refuses to name the financial backers of the scheme.

The Shiawassee Light and Power Company was granted a 20-year franchise in Vernon at the last council meeting. Ten or more street lights will be furnished at a rate of $50 a year each. The service is to begin not later than June 1, 1908.

The first unit in the Superior plant of the Michigan Edison Company was started on November 9th. This will aid materially in carrying the Christmas peak load.

The constitutional convention in session at Lansing has been requested to change the constitution and statutes which permits boards of supervision to grant permission to build power dams on nonnavigable rivers. It is requested that supervisors be given the right to exercise control over rates and distribution, to prevent power being transmitted to a distance if there is a local demand for it.

The Owosso Light and Power Company will be incorporated to develop a waterpower on the Shiawassee River near Owosso. Power will be used for the Grand Rapids and Pontiac Railway eventually, but the immediate use will be for light. E. M. Hopkins of Detroit is president.

The Detroit Council granted a public hearing to merchants asking for a uniform rate for light instead of the present differential rate. Mr. Crowell, the engineer retained by the mayor to investigate the Edison company's rate, was present. A written statement of grievances was requested. This will be referred to the Edison company for answer. D.

Indiana.

Indianapolis, November 16.—In the elections held in two townships of Vigo County and two townships of Sullivan County to vote on the proposition of a subsidy tax in aid of the construction of the Terre Haute and Merrom Traction Company, the proposition in each case was defeated by a close vote. The promoters of the enterprise claim to have right-of-way, and that work would have begun in a short time had the aid been voted.

The Wabash Railroad Company has put on a local passenger train to make the round trip between Fort Wayne and Lafayette daily in opposition to the interurban company, which of late has secured all the local traffic by reason of the steam line having no local train.

The Town Board of Nashville, Brown County, has granted a 50-year franchise for the use of any of the streets to the Ohio Valley Traction Company. This is the first franchise granted an electric road by the Nashville Council, and the citizens have contributed $10,000 in aid of the construction of the road.

The Terre Haute and Western Traction Company has completed its line between Terre Haute and Paris, Ill., receiving at last a new franchise to enter the latter city. The completion of this line by the McGowan interests is believed to be the first step toward an extension to Charleston and other points west, with St. Louis as the ultimate objective point.

The first Saturday of February, 1908, is the date set for the sale of the Indianapolis, Huntington, Columbia City and Northwestern Electric Railway Company's roadbed and other assets, by W. M. Self of Syracuse, receiver. The company owns four miles of track between Syracuse and Vawder Park.

The citizens of Nappanee have raised a fund of $35,000 to encourage the building of a north-and-south electric railway out of Nappanee to penetrate the great onion farms of Elkhart County.

The first United States mail service to be established on an electric railway in Southern Indiana has been put in operation on the Evansville and Eastern electric railway between Evansville and Rockport and intervening towns.

The Indiana and Michigan Electric Company, which is building a dam across the St. Joseph River north of South Bend, announces that by July next it will be generating 10,000 horsepower of electricity to be distributed in the St. Joe Valley. Nearly $1,000,000 has been expended in the construction of the concrete dam, which will create 10 miles of back water 1,500 feet wide.

The Blackhawk Light, Heat and Power Company of Vincennes has filed articles of incorporation, capitalized at $1,000,000. The company proposes to install heat, light and power plants in towns, communities, industries or places of amusement by distributing natural or artificial gas and electricity. Cyrus Hoffman, George H. Smith and H. S. Shoffer are directors.

While the Indiana Railroad Commission has a specific object in sending out quarterly bulletins relative to grade-crossing accidents, these bulletins, together with other work which is being done by the commission, are expected to create a sentiment in favor of elimination of all grade crossings in Indiana. The bulletins state that, owing to the bad condition of some crossings and the present high speed of trains, it is difficult for anyone to get off a crossing in time to escape a rapidly approaching train. Managers and superintendents of railroads are requested to issue special instructions as to the manner of giving crossing signals in order that the engineers and motormen will give proper warning when nearing crossings. S. S.

Northwestern States.

Minneapolis, November 16.—The Minneapolis City Council has adopted resolutions instructing the Twin City Rapid Transit Company to make improvements in the way of new extensions to its system which will mean an additional six or seven miles of track.

Charles P. Murray & Co. of Cedar Rapids, Iowa, have applied for a street-railway franchise at Iowa City. Another company is also seeking a franchise there, headed by Henry Negus of Iowa City.

The Polar Star light plant at Faribault, Minn., has been sold to the Tri-state Telephone Company.

The council at Eveleth, Minn., has rejected the bid of the Mesaba Traction Company for a street-railway franchise in that city.

The Wagner, Lake Shore and Armour Traction Company has purchased a site at Aberdeen, S. D., for its new electric-light plant and has let the contract for its erection to J. Lauesen. It will cost $75,000. The company will carry on its local operations as the Aberdeen Light and Power Company with a capitalization of $200,000.

The Omaha Electric Light and Power Company contemplates putting in an electric-lighting system at Papillion, Neb.

The contract for the erection of an electric-light plant at Tekamah, Neb., has been let to Mr. Bartlanger of Omaha, and work has been started.

Wix & Brenner will establish an electric-lighting system at Stella, Neb. R.

Illinois.

Peoria, November 16.—The Dallas City Light Company is building an electric-light plant at Dallas City in connection with a waterworks system. L. M. Loomis is in charge. The company has a contract for 25 street arcs for lighting the streets. A line will be run to Pontusuc to furnish street lights. The plant is being equipped with Westinghouse machinery.

For some time the Peoria Terminal Railway has not been running its cars into the center of the city as it could not agree with the Peoria Railway Company as to compensation for the use of the latter's tracks. Both companies have asked for a franchise up Washington Street to the center of the city and the Terminal company has been refused one by the Common Council. The Promotion Club has taken up the question and has succeeded in making an agreement that it is believed will be satisfactory to both companies until the matter of a franchise up Washington Street can be settled.

The prospectus of the proposed electric road between Quincy and Taylorville, called the St. Louis, Terre Haute and Quincy Traction Company, has been issued. George H. Lawrence of St. Louis has just completed the survey of the road. It will be 142 miles in length and pass through a thickly settled part of the country.

The Missouri Valley Bridge Company, which has the contract for building the piers for the Illinois Traction Company's bridge at St. Louis, has a force of 100 men at work. The piers will be of Bedford stone and granite, like the Merchants' Bridge, and will range from 106 to 126 feet in height from bedrock. The bridge proper will be 2,365 feet long, with three central spans and two smaller spans. The bridge will carry a double track and on each side of the tracks will be a wagonway 14 feet wide and a seven-foot sidewalk. The traction company owns a tract of land consisting of 24 acres at the foot of Salisbury Street that will be used for terminals. The cost of the piers is nearly $300,000. The contract for the steel work has not been let as yet.

The new coal-conveying machinery for the Peoria Gas and Electric Company will be put into commission today. V. N.

Pacific Slope.

San Francisco, November 13.—The City Electric Company's new plant, which is now in successful operation in San Francisco, is to be increased by the addition of another Westinghouse generating unit. The present equipment consists of two 2,500-kilowatt Westinghouse-Parsons turbo-generators, 11,000 volts, supplied with steam by oil-burning Babcock & Wilcox boilers. Contracts have been signed for commercial business requiring the entire capacity. The company's main office is located at 347 Grant Avenue.

Miscreants have been for some time dynamiting poles of the California Gas and Electric Corporation's high-tension lines which supply electric power to the sub-stations of the United Railroads of San Francisco. The fact that the places of the striking conductors and motormen have been filled by new men and the lines are being operated almost as usual, with the exception of there not being a sufficient supply of power to operate the full complement of cars, may have something to do with these disturbances. The electric company will string a 2,200-volt circuit along the pole lines and install incandescent lights so that the guards can see to prevent future depredations.

The reconstruction of the Geary Street Railway in San Francisco, which was to have been made into an electric underground-conduit system by the city, is again being agitated.

The Prosser Traction Company, organized several months ago to construct an electric railway in the neighborhood of Prosser, Wash., has selected a site for a power house seven miles below Prosser, on the Yakima River, and has applied for a power-right.

Beall Foster and Samuel T. Lewis, officers of the Bismark Mill Company, Tacoma, Wash., are projecting an electric power plant in that city. They have applied for a franchise to erect transmission lines. The plant will be erected in the vicinity of the company's mill and will be operated by steam, the mill refuse being used for fuel.

The Ventura County Power Company has made a proposition to the people of the Ojai Valley, Ventura County, Cal., to install a plant immediately, if the people will subscribe for stock enough to pay half the cost.

Plans are being made to illuminate the long pier at Long Beach, Cal., by electricity. The cost would be in the neighborhood of $1,000.

There is much discussion in Pasadena, Cal., over the proposition to issue $200,000 of bonds for a municipal electric-lighting plant. A.

PERSONAL.

Mr. G. H. Clendenin, manager of the Nebraska Telephone Company at Nebraska City, Neb., has been transferred to Beatrice, Neb.

Sir Oliver Lodge has succeeded the late Sir William Perkin as president of the Faraday Society of England, which, as is well known, investigates the problems of electrochemistry.

Mr. J. E. Montague, general manager of the Buffalo and Niagara Falls Electric Light and Power Company, is recovering after a successful operation for appendicitis. Mr. Montague is a progressive central-station manager and is much interested in the new-business movement.

Mr. B. E. Merwin, general superintendent of the Interurban Railway and Terminal Company of Cincinnati, Ohio, has resigned to take a position with the Aurora, Elgin and Chicago Railway Company. Mr. F. H. Talbot, electrical engineer of the Cincinnati company and assistant to President C. H. Davis, has been appointed to take Mr. Merwin's place.

Mr. W. H. Blood, Jr., has been retained for another year as insurance expert of the National Electric Light Association. Mr. Blood's services, which are at the disposal of members to any reasonable extent, are of great value to the association in questions relating to the electrical fire hazard. He is addressed at 147 Milk Street, Boston.

Mr. William S. Heger, assistant to President Whiteside of Allis-Chalmers Company, Milwaukee, was a Chicago visitor on Wednesday.

Mr. R. A. Brown has been appointed city electrician of Nelson, B. C. He was formerly connected with the electrical department of the city of Calgary, Alberta.

ELECTRIC LIGHTING.

St. Paul, Neb., has voted to establish an electric-light plant.

The Omaha Electric Light Company will extend its lines to Papillion, Neb.

L. W. Chilton is about to begin construction work on an electric-light plant at Goliad, Tex.

W. A. Clark has been granted a franchise to install an electric-light plant in Virginia City, Mont.

M. A. Harrison and H. H. Caughlan have bought the electric-light plant at Nevada, Idaho, and will make improvements.

The Independent Light and Power Company of Shawnee, Okla., has been incorporated with a capital of $100,000 by J. W. Rubey and others.

H. C. Hodge and others are building a dam across the Big Creek Canyon, and will furnish electric light and power to Victor and Stevensville, Mont.

A petition has been circulated in Bay City, Mich., protesting against the proposed action of the City Council to improve and extend the municipal electric-light plant.

While placing a large new switchboard in the electric-light plant at Vincennes, Ind., workmen lost control of the heavy structure and it fell to the floor, breaking the marble panels into fragments.

The Cornell (Ill.) Journal says: "The electric-light plant is furnishing a very fine quality and plenty of light since the new generator has been installed. Cornell is to be congratulated on the lighting system, and Mr. Rhodes [owner of the plant] is deserving of the patronage of every citizen and business man in our city. Put in electric and help boost."

The San Antonio Gas and Electric Company of San Antonio, Tex., will soon rebuild its entire arc-lighting system and will install four new arc-light generators. Since the first of the year the company has undertaken various improvements in its plant on Villita Street, including the installation of an alternating generator, to take care of 20,000 incandescent lights, and another generator to furnish power for operation of street cars.

A special meeting of the Consolidated Gas, Electric Light and Power Company of Baltimore, Md., has been called to consider taking a lease on the Baltimore Electric Company, its only rival. Negotiations have been under way for some time, and it is understood an agreement has been reached. The Baltimore Electric Light Company also controls the Maryland Telephone Company, the only rival to the Chesapeake and Potomac, which is part of the Bell system.

The Economy Light and Power Company of Oconto, Wis., is seeking a franchise to light the city of Marinette. The company offers to furnish arc lights at $50 a year and supply current for commercial lighting at eight cents a kilowatt-hour for the first 1,000 hours' use, 7½ cents up to 6,000, 7 cents up to 10,000, 6½ cents up to 14,000, 5 cents to 18,000 and 4 cents a kilowatt-hour for consumers using more than 18,000 kilowatt-hours. The company also proposes to build an interurban road between Marinette and Peshtigo.

The Live Oak Manufacturing Company of Live Oak, Fla., furnishes electric light and power for Live Oak, a small city of 8,000, in addition to the operation of a planing mill, for the manufacture of dressed lumber. The electrical plant comprises two Allis-Chalmers alternating-current generators, one of which has been in operation for over five years and the other for three years, and the plant has never been shut down on account of either machine. A duplicate plant was provided at the time of installing the second unit, but up to the present time it has never been necessary to use it. The plant was kept in operation continuously night and day for over three years, with the exception of 12 hours on Sundays.

Mr. Silva, senior partner of a large Paris firm of electricians, says that several firms have discovered what a rich field London is likely to prove for the illuminated-sign business, and as a result London within two years will be the most electrically illuminated city in the world. "Ten years ago," he says, "London was the only city in Europe where electric illuminated advertising signs were to be seen, as in American cities. We knew nothing about such signs in Paris, but in 1898 our attention was drawn to them, and Paris electricians were quick to see the immense business that they could do with these electric signs in Paris. At the present time Paris is justifying her title of the 'Ville Lumière,' for her main streets and boulevards are a perfect blaze of illuminated electric advertising signs."

The electric-light plant of Shepherdstown, W. Va., which was built and operated by the municipality, has been sold by the Town Council to John L. Livers of Martinsburg, W. Va., for $3,500. Shepherdstown will be supplied by Mr. Livers, who will get his supply from the Martinsburg Power Company. The old plant at Shepherdstown will be dismantled.

ELECTRIC RAILWAYS.

Gross earnings of the Aurora, Elgin and Chicago Railway Company for October show an increase of about $9,000 a day compared with the corresponding month last year.

Poles are now being erected for the Bucyrus-Mansfield (Ohio) electric railway, and a portion is ready for the wiring. It is understood that the balance of the improvements will follow immediately.

The various electric railways in the vicinity of Toledo, Ohio, have perfected arrangements for carrying hunting dogs. The demands of hunters during the present open season brought about the arrangement.

Articles of incorporation of the Manitou Incline Railway Company have been filed in Colorado. The company has a capital stock of $220,000 and has purchased from the Hydro-electric Company of Denver the cable tram road from Manitou to the summit of Mount Manitou, a distance of one mile. The line will be reconstructed and re-equipped for the tourist season of 1908. N. N. Brumback is president of the company.

The Northwestern Pacific Railroad Company of San Francisco, a consolidation of the old North Shore and the San Francisco Northwestern Railway, now owned by the Southern Pacific system, has recently purchased for additional installation in the San Anselmo sub-station of the North Shore Railroad two 500-kilowatt Allis-Chalmers two-bearing motor-generator sets, a 30-kilowatt induction motor-generator exciter set and three 300-kilowatt Allis-Chalmers oil-filled, water-cooled transformers of 54,000 volts. The San Anselmo sub-station will receive three-phase, 60-cycle alternating current at 54,000 volts and furnish direct current at 600 volts and at 1,200 volts by means of Allis-Chalmers synchronous motors driving 600-volt direct-current generators and through a double set of bus-bars. These synchronous motors will have normal rated full-load capacity of 800 horsepower.

WIRELESS COMMUNICATION.

The newspapers report that the Marconi wireless station at Siasconset, Mass., was destroyed by fire on November 15th.

A cable dispatch from Berlin announces that a German company is now telephoning wirelessly from Nauen to various places in Germany, 50 to 60 miles distant. One of the managers said that conversations had been conducted with extreme clearness and precision.

POWER TRANSMISSION.

It is said that engineers of many of the factories in Moline, Ill., and vicinity are figuring on some means of replacing steam power in the various industries with electricity. The factory owners are convinced of the superiority of electricity over steam and believe that one or several hydro-electric generating plants could be built within economical transmitting distance for the use of all the factories. As a first step toward the change a site for a generating plant on the Rock River has been located by S. S. Davis, who is said to have a feasible plan.

Chappie Rapids on the Menominee River in Wisconsin, where about 5,000 horsepower is available, is to be developed by interests represented by the Menominee River Boom Company and the current transmitted to Marinette and Menominee. The Menominee River Boom Company controls waterpowers on the Menominee River, totaling over 50,000 horsepower. The Peshtigo River, a short distance away, has fully that amount of power available. Only one of the waterpowers on the Peshtigo and one of those on the Menominee have thus far been developed. Engineers making the surveys state that there is more power in the two rivers than in any other two rivers in Michigan or Wisconsin.

PUBLICATIONS.

The various types of Zoar storage batteries manufactured by the Zoar Battery Company of Zoar, Ohio, are illustrated in a new catalogue and instruction book just issued by the Zoar company. This company manufactures storage batteries for gas and gasoline engines, telephone and lighting plants and electric vehicles.

SOCIETIES AND SCHOOLS.

At the next meeting of the Chicago section of the Illuminating Engineering Society, which will probably be held on December 12th, the subject for discussion will be "Lighting of the Downtown Streets."

The programme for the next three meetings of the Worcester Polytechnic Institute branch of the American Institute of Electrical Engineers is as follows: November 22d, Prof. H. H. Norris of Cornell, subject to be announced; December 6th, J. R. Bibbins, "Gas Engineering;" December 20th, J. A. Sandford, "Manufacture of High-potential Insulators."

MISCELLANEOUS.

A recent Census bulletin shows that the use of electric appliances for automatic piano playing is on the increase. These devices do away with pumping and may be transposed to a higher or lower key.

According to a paper read before the Academy of Sciences in Paris, the long-sought absolute test of death has been discovered. Dr. Vaillant, chief of the radiographic service in La Riboisiere Hospital, described many experiments he has made which show that skiagraphs of the intestines differ in cases in which the subjects are alive or dead, the details showing clearly in the case of a corpse, but not showing if life is present.

A natural and artificial-gas franchise and an electric-light and power franchise have been granted to the Independent Light and Power Company of Shawnee, Okla., and a franchise to maintain and operate a telephone line and exchange in the city was granted to the Shawnee-Tecumseh Telephone Company by the City Council. The officers of both companies are Shawnee men, including J. W. Rubey, Homer Alexander and Harry Mead.

A New York dispatch says that Thomas A. Edison of East Orange, N. J., and Henry Phipps, a New York millionaire, believe they can solve the tenement-house problem by erecting an entire city of concrete houses in New Jersey. Some time ago the newspapers reported that Mr. Edison had perfected plans whereby he can build within 12 hours and at a cost of from $1,000 to $1,200 a beautiful nine-room house, suitable for two families. Each apartment of these double houses can be rented profitably at $7.50 a month, according to the report.

The Long Island Railroad will use concrete pile foundations for the new conduit line in the North Shore yards at Long Island City. The contract has been awarded the Raymond Concrete Pile Company of Chicago and New York by J. P. Savage, chief engineer. The conduit, which will be of concrete, will be 1,100 feet long and will carry the feed wires for the electric system. The application of concrete piling to conduit foundations is a novel one, this being the first time such use has been made on a contract of any magnitude. The Abbott-Gamble Company is the general contractor.

A company has recently been formed in Bombay, with a capital of $7,500,000, for the purpose of constructing in India blast furnaces, open-hearth steel furnaces, rolling mills, coke ovens, and other plant necessary for the manufacture of pig-iron, steel rails, bars, plates, etc., and to acquire mining rights over very valuable and large deposits of iron ore. A site for the new works has been selected near Sini Junction, on the Bengal-Nagpur Railway, where the three essentials—iron ore, coal and limestone—can be assembled at a low rate of transit. The enterprise is to be a distinctly Indian concern, the capital being Indian and the board of directors composed entirely of native Indians.

Allis-Chalmers Company of Milwaukee has been awarded the gold medal for electric generators and motors, issued by the authorities of the Jamestown Exposition, as determined by a jury of well-known technical experts representing leading electrical interests of the country. A second gold medal has also been granted for the good judgment and taste shown in the design and erection of the exhibit, which has been one of the most attractive features of Machinery Hall. Gold medals have previously been taken by electrical apparatus of this company's build at the Louisiana Purchase Exposition, Paris Exposition and other exhibitions where there was international competition.

The new annexes of the House and Senate at Washington, D. C., are being connected with the capitol by marble-lined electrically illuminated tunnels. In these tunnels small electric trains of six cars each will carry the senators and representatives and their friends back and forth from their quarters in the annexes to the capitol. The train to the annex of the House of Representatives is already in operation. It starts from the subway station beneath the great rotunda, the passengers being raised and lowered by elevators. A motorman and one conductor are in charge of each train of six cars. The cars are of steel, 16 feet long and carry 10 passengers each. The annexes are palatial structures, providing private quarters for each senator and representative, and will be equipped, except sleeping quarters, with the luxuries and conveniences of the finest hotels.

A dispatch from the Boston News Bureau states that during the month of October the production of copper in the United States, Mexico and Canada fell off over 31,036,040 pounds, or, as compared with October, 1906, a drop of over 30 per cent.

A direct commercial-telegraph wire connecting Lewiston, Idaho, with Portland, Ore., is being completed by the Western Union Telegraph Company. This will give Lewiston direct wire connection with Portland and other Pacific Coast points, and will do away with the necessity of relaying messages at Spokane.

TRADE NEWS.

E. G. Ekstromer of Albro Street, Cambridge, Mass., has invented a new storage battery which is said to be very efficient. A factory has been equipped to manufacture the new cells for the market.

Announcement is made of the removal of the New York offices of the Raymond Concrete Pile Company to 140 Cedar Street in the new West Street Building. The steady increase in the business of the company made the abandonment of the former quarters necessary in order to gain greater floor space.

The Wall Street Journal of November 13th says: "It is expected that the last quarter of the Union Switch and Signal Company's year will show results almost as favorable as reported in the first three quarters. Net earnings for the year are estimated at $1,100,000 on a total capital stock of $2,500,000 and outstanding bonds of $243,000. The company is free from debt and in a good position to meet a business reaction. The company has about $1,250,000 of 'accounts receivable' and enough money in the bank to meet the company's pay roll for two months even if another cent is not collected in that time. Although the company [illegible] Westinghouse company, it has absolutely no commitments or entanglements of any sort with any other companies. Out of a total of about 500 individual stockholders of the Union Switch and Signal Company, there are 227 women and estates on the list."

One of the American consular officers in [illegible] reports the granting of a concession for the construction of an electric railway, for the lighting of streets, and the supplying of electric power at the place in question. He furnishes the name of the officials of the new company, and states that it would be a profitable investment for the manufacturers of electrical goods to maintain an active agent there to take advantage of trade opportunities as they present themselves. Information may be gained by writing to the Bureau of Manufactures, Washington, D. C., referring to file No. 1623.

On November 15th the Circuit Court of Appeals for the Second Circuit rendered a decision sustaining claims five and seven of the Benjamin wireless cluster patent No. 721,774, dated March 3, 1903. The suit was that of the Benjamin Electric Manufacturing Company of Chicago against the Dale Company and John H. Dale, and involved the Dale multiple wireless cluster. The case originally came before Judge Holt of the Circuit Court, and he sustained the validity of the Benjamin patent, but he held that the Dale cluster did not infringe. The Court of Appeals, while confirming Judge Holt as to his finding of validity, reverses the lower court on the question of infringement and finds that the Benjamin patent as to claims five and seven is infringed by the Dale wireless cluster. A second suit brought by the Benjamin company against the Dale Company and John H. Dale concerns the series wireless cluster marketed by the Dale Company. An order has heretofore been entered in this second suit providing for an injunction and accounting as to the Dale series cluster in case the court entered an injunction and an accounting as to the multiple cluster involved in the first suit. The litigation has been closely contested, and has been in the courts during the last three [illegible]

[illegible] Company [illegible] bore [illegible] engines [illegible] on all [illegible] brake horsepower. [illegible] producer gas, [illegible] in the Otto cycle [illegible] zontal tandem and [illegible] The company controls the [illegible] patents [illegible] ternal combustion engines and has [illegible] Charles E. Sargent as the engineer [illegible] department. It has recently [illegible] steam engines to such concerns as the [illegible] Company, Jones & Laughlin Steel Company, Packard Motor Car Company, American Sheet and Tin Plate Company, Amoskeag Manufacturing Company, New Hampshire Spinning Mills, National Tube Company, City of Milwaukee, Carnegie Steel Company, American Woolen Company, United States Envelope Company and the Carnegie Natural Gas Company, and has built up an unusual reputation for shipping "on time." It promises to do as well on gas-engine orders.

BUSINESS.

Mr. Fred. T. Wright announces that he has taken over the entire business formerly conducted by George H. Erich & Co., Chicago, and he is now prepared to solicit business for manufacturers represented by Geo. H. Erich & Co. Mr. Wright is located at 99 Randolph Street.

The Steptoe Valley Smelting and Mining Company of Ely, Nev., recently purchased, through the American Smelters Securities Company of New York city, six 150-horsepower Allis-Chalmers type AN induction motors, each for operating on 60-cycle, three-phase, 550 volts, at a speed of 600 revolutions per minute.

ILLUSTRATED ELECTRICAL PATENT RECORD.

Issued (United States Patent Office) November 12, 1907.

870,545. Plating Device. George W. Clough, Cleveland, Ohio, assignor of one-half to John R. Baird, Cleveland, Ohio. Application filed October 10, 1906.

A pivoted receptacle is mounted in a tank. Anode plates are connected at right angles to the shaft and cathode plates are similarly connected to the sides and bottom of the receptacle.

870,551. Central-energy Telephone System. Francis W. Dunbar, Chicago, Ill., assignor to the Kellogg Switchboard and Supply Company, Chicago, Ill. Application filed December 19, 1900.

A supervisory signal-controlling electromagnet is connected across the two limbs of one end of the cord circuit. The magnet has two differential windings offering impedance to the talking currents. When the subscriber's book-switch is down the circuit is closed through only one of these windings, when up both are in circuit but neutralize each other.

870,555. Controller. Frank W. Garrett, Norwood, Ohio, assignor to the Bullock Electric Manufacturing Company, Cincinnati, Ohio. Application filed August 21, 1905.

This controller has a single contact drum with segments engaging contact fingers. A special form of blow-out magnet is provided, which has a number of polar projections between the segments adjacent to the contact fingers. The cover carries corresponding strips of magnetic material completing the magnetic circuit.

870,564. Third-rail Electric-railway System. Charles Kozesnik, New York, N. Y. Application filed June 16, 1904.

The third rail is hollow and consists of an upper and a lower part mechanically connected but electrically insulated from each other. The hollow portion contains armatures and electrical connections for the same.

870,574. Fire-alarm System. Charles W. McDaniel, Kansas City, Mo. Application filed April 23, 1906.

A combined fire alarm and telephone system is operated from a central exchange. A thermostat controls the alarm circuit, which runs through a primary winding of an electromagnet, the secondary winding connecting to the telephone line.

870,577. Electrical Water Heater. Emil Naumer, New York, N. Y. Application filed July 17, 1906.

A number of hollow carbon rods are mounted obliquely on a base with metallic connections between them, the rods and connections forming a continuous conductor for both the water and electric currents.

870,595 Controller, and 870,596 Motor Controller. Lewis L. Tatum, Norwood, Ohio, assignor to Allis-Chalmers Company and the Bullock Electric Manufacturing Company. Applications filed April 16 and August 31, 1906, respectively.

A three-phase induction motor has a set of Y-connected resistances in its rotor circuit that are governed by a controller which has a group of snap switches associated with each section of the resistances. A shaft in the controller carries a pair of cams for each group of switches, one of each pair being arranged to close the switches successively and the other to open them as the shaft is rotated in the opposite direction. In the second patent the switches are oil-immersed. (See cut on next page.)

870,611. Series Shunt for Dynamo-electric Machines. Henry C. Beekley, Norwood, Ohio, assignor to the Bullock Electric Manufacturing Company, Cincinnati, Ohio. Application filed November 29, 1905.

A shunt for the series field consists of a looped strip of resistance metal clamped between separable insulating blocks that are arranged to put a tension on the strip.

870,621. Electric-railway Signaling System. Norman P. Fraser and William Gribben, Carsonville, Mich. Application filed May 17, 1907.

A sectional conductor is mounted between the rails, batteries connecting the different sections in series. On the train there is an electromagnet, an alarm and a motor, all controlled by contacts with the rails and sectional conductor, the motor being intended to apply the brakes.

870,622. Electric Signaling System. Willard H. Gilman, Medford, Mass., assignor to the International Telemeter Company. Application filed October 31, 1906.

This system provides a lock for each signal-controlling mechanism and means for releasing the locks by a current of different direction from that actuating the mechanism.

870,632. Electrical Measuring Instrument. John M. Lea, Chicago, Ill., assignor to the International Electric Meter Company, Chicago, Ill. Application filed June 4, 1906.

The instrument consists of a transformer, the primary and secondary coils of which are spaced apart on the core. A movable secondary coil is arranged so it can oscillate between the others.

870,634. Calling Device for Telephone Exchanges. Frank A. Lundquist, Chicago, Ill. Application filed May 28, 1906.

An automatic telephone has a plate with marked numbers that is moved by a lever, which, after being moved to any desired point, passes out of the reach of the operator.

870,637. Incandescent-lamp Guard. Charles Molitor, Chicago, Ill., assignor to James H. McGill, Valparaiso, Ind. Application filed March 8, 1906.

A cage about the lamp has a handle attached to its base ring.

870,674. Apparatus for Electrochemical Analysis. George A. Guess, Silverton, Colo., and Herbert E. T. Haultain, Nelson, British Columbia, Can. Application filed April 26, 1905.

A bench is equipped with adjustable beaker supports. Over each beaker is a set of three split aluminum terminals holding independent electrodes, the middle one of each set receiving the deposit.

870,675. Electrode. George A. Guess, Silverton, Colo., and Herbert E. T. Haultain, Nelson, British Columbia, Can. Application filed April 26, 1905.

This electrode is used in the apparatus just referred to above and has its body plate made of thin corrugated sheet metal integral with a central support adapted to be frictionally engaged by the terminal.

870,688. Automatic Electric Storing Device. John W. Ringer, Castleton, Ind. Application filed July 17, 1906.

A face plate has an arm pivotally mounted on it and connected with a disk wheel. A series of contact plugs is mounted on the plate and on the wheel, a series of cells being connected to the plugs on the latter. A generator is connected with the cells and the pivoted arm.

870,691. Process of Producing Porous Barium Oxide. Hermann Schulze, Bernburg, Germany. Application filed October 15, 1903.

The process consists in melting 94 parts by weight of barium carbonate with 6 parts of carbon in an electric furnace, then mixing 89 parts of this product with 10 of barium nitrate and 1 of carbon, and then heating again in the electric furnace, whereby it becomes inflated.

870,714. Electrothermal Protector. Frank B. Cook, Chicago, Ill. Application filed February 15, 1907.

This is a heat cartridge of the longitudinally operating type, the two metallic shells of which are held together by a thin film of heat-susceptible non-conducting cement. The circuit is maintained after the device has operated.

870,732. Burglar Alarm. Hermann R. Lassen, Hamburg, Germany. Application filed May 21, 1907.

A weight, on being pulled by a string, contacts with two bent springs and thus closes the alarm circuit.

870,736. Electric Fixture. Harry R. Mitchell, North Yakima, Wash. Application filed February 23, 1907.

This fixture contains a reel for winding up the lamp cord which is vertically adjustable. The terminals of the circuit connect with the ends of the reel.

870,737. Street and Station Indicator. Charles A. Myers, Niagara Falls, N. Y. Application filed November 8, 1906.

The indicator has a gear and ratchet wheel actuated by pawls connected with two armatures of an electromagnet. These rotate it in opposite directions. Only one operates at a time, the other being locked.

870,740. Hair-drying Apparatus. Evander McIver and John Widua, Chicago, Ill.; Margaret McIver, administratrix of said Evander McIver, deceased. Application filed January 11, 1907.

A motor-driven blower forces air over a heater and through a series of ducts to the upper part of the apparatus.

870,742. Recording Apparatus. Harry B. Palmer, New York, N. Y., assignor to George E. Sly, New York, N. Y. Application filed November 15, 1904.

This apparatus comprises time-controlled electrical record-printing means and similar means for properly positioning the record-receiving medium.

870,755. Trolley-pole Guide. Lewis A. Allen, Passaic, N. J. Application filed August 14, 1907.

The main trolley pole carries a roller and a lever for supporting an auxiliary trolley pole upon the end of which is the wheel.

870,772. Trolley. Clarence A. Gouty, Springfield, Ill. Application filed June 8, 1907.

An arch has a slotted tubular part in the upper end of which fits a tubular shank that screws into the body of the harp.

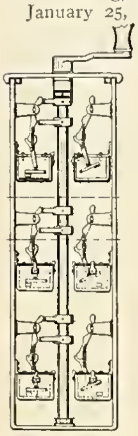
870,779. Electric Soldering Iron. William G. Hartwig, Chicago, Ill. Application filed March 21, 1907.

The head of this iron constitutes one terminal. A body of high-resistance carborundum crystal bears against the head and is surrounded by an insulating sleeve. A spring-pressed metallic plunger bears against the carborundum and forms the other terminal.

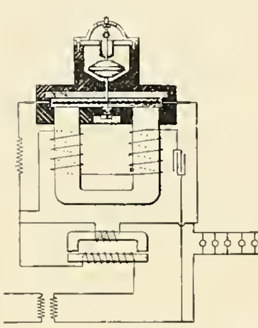
870,802. Vehicle-control System. Norman W. Storer, Pittsburg, Pa., assignor to the Westinghouse Electric and Manufacturing Company, Pittsburg, Pa. Application filed January 3, 1906.

This is a combination with a pair of carrying trucks and electrical driving motors for a vehicle of electrically controlled means for automatically applying downward pressure upon the trucks at points ahead of the normal point of application of the weight of the vehicle body upon the trucks.

870,803. Electrical Measuring Instrument. Charles B. Thwing, Philadelphia, Pa. Application filed January 25, 1907.



NO. 870,596.—CONTROLLER.



NO. 870,970.—ALTERNATING-CURRENT METER.

A moving-coil galvanometer has a permanent magnet whose poles are automatically moved toward or from each other with changes of temperature, thus varying the reluctance of the magnetic circuit to compensate for temperature changes in the electrical resistance of the instrument.

870,816. Vehicle Motor-control System. William Cooper, Wilkinsburg, Pa., assignor to the Westinghouse Electric and Manufacturing Company, Pittsburg, Pa. Application filed January 3, 1906.

This system provides a shunt around the series field of the forward motor on each truck of an electric vehicle during starting, thus decreasing the torque upon the leading pair of wheels and producing smoother starting.

870,836. Floor Surfacer. Casper W. Miles, Anderson Township, Hamilton County, Ohio. Application filed March 25, 1907.

An electric motor drives a rotary cutter head having fan-shaped arms to drive dirt and obstructions from the path of the knives.

870,847. Method of Making a Joint in Thin, Flat Material. Adolph F. Rietzel, Lynn, Mass., assignor to the Thomson Electric Welding Company, Lynn, Mass. Application filed October 15, 1903.

This method consists in bringing the borders together at an angle, passing an electric current across the joint, applying edgewise pressure to cause the heated metal to buckle, and then applying a laterally acting welding force to the heated parts.

870,852. Speed Indicator and Distance Recorder. Ralph Shipman, Sunbury, Pa. Application filed November 15, 1906.

The apparatus consists of electrical time-controlled mechanism, an indicator and coacting mechanism for setting and resetting the indicator.

870,858. Telegraph Pole. Frederick H. Tidnam, Oklahoma, Okla. Application filed July 9, 1907.

A reinforced concrete pole for electrical lines has a hollow conical core.

870,892 and 870,893. Alternating-current Motor. Robert Lundell, New York, N. Y. Applications filed September 26, and November 27, 1905.

A single-phase commutating-type motor is provided with brushes for short-circuiting certain coils of the rotor winding and with means for reversing the rotation of the motor.

870,900. Time-controlled Circuit-closing Device. Carl A. Palmgren and Arthur H. Young, Chicago, Ill. Application filed February 16, 1907.

The hand of a clock closes a normally open circuit. A number of controlling devices operating contacts are geared to the clockwork and connected in series with the hand-controlled contacts.

870,902. Ignition Plug for Hydrocarbon Motors or Explosion Engines. Edward J. Pennington, New York, N. Y. Application filed August 7, 1907.

The terminals are reversely threaded and concentrically arranged.

870,915. Process of Manufacturing Arsenic Compounds of Lead. Cornelius D. Vreeland, Montclair, N. J. Application filed February 5, 1906.

The process consists in the formation of a soluble salt of lead by electrolysis in the presence of a soluble compound of arsenic and the simultaneous precipitation of the lead thereby as an arsenic compound of lead.

870,926. Composing Mechanism for Printing Bar, Matrix-making and Typesetting Machines. Erl V. Beals, Boston, Mass. Application filed February 21, 1898.

A series of line-composing mechanisms has electric circuits for connecting the same with a single matrix or type-assembling mechanism. A series of circuit-closing devices is interposed in the circuits, each circuit-closing device closing its circuit at a particular point at the conclusion of the composition of a line.

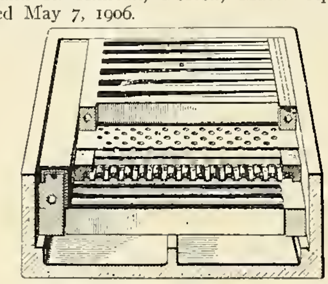
870,927. Electrotherapeutic Instrument. Benjamin Y. Boyd, Chicago, Ill. Application filed January 18, 1907.

The instrument has an electrode for rectal insertion, consisting of an insulating stem and transverse portion, with the poles at the ends of the latter. A battery and induction coil are placed in the stem.

870,935. Automatic Switch Governor. Leonard Colson and Charles Gebauer, New York, N. Y.; said Colson assignor to said Gebauer. Application filed June 25, 1907.

This is a combination of a moving-picture projector, an electric lamp movable relatively to the projector, and means controllable by the position of the lamp relatively to the projector for lighting and extinguishing the lamp.

870,938. Alternating-current Generator. George H. Cove, Roxbury, Mass., assignor of one-half to Frank R. Kimball, Boston, Mass. Application filed May 7, 1906.



NO. 870,973.—STORAGE BATTERY.

A series of permanent magnets are set with successive opposite poles in the arc of a circle. An electromagnetically oscillated pendulum having coils at its swinging end is moved back and forth before the magnet poles.

870,946. Controlling Mechanism for Electric Circuits. Taylor T. Fogel, Reading, Pa., assignor of two-thirds to Alfred J. Mason, Reading, Pa. Application filed May 1, 1907.

A motor starting box is provided with an electromagnet for holding the arm in running position, and with overand underload coils for short-circuiting this magnet.

870,950. Trolley. Walter P. Gisske, Los Angeles, Cal. Application filed April 10, 1907.

A pair of arms is mounted on a shaft operated vertically by coiled springs and circularly by roller-pressed lugs projecting from hubs of the arms.

870,954. Electrical Sparking Device for Explosive Engines. William B. Hayden, New York, N. Y. Application filed June 12, 1906.

A twofold electrical source is connected to a pair of electrodes, one of which is moved by an electromagnet.

870,970. Alternating-current Meter. Robert C. Lanphier, Springfield, Ill. Application filed September 8, 1904.

A mercury motor wattmeter has a rotary conductor through which the main current passes and which is immersed in mercury. The pressure coil is connected in series with a condenser across the line and energizes a magnetic field about the rotary conductor. (See cut.)

870,973. Storage Battery. Homer E. R. Little, New York, N. Y. Application filed January 17, 1907.

The electrodes are carbon and zinc, separated by a layer of fibrous material. About the lower (carbon) electrode is a solution of carbon tetrachloride. Above this is a solution of zinc bromide. (See cut.)

870,985. Carbon Electrode for Galvanic Elements. Wilhelm Mollenbruck and Wilhelm Dielmann, Dusseldorf, Germany, assignors to Hermann Peltzer, Dusseldorf, Germany. Application filed October 23, 1906.

This electrode for dry cells is composed of a number of circularly grouped carbon members embedded in the depolarizer and forming a central cavity into which a removable carbon contact plug fits.

870,999. Trolley Harp. Samuel T. Simmons, Columbus, Ohio. Application filed April 16, 1906.

A fork bearing the trolley wheel has a swiveling connection with the pole head. A guard secured to the head has forwardly projecting arms with their ends starting out laterally and resting on the axle housings of the trolley wheel.

871,002. Insulating Fixture. Louis Steinberger, New York, N. Y. Application filed November 5, 1906.

A ring made in halves has eye-bolts extending radially into it between the halves. Insulating sleeves pass through the bolts and fastening members through the sleeves.

871,042 and 871,043. Telephone Exchange. Samuel A. Norstrom, Chicago, Ill., assignor to Casper L. Redfield, Chicago, Ill. Applications filed July 13 and August 23, 1905, respectively.

Among the features covered is a party-line system, each station having a switching mechanism. This can be controlled from the central office so as to simultaneously break all telephonic connections and then to re-establish them between selected stations. An emergency device permits an unselected station to signal central while two other stations are in telephonic connection.

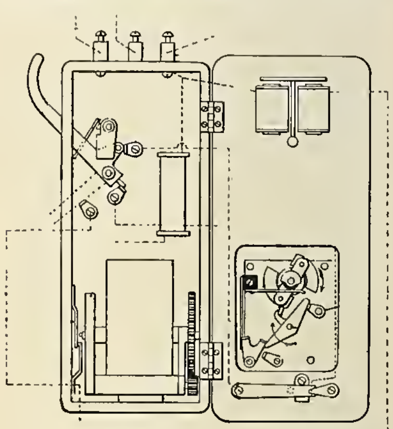
871,064. Three-point Contact Trolley Timer for Internal-combustion Motor Cars. George M. Hurley, Los Angeles, Cal. Application filed April 4, 1907.

A trolley timer comprises an insulating ring having an internal lip, contacts in the lip and a V-shaped trolley yieldingly mounted to run on the lip and contact with the contacts at a number of points.

871,082. Safety Razor. Isaac N. Brigham, Melrose Park, Ill., assignor to the Electro Automatic Safety Razor Company, Orange, Cal. Application filed April 22, 1907.

A small electric motor imparts a reciprocating movement to the razor blade, which is mounted in a casing provided with guard fingers.

871,092. Selecting Device for Telephone Exchanges. Frank A. Lundquist, Chicago, Ill. Original application filed August 8, 1903. Divided and this application filed January 16, 1905.



NO. 871,092.—TELEPHONE SELECTIVE DEVICE.

An automatic telephone has a dial with numbers on its face. A selecting pointer is moved by hand to any position on the dial and thus sends a corresponding series of impulses over one side of the telephone line. The automatic return of the pointer sends one impulse over the other side of the line. (See cut.)

871,097. Sealing-in Machine. Mark H. Branin, Newark, N. J., assignor to the General Electric Company, Schenectady, N. Y. Application filed May 11, 1906.

A frame rotates on a standard and carries a number of rotating heads, each supporting an incandescent lamp bulb and stem to position for sealing with a burner.

PATENTS THAT HAVE EXPIRED.

Following is a list of electrical patents (issued by the United States Patent Office) that expired November 18, 1907:

440,614. Electric Switch. E. T. Barberie and J. Des Brisay, New York, N. Y.
440,627. Electric Meter. S. Z. De Ferranti, Hampstead, County of Middlesex, England.
440,640. Electric Welding Transformer. H. Lemp, Lynn, Mass.
440,641. Electric Welding Apparatus. H. Lemp, Lynn, Mass.
440,654. Lightning Arrester. E. W. Rice, Jr., Lynn, Mass.
440,662 and 440,663. Electric Arc Lamp. E. Thomson and E. W. Rice, Lynn, Mass.
440,664. Method of Electric Welding. E. Thomson, Lynn, Mass.
440,665. Trolley Arm for Electric Railways. E. Thomson, Lynn, Mass.
440,685. Electric Cut-out. G. H. Alton and E. R. Rice, Jr., Lynn, Mass.
440,686. Electric-railway Car Motor. I. F. Baker, Lynn, Mass.
440,689. Electric-railway Car. W. S. Belding, Chicago, Ill.
440,699. Electric Motor. C. E. Dressler, New York, N. Y.
440,700. Electric Motor and Generator. C. E. Dressler, New York, N. Y.
440,717 and 440,718. Electric Motor Mechanism. S. E. Mower, New Haven, Conn.
440,720. Electric Switch. C. A. Pfluger, Chicago, Ill.
440,766. Telegraphy. P. B. Delany, New York, N. Y.
440,767. Synchronous Telegraphy. P. B. Delany, New York, N. Y.
440,768. Multiplex Telegraphy. P. B. Delany, New York, N. Y.
440,776. Electric Motor. H. B. Pullman, Cambridge, O.
440,821. Electric Motor. L. Bock, Jr., New York, N. Y.
440,822. Electric Conduit. W. J. Brewer, New York, N. Y.
440,881. Signaling Apparatus for Electric Railways. F. F. Loomis, Akron, O.
440,906. Electric Railway. S. Trott, Halifax, Canada.
440,908. Dynamo-electric Machine and Motor. F. V. Andersen and J. O. Girdlestone, London, England.
440,976. System of Electrical Transmission of Power. C. J. Van Depoele, Chicago, Ill.
441,030. Train Signal for Railroads. W. D. Sheldon, Providence, R. I.
441,031. Train Signal. W. D. Sheldon, Providence, R. I.
441,059. Incandescent Electric-lamp Socket. J. W. Collier, New York, N. Y.

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Electricity in the Manufacture of Roofing Paper.

By L. B. Van Nuys.

Electric drive is susceptible of many modifications; indeed, this flexibility is one of its conspicuous advantages. Manufacturing establishments of almost all kinds now use electric motors, and often the methods of distributing and applying the power may be studied with advantage. A recent and excellent example of this type of installation is afforded by the factory of the Barrett Manufacturing Company in Peoria, in which an extensive use of electricity is made in the manufacture of roofing paper, the most conspicuous application here being the use of electric power to drive the large paper rolls with the necessary speed-governing devices.

Current is generated on the premises. Coal is hoisted to the bunkers by a conveyor run by an electric motor and is then distributed to the various bunkers by another conveyor, which is also operated by an electric motor. An interesting interlocking arrangement is used on these two conveyors to prevent the distributing conveyor becoming clogged by the hoisting conveyor running when the other is idle, with the result that should the conveyor that feeds the bunkers be started the gears would be stripped.

The generating unit is a Westinghouse-Parsons turbine direct-connected to a Westinghouse 650-kilowatt generator running at a speed of 3,600 revolutions per minute, three-phase, 480 volts, 60-cycle. Fig. 1 shows the generator and turbine. A cross-compound steam engine is used to run the beaters and mixers. The engine has twice the horsepower of the turbine, but the space occupied is about four times as much.

The buildings are entirely of brick and the engine room is lighted with large monitor lights in the roof as well as the windows on the side. Electricity is used to run all the other machinery in the plant, except the beaters and mixers, and the motors are all of the three-phase type.

An exciter set is provided in the engine room and is direct-connected to a Harrisburg 10 by 10-inch engine running at a speed of 300 revolutions per minute. Provision is also made in case of a breakdown in the exciter engine to connect the exciter to the large engine by belt. In addition to the steam-driven exciter set a 50-kilowatt Westinghouse, 480-volt motor is direct-connected to a 25-kilowatt, 125-volt, 200-ampere generator, with speed of 1,200 revolutions per minute. Thus there are three methods of excitation.

The wiring of the whole building is in iron conduit. The wires from the generator are shown terminating in the main contactor box (Fig. 3). A contactor for each phase is provided, operated from the switchboard. Fuses are also provided. They are used two for each phase, as this plan permits a smaller fuse and also allows the use of smaller wire in the leads and so is much easier to handle in installing. This contactor cabinet is installed at the rear and to the left of the switchboard shown in Fig. 1. The switchboard is built of gray marble in small panels and is provided with Terrill regulators, synchronizing meters and also power-factor meters besides the regulation-field rheostats and switches. The steam gauges and vacuum gauges are also mounted on the board.

The large paper machine is run on the Ward Leonard system of control. A three-phase, 480-volt, 150-horsepower motor is direct-connected to a 100-kilowatt direct-current, 250-volt generator running at speed of 570 revolutions per minute. The fields of the generator are separately excited from an exciter set consisting of a 7½ horsepower, three-phase motor running at a speed of 1,500 revolutions per minute, direct-connected to a 5½ kilowatt generator. The motor, supplied with current from the 100-kilowatt direct-current generator, is shown at the extreme right of Fig. 2, and is a 120 horsepower, 250 volt machine running at a maximum speed of 470 revolutions per minute. This is belted to the shaft that drives the paper machine proper. The front end of the paper machine is run by a separate motor of 75 horsepower, while still another motor takes care of the finished product. This equipment was necessary in order to get the close regulation of speed necessary in a paper-making machine, and since it was installed has given the best of satisfaction. The motors are all placed in the basement, and the controlling apparatus is placed on a marble board close to the rolls and can be instantly adjusted to meet the necessary requirements.

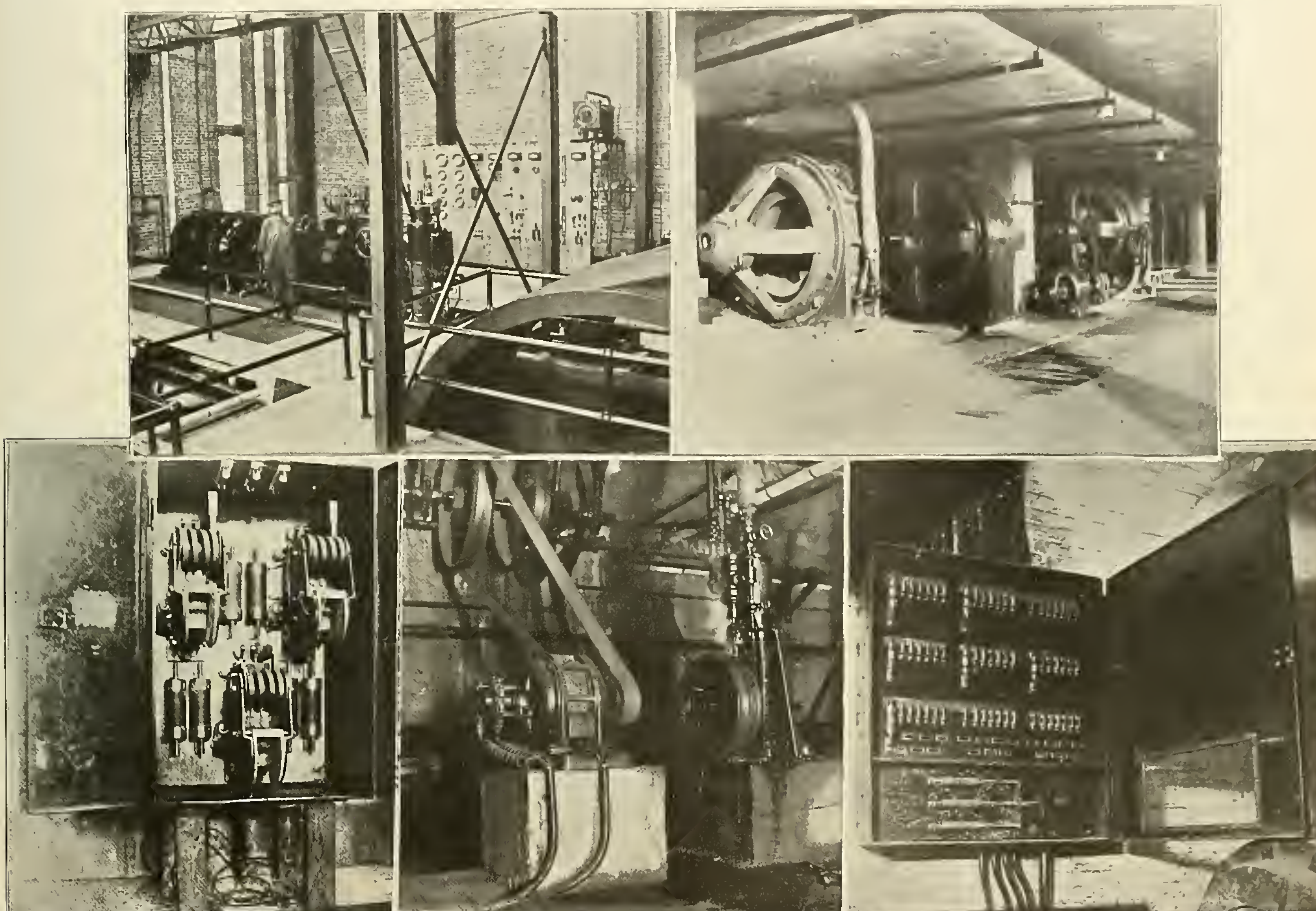


Fig. 1. Turbo-generator and Switchboard. Fig. 2. Motor-generator and Direct-current Motor for Large Paper Machine.
Fig. 3. Main Contactor. Fig. 4. Variable-speed Motor Driving Stoker. Fig. 5. Lighting Panel Cabinet in Steel Box with Glass in Cover.

ELECTRICITY IN THE MANUFACTURE OF ROOFING PAPER.

All the small machinery throughout the plant is run by three-phase General Electric motors. The wiring in each case is brought to a steel box, and the main switch and compensator and I. T. E. type W circuit-breakers are installed in this box, which is fitted with a good lock. The wiring distribution panels are also mounted in a steel cut-out cabinet.

A good example of the work is shown in Fig. 5, which is one of the lighting panels. The large switch shown at the bottom is from the mains and is 480-volt, three-phase. From this switch the wires are taken to the transformer, which is hung outside the building. The transformer lowers the voltage from 480 to 240, a tap is taken off the middle and the distribution is made on the three-wire system at 120-240 volts. The wires are brought back to the panel and the distribution of the circuits is shown in the upper part of the cabinet. A novel idea in these steel boxes is the cutting away of the part of the steel door and placing a piece of glass over the main switch, so that if the door is locked the position of the switch is shown, and also in case of fire or accident the glass may be broken and the switch can be opened.

Gem high-efficiency lamps are used to illuminate the entire building, most of them being of the 125-watt size. The wiring for the lighting system is all in conduit, with waterproof sockets and reinforced cord for all the pendents.

A small three-phase motor driving the stokers is shown in Fig. 4. This is of the variable-speed type and the slip rings to carry the current to the motor are shown at the left of the figure. The engine shown at the right is only used to start the stokers and for use when the turbine is not running.

At present only one turbine is installed, but the foundations are in for another set. Only one paper machine is installed likewise, but provision has been made for another of the same size. As paper-making uses a great deal of water, the electrical construction has been carried out with this in view, and everything has been wired with the best of rubber-covered wire in conduit.

Taken all in all, the plant shows what can be done in equipping a plant with the electric motor drive. The electric work was installed by Walter Kidde of New York city.

A Pyrometer Compensated for Room Temperature.

In the ordinary form of thermo-electric pyrometer the pointer or indicator is adjusted to stand at a certain fixed point on the scale when the thermo-electric couple is idle and no current is passing through the instrument, regardless of what the temperature is surrounding it. Consequently, should the pyrometer be adjusted, say in a room having a temperature of 60° F. and subsequently be used in one having a temperature of 100° F., the instrument, instead of registering accurately the temperature to which the heated end of the thermocouple is exposed, would be faulty. In other words, the current generated in the couple would not deflect the pointer sufficiently to carry it far enough on the scale to indicate the correct temperature.

An invention of Charles B. Thwing of Philadelphia, recently patented, has for its principal object to obviate this defect and to produce a pyrometer which will always indicate on its scale the temperature of the atmosphere surrounding it when current is not passing through the instrument.

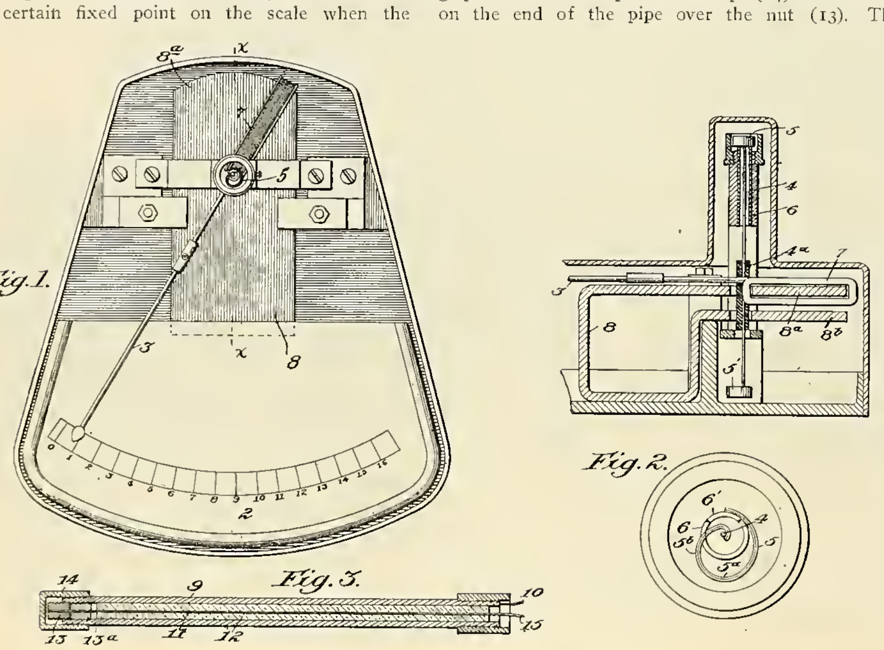
The accompanying illustrations will make the details of this pyrometer clear. Fig. 1 is a top view of the galvanometer part with the casing removed; the upper part of Fig. 2 is a vertical section along the line (x-x) of Fig. 1, the lower part is an enlarged plan view of the bearing for the pointer and coil; and Fig. 3 is a longitudinal section of the thermo-electric couple forming the vital part of the instrument.

Referring to the drawings, (2) represents the calibrated scale for indicating temperatures, and (3) the pointer of the instrument suspended by the wire (4). This wire is rigidly attached at its upper end to one end of a helical spring bearing (5), the other end of which is fixedly connected to an extension (6′) of a sleeve (6), through which the wire extends downwardly to the sleeve (4^a) of the pointer. The spring bearing (5) is constructed of strips or ribbons of materials having relatively different coefficients of expansion (preferably of brass and iron), rigidly fastened together throughout their length to form a single compound strip, the inner strip (5^a) being of brass and the outer one (5^b) of iron. The wire (4) is preferably connected at its lower end to a spring bearing (5′), similar in construction and function to the top spring bearing (5).

The current set up by the thermo-electric couple is conducted to the coil (7) by connections not shown. The permanent magnet (8) is specially constructed with its poles (8^a, 8^b) parallel and close together. Coil (7) swings about the pole (8^a) and has its lower side in the air gap between the two poles. The coil and pointer are mounted in line on opposite sides of the sleeve (4^a) so as to balance the weight on the suspension (4).

The thermo-electric couple, as shown in Fig. 3, consists of a section of iron tubing (9) and a wire of a different metal (11), extending through suitable insulating material or insulating sleeves (12). A nut has split ends (13^a) between which the end of the wire (11) is placed, and which, when the nut is screwed to place in the end of the pipe, will be forced toward each other and firmly grip the wire. A protective cap (14) is screwed on the end of the pipe over the nut (13). The wire (11) and tube (9) are connected by the wires (10, 15) to the coil (7). When the end of the couple containing the nut is heated to a temperature above that to which the end where the wires (10, 15) are attached is exposed, current will be generated, the amount of current so generated depending upon the disparity of temperature between the two ends. Nickel or a refractory alloy may be substituted for the iron tube. The tube formed of iron or other refractory metal or alloy, in addition to its function as one member of the thermo-electric couple, also serves as a protector to the wire, which is made of a less refractory metal.

The operation of the pyrometer is as follows: The pointer of the instrument and its bearings are so adjusted as to indicate on the scale the temperature of the atmosphere at the place of adjustment. Any increase of temperature of the atmosphere at the point of use above that at the place of adjustment will expand the metals of the helical bearings (5, 5′), but the brass strips (5^a), having a greater expansion than the iron strips (5^b), will cause the bearing to uncoil to a certain extent and swing the pointer to the left to a position on the scale indicating the temperature of the atmosphere then prevailing. The pyrometer being thus always accurate as to the temperature of the atmosphere surrounding it, and the cooler end of the thermo-electric couple being at substantially such temperature when the instrument is in use, the swing of the pointer caused by the current generated by the couple and flowing through the coil will carry it to a point on the scale which will always accurately indicate the temperature prevailing around the hotter end of the couple.



A PYROMETER COMPENSATED FOR ROOM TEMPERATURE.

Joint Construction of Pole Lines.[1]

By H. B. Gear.

The rapid extension of telephone and electric-light distributing systems in recent years has caused the erection of pole lines on many of the principal thoroughfares of our American cities. In many cases all the available space for such lines has been occupied, and this has resulted in a badly tangled condition of poles, wires and service drops. The situation is further much aggravated in some cities by the presence of two telephone systems, thus making three claimants for space in the public streets and alleys.

In the average American city there are, therefore, two or more pole lines in most of the principal streets and alleys, with service drops from each passing over, through and under the other in a very unsightly and dangerous manner.

These conditions are especially bad in alley construction, where the pole lines are necessarily close together and the opportunity for proper clearance is very limited. This condition is illustrated in Fig. 1, in which telephone and lighting service wires cross each other, the telephone services being above the primary line.

The increasing danger of such conditions as these has led the lighting and telephone companies in some cities to enter into arrangements for the joint use of pole lines. This policy has been further encouraged by municipal officers, who are desirous of keeping the number of poles on public thoroughfares down to a minimum in response to an increasing public sentiment favoring the removal of poles from streets.

Joint arrangements have been in effect in the city of Chicago between the lighting and other companies for the last eight or nine years, with the result that a comparatively small part of the distributing systems of the lighting and telephone companies occupy separate pole lines on the same street or alley at the present time. The general nature of this construction is shown in Fig. 2, which illustrates congested conditions very well. It will be noted that the lighting wires are carried on the top of the pole with a clearance of five feet between the lower cross-arm of the lighting company and the upper cross-arm of the telephone company. The lighting company's transformer is allowed to encroach on the clearance space, provided that at least 3½ feet is maintained between the bottom of the transformer and the top telephone wire. Ground wires on secondary lines and lightning arresters are covered by a half-round wood molding for the protection of linemen as well as to prevent the possibility of any stray current being communicated from the ground wire to the telephone system.

The telephone company limits its open-wire equipment to two cross-arms and a service buck-arm in outlying districts and to one cross-arm in the more congested districts. Cables are used for the transmission up to within a block or two of the location of the telephone served. This avoids the necessity of extra cross-arms for through lines and greatly reduces the possibility of crosses with lighting services or high-tension wires. The lighting services, being taken off above the telephone wires, cannot pass through or under a telephone line, and are therefore not likely to become crossed with the telephone wires. Being the stronger, they are not so likely to break and fall across the telephone lines as would the telephone lines be to break and fall across the lighting lines were they run above. A clearance of two feet is maintained on the sides of buildings between lighting and telephone services.

Where underground lighting cables are brought up a pole the iron pipe is extended to the top of the clearance space, thus safeguarding the telephone linemen and minimizing the danger of a cross between the lighting and telephone wires. This is illustrated in Fig. 3.

The major portion of the distributing systems of the lighting and telephone companies in Chicago is carried in alleys, owing to the existence of a very general alley system, which makes it unnecessary to utilize the streets except for through lines. The through lines are in many cases carried underground on the streets, with lateral connections at alley intersections for the distributing lines.

There is some advantage to both companies in joint-pole arrangements from the standpoint of investment. The equipment of the two companies may be carried on one 35 or 40-foot pole instead

1. An address before the Western Association of Electrical Inspectors at the annual meeting at St. Paul, Minn., October 23, 1907. Mr. Gear is general inspector of the Commonwealth Edison Company, Chicago.

of on two 30 or 35 foot poles in case the lines were not joint. This saving amounts to approximately 20 or 25 per cent. of the investment in overhead lines in cases where new lines are being built.

But in cases where either company desires to extend its lines along routes already occupied by the other company it is usually necessary for the company which desires to make the extension to do more or less reconstruction work.

Where poles must be replaced in order to secure sufficient height for the wires of both companies, the expense incurred by the original company in transferring its equipment from the old to the new poles must be borne by the new company, and the cost of the line usually amounts to about what it would have been had the new company constructed a new line on the other side of the thoroughfare.

There is little saving in investment to either company in such cases. The telephone system usually precedes the lighting system in growing sections, and unless the lighting company can forecast its requirements in such a way as to be able to take ownership in poles before it needs them, it must stand the expense of providing space on the telephone poles by lowering the telephone equipment or replacing the poles.

The operating advantages are, however, considered such by the Chicago companies that in all such cases the old line is reconstructed in preference to erecting a second line on the opposite side of the thoroughfare.

The use of joint pole lines has, however, some objections which may not be overlooked. The service of each company is likely to be interfered with by the employes of the other company, who may be engaged in construction or repair work in which they may carelessly or ignorantly cause injury to the equipment of the other company. It is therefore essential that the relation between the employes of the companies interested should be friendly, and a spirit of forbearance must exist at all times.

The details of the business arrangement covering the erection of new lines and rearrangement of old lines are very numerous and at times perplexing. When once established, however, the various employes interested may be given a policy to follow which can be carried out without undue friction.

The arrangement in effect in Chicago may be outlined briefly as follows:

Each company, when it proposes to make any extension of its lines, notifies the other company by letter of its intention, giving a description of the number, size and location of poles which it intends to erect. Several copies of these letters are passed between the companies so that each situation may be looked over by the foreman or inspector, who makes a recommendation as to whether he considers it advisable for his company to take an interest in the poles which are to be set. If the foreman of the other company desires larger poles he may ask for them and they will be set as requested by the other company. Payment is then made on the basis of the number of gain spaces reserved for the use of each company.

If the other company does not feel that it will require space on the poles within a reasonable time it reserves the privilege of refusing to take an interest in the poles which are to be erected.

In case one company wishes to extend its lines where the other company already has a line it will ask for space on the existing poles if they are high enough and will attach its equipment after agreeing to purchase from the other company an interest in the poles concerned. In case of the lighting company, however, it must stand the expense of the other company lowering its equipment in order to provide space for the lighting wires at the top of the pole. In case the poles in the existing line are not tall enough for the equipment of both companies, the incoming company replaces the existing poles at its own expense, taking the old poles as salvage and paying the other company the expense incurred by it in transferring its equipment from the old to the new poles. The new poles are then jointly owned by the two companies.

The expense of maintenance of joint poles is shared by the two companies in proportion to their interest in the pole.

In cases involving reconstruction work and in cases where either company proposes to do new work where separate parallel lines exist, representatives of each company meet on the ground and agree upon a suitable arrangement for the consolidation of the existing lines into one joint line. In such cases each company stands its proportion of the expense of the new work and transfers its equipment from the old to the new poles at its own expense.

In general, the lighting company is apt to bear the greater portion of the expense, owing to the fact that it must pay for the lowering of the other company's equipment and also because the lighting lines are usually preceded by telephone lines so far that the lighting company cannot forecast its requirements with sufficient accuracy to derive the benefit of taking an interest in the poles when they are originally set.

The safety to the lives of employes and the public as well as the diminished fire risk are well established by the fact that hardly a single serious case of trouble possibly due to joint occupancy has occurred in seven years of operation of joint lines. This record has been made on lighting and telephone systems which have been rapidly extended until there are at the present time about 2,000 poles jointly occupied by the wires of the Chicago lighting company and the Bell Telephone Company.

Joint arrangements are also in effect on about 2,500 poles with the city and with telegraph and street railway companies. In addition to this the city of Chicago has the privilege of attaching its wires for electric light, fire alarm and police telephone service. It is therefore frequently necessary to provide space on the upper part of a joint pole for the lighting wires of the city and on the lower part for the fire alarm and police telephone systems. In general, all signaling systems are kept on the telephone company's portion of the pole and all lighting or traction systems on the lighting company's portion of the pole.

Cases of triple occupancy in which the city is the third party are numerous, but triple occupancy with other companies is not frequent.

FIG. 1. TELEPHONE WIRES CROSSING ABOVE ELECTRIC-LIGHT PRIMARY CIRCUIT IN ALLEY.

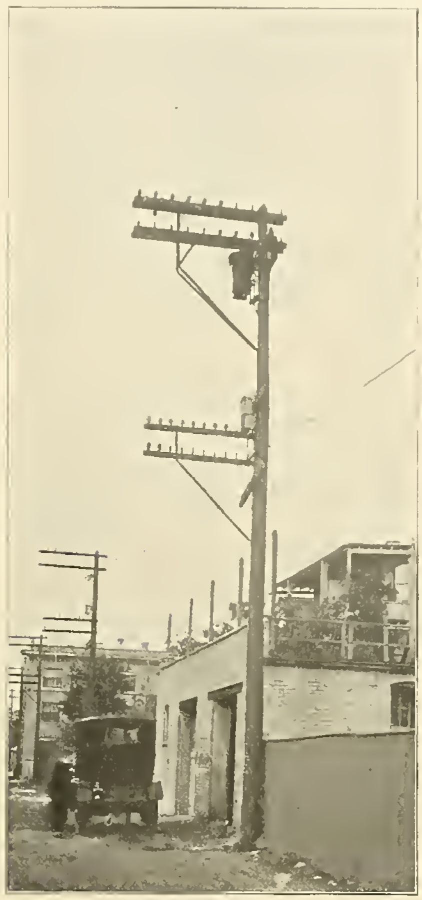


FIG. 2. JOINT OCCUPANCY OF POLE LINE.

FIG. 3. POLE WITH IRON PIPE CONTAINING ELECTRIC-LIGHT WIRES CONNECTING OVERHEAD AND UNDERGROUND WORK AND PASSING TELEPHONE CROSS-ARM.

The writer realizes that methods which can be applied in metropolitan work are not always suitable for smaller cities on account of the limited resources of the companies involved, which prevents the use of underground work to any great extent. In cities where the main runs cannot be carried underground separate routes on high poles should be established for these by each company, and the distributing lines which it may be necessary to have strung along these routes may be carried well below the through lines.

As far as possible the through lines of the telephone company should be carried in aerial cable, which, for a considerable number of lines, is practically a physical necessity in any event.

The presence of two lighting or telephone-distributing systems is a deplorable condition from any point of view, and joint construction of the three companies involved in such situations is not practical under existing conditions. Conditions can be somewhat improved by the encouragement of one of the telephone companies to operate jointly with one lighting company.

Largest Quantity of Radium Yet Obtained.

A cable dispatch from Vienna to the Chicago Daily News says that through the successful work of the Vienna Academy of Science three grams (one gram equals 15.432 grains) of pure radium have been obtained, a quantity exceeding any ever before available for scientific research. The radium was extracted from 10 tons of pitchblende from Joachimsthal, Bohemia. It is worth $36,000 a gram, the laboratory work alone costing $9,000.

Electric Power Supply In Yorkshire.

One of the central-station companies of England which has made marked progress in economical operation and has demonstrated the reliability of electric power is the Yorkshire Electric Power Company. Operation was begun two years ago, and the power-house equipment has been added to from time to time until now it consists of three 2,000-kilowatt turbo-alternators of the Curtis type. The auxiliary apparatus in the generator and boiler rooms is modern and efficient.

The Thornhill power station is the first of four planned ultimately for the supply of the company's extensive area. This station is situated in the Calder Valley, one of the chief centers of the woolen industry of Yorkshire. It lies between the Calder River and the railroad, two miles from

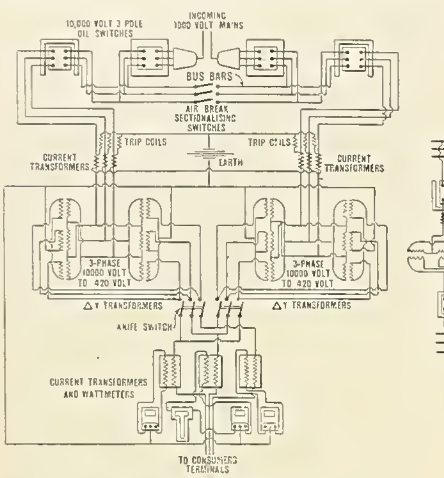


FIG. 1. CONNECTIONS AT STANNINGLEY SUB-STATION.

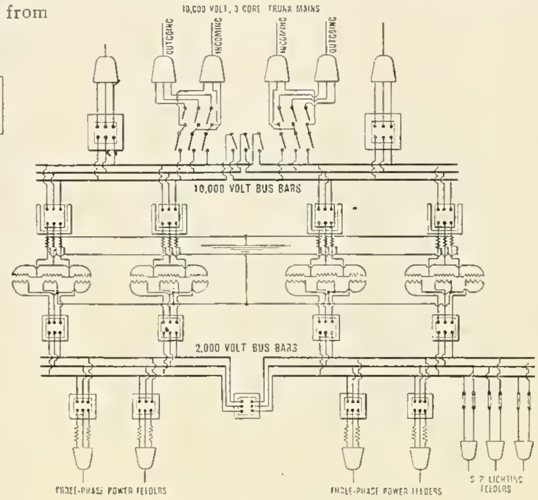


FIG. 2. CONNECTIONS AT GOMERSAL SUB-STATION.

Dewsbury and seven from Huddersfield; it is therefore admirably situated for the supply of both coal and water.

The area of supply served by this company comprises the whole of the industrial part of the West Riding of Yorkshire, 1,800 square miles in extent, with an aggregate population of 2,800,000, and an estimated industrial power demand of 2,000,000 horsepower. The Calder Valley is known as the heavy woolen district, but there are, in addition to the numerous woolen mills, dye and bleach works, chemical works, glass works, brick fields, leather dressers and boot factories, as well as collieries, quarries and all classes of engineering works.

Development among consumers was very slow for the first 18 months, partly owing to trade depression and partly owing to the exceedingly conservative characteristics of the Yorkshire factory owners. However, time solved this difficulty as well as others, and at the present moment development is proceeding at a rate sufficient to tax the resources of the company's installation department to their utmost capacity.

The methods of charging to be adopted for power supply always constitute a difficult problem, and since the power factor and other conditions vary in almost every case it is impossible to lay down any hard and fast tariff. In most cases a charge is made per kilowatt of maximum demand, to which is added a charge per unit consumed, according to a sliding scale dependent upon the extent of consumption. This method is generally approved, as it encourages consumers to increase their load factor, with the result in the present instance that the station load factor is now well over 30 per cent. The existing consumers are entirely satisfied with their supply. During the present year the horsepower connected as additions to existing installations has already reached a total of 418.

A significant fact from a general point of view is that the attitude of the local authorities, which in the beginning was either hostile or indifferent to the company, has lately undergone a complete change. The hope is expressed that this is the prelude to an awakening on their part to the benefits derived by all from the existence of a cheap public supply of electricity, quite apart from the question as to who provides that supply. The possibility of electric-light supply in residential districts is one which in the future is likely to become a valuable asset to the company, and arrangements have already been made for an early supply to various populous localities. In order to develop this side of the business a separate company was promoted, the Electrical Distribution of Yorkshire.

From the Thornhill power station three pairs of 10,000-volt, three-phase, paper-insulated, steel-wire-armored cables are laid solid in bitumen and wooden troughs for a total distance of 48 miles. These constitute the trunk mains and connect the generating station with sub-stations in the districts of Earlsheaton, Ravensthorpe, Mirfield, Liversedge, Gomersal, Pudsey, Farsley, Stanningley and Calverley. From these sub-stations, in which in most cases the pressure is transformed to 2,000 volts, feeders radiate to various parts of the districts and also to the outlying districts of Hartshead, Kirkheaton and Horsforth. The feeder cables are for the most part paper-insulated, lead-sheathed and steel-taped, laid directly in the ground. The total length of cable used in the various networks amounts to 19 miles.

A further reduction of pressure is generally made on or near to the actual consumer's premises, the final transformation being designed to give either a three-phase supply at 400 volts, 50 periods, for power purposes, or a single-phase supply at 230 volts for lighting purposes. Direct current is supplied in only two instances. In the case of a few consumers in isolated districts a supply is given direct from the 10,000-volt trunk mains by a single reduction to 400 volts. Quite recently the Board of Trade has given permission for the erection of overhead lines in the districts of Thornhill, Pudsey, Calverley and Horsforth, and various lines have been erected for both high and low-pressure distribution. These overhead lines are cheaply and strongly built.

The design of sub-stations is naturally a subject which has received great attention from the company's engineers, and considerable differences should exist between the earlier and the later examples. The diagram of connections for a standard 400-kilowatt sub-station for reducing 10,000 to 400 volts is shown in Fig. 1, while a similar diagram of a 600-kilowatt, 10,000 to 2,000-volt equipment is shown in Fig. 2. A typical sub-station of the earlier design is that of Mirfield, from which power feeders radiate to Batley, Castleford, Kirkheaton and Eastthorpe; while the local authority takes a single-phase bulk-lighting supply derived from the 2,000-volt star-connected secondary. At Pudsey a somewhat similar sub-station is installed, but in addition a three-wire, 460-volt, direct-current bulk supply is given to the corporation for public and private lighting.

At Stanningley (shown diagrammatically in Fig

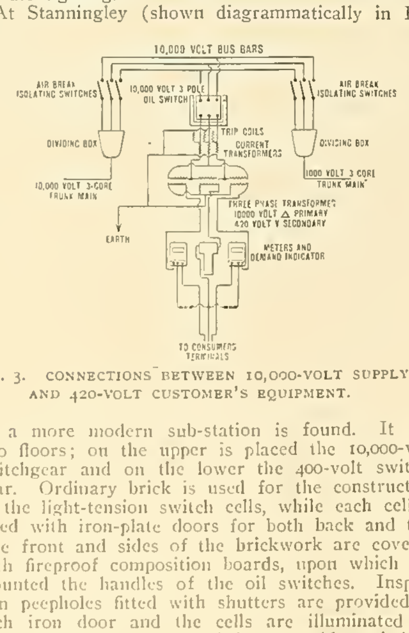


FIG. 3. CONNECTIONS BETWEEN 10,000-VOLT SUPPLY AND 420-VOLT CUSTOMER'S EQUIPMENT.

1) a more modern sub-station is found. It has two floors; on the upper is placed the 10,000-volt switchgear and on the lower the 400-volt switchgear. Ordinary brick is used for the construction of the light-tension switch cells, while each cell is fitted with iron-plate doors for both back and top. The front and sides of the brickwork are covered with fireproof composition boards, upon which are mounted the handles of the oil switches. Inspection peepholes fitted with shutters are provided in each iron door and the cells are illuminated by incandescent lamps controlled by outside switches; hence examination is very much facilitated without the necessity for removing the doors. The busbars are mounted in a plane at an agle of about 45 degrees to the horizontal, so that horizontal and vertical connections may be made with equal facility; at the same time it is possible to operate the sectionalizing switches by means of the ordinary wooden rods inserted through the peepholes. The whole design and construction is essentially practical; it is "mouseproof," "foolproof," and combines strict economy with safety of operation. The transformers, together with the 400-volt distributing switchboard, are placed on the lower floor of the sub-station.

There is nothing unusual about the low-tension switchboard. It controls the supply to the Stanningley Iron Works, which has recently been converted to electric driving and is now equipped with 55 motors of an aggregate horsepower of 950. The works are engaged in the manufacture of bridge steelwork, railway rolling stock, etc., and form a good example of an old straggling engineering works wherein the economies of electrical driving are most evident.

Figs. 3 and 4 show the company's standard diagrams of connections in transforming stations on consumers' premises for a 100-kilowatt equipment in the case of both 10,000-volt and 2,000-volt supply. It will be observed that in both diagrams the utmost simplicity has been aimed at, while the quantity of switchgear and apparatus involved has been reduced to the absolute minimum compatible with facility for all ordinary operations and the necessary control.

The company's consumers include representatives of practically every industry characteristic of the district as well as outsiders who are being attracted from Dewsbury and other centers by the lower local rates and advantages of a cheap power supply. To mention a few: A typical shoddy factory has two 20-horsepower motors driving rag-pulling machines. Near by this factory is a pumping station owned by the Mirfield Urban District Council, where a 20-horsepower motor and centrifugal pump serve to pump the local sewage to a sewage farm. In the Gomersal worsted spinning mills are 13 motors, with an aggregate of 368 horsepower; the motors are all three-phase induction type provided with enclosed starters, while the wiring throughout the mill is open and supported on porcelain insulators. In the Cliffe mills at Pudsey 15 motors, with an aggregate of 312 horsepower, are used in cloth manufacture.

The Calder colliery is a case where motors are used for almost every purpose save that of winding. There are 11 motors installed, their aggregate horsepower amounting to 125. The "Three Nuns" pit of the Low Moor Company contains an electrically driven four-stage centrifugal pump, which, in comparison with the enormous steam-driven ram pumps which it has displaced, constitutes a striking object-lesson in the economy of space and capital effected by modern electrical pumping plant. The pump is situated at the bottom of the shaft and is directly driven by a three-phase, 400-volt, 67-horsepower motor. Four hundred gallons of water per minute are raised 414 feet to the surface. The underground electric lighting at this pit is charged for at power rates, since it makes practically a 24-hour load.

The number of cases in which steam or gas engines have been displaced and abandoned by their owners is quite a large one. One example is that

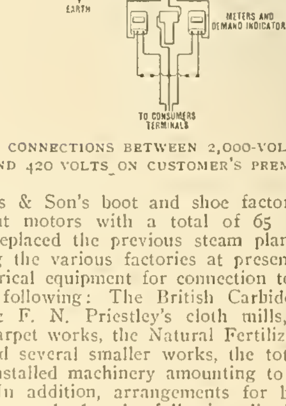


FIG 4. CONNECTIONS BETWEEN 2,000-VOLT SUPPLY AND 420 VOLTS ON CUSTOMER'S PREMISES.

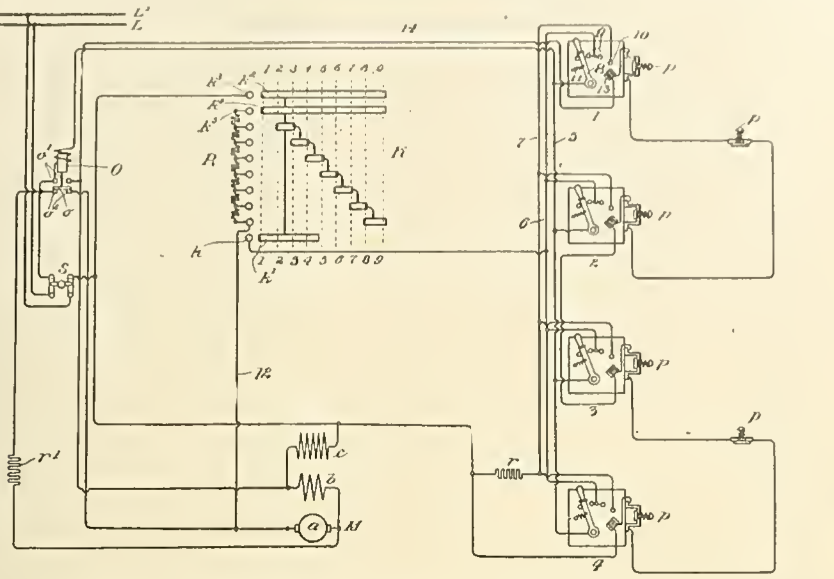
of Scales & Son's boot and shoe factory in Pudsey, eight motors with a total of 65 horsepower having replaced the previous steam plant.

Among the various factories at present undergoing electrical equipment for connection to the mains are the following: The British Carbide factories, J. W. & F. N. Priestley's cloth mills, the Spen Valley carpet works, the Natural Fertilization Company, and several smaller works, the total capacity of the installed machinery amounting to 1,950 kilowatts. In addition, arrangements for bulk supply have been made for the following districts: Brighouse, Castleford, Farsley, Hipperholme, Horsforth, Liversedge and Ossett.

The facts here given were taken from Electrical Engineering of London.

A System for Controlling a Motor from Any Number of Points.

In driving complex machinery by means of electric motors it is important that the operator should be able to control the motors from a number of points around the machines. Usually there are only a few stations from which it is necessary to be able to start and stop the motor or motors at will; but it is desirable to have a comparatively large number of points from which the motor or motors may be brought to rest, so that no time need be lost in reaching a switch in case of emergency. Thus in control systems for rotary web-printing presses, for example, it should be possible to control the motor or motors from a few stations in order to operate the machine at a low speed and start and stop it while the proper adjustments are being made.



A SYSTEM FOR CONTROLLING A MOTOR FROM ANY NUMBER OF POINTS.

While simple spring-actuated push buttons answer all the requirements for a stop switch, a combined stopping and starting switch should preferably be arranged so that the operator has perfect control over the machine to stop and start it at will and still allow him the free use of his hands for making the required adjustments. By using the combined starting and stopping switches at all points from which it is desirable to stop the machine the expense of the apparatus is unnecessarily increased, while if stopping and starting switches are employed only at the stations from which adjustments are made the effectiveness of the system is impaired.

A control system has been devised by Charles E. Mandelick of New York to meet these requirements. This invention has been patented and assigned to the Sprague Electric Company. The illustration herewith shows the system applied to a motor (M) having an armature (a), a series field winding (b), and a shunt field winding (c). A controller (K) is adapted to connect the motor to a source of current supply (indicated by lines L L') and to control the speed of the motor by varying the amount of the resistance (R), which is included in the armature circuit.

A relay (O) has a movable contact member (o) arranged, when the relay is energized, to bridge contacts (o'), and thereby connect one terminal of the motor to line (L), and, when the relay is de-energized, to bridge contact (o^2), and thereby short-circuit the armature through a braking resistance (r').

This system constructs and arranges the parts so that switches adapted to perform all the necessary functions, and only those functions, are employed, so that the combined starting and stopping switches may be as elaborate as may be desirable and as many stopping points provided about the machine as may seem advantageous without incurring needless expense or decreasing the efficiency of the system. To this end there have been provided a number of combined starting and stopping station switches, together with a separate set of push-button switches from which the station switches may be controlled in order to stop the motor.

In the drawing four such station switches (1, 2, 3 and 4) are shown; but the number of these switches depends upon the number of points from which it is desirable to start and stop the motor without moving the main controller. The station switches control the relay (O) and are in turn controlled by a series of push buttons (p). The station switches are all alike, so that a description of one will suffice for all. Referring to station switch (1), it will be seen that the arm (8) is permanently connected to wire (5), while twin contacts (9) are connected to wire (6) and contact (10) to wire (7). Normally the switch arm is maintained in the position shown by means of the spring (11). When the arm (8) is moved into engagement with either of contacts (9), wires (5) and (6) are connected together, while upon moving the arm into engagement with contact (10) wires (5) and (7) are joined. An electromagnet (13) is adapted to hold the switch arm in engagement with contact (10) against the tension of the spring (11). The coils of the several electromagnets are in series with each other and the push buttons (p).

When the main controller is moved into one of its operative positions—namely, when the row of fixed contacts engages with the movable contacts along line (1, 1)—a circuit may be traced from line (L) through one arm of switch (S) through the actuating coil of the relay (O), and thence to wire (5), and if any station switch has been moved, so as to complete circuit at contact (9), then through such station switch to wire (6), and thence through contacts (k, k'; k^2 and k^3), through switch (S) to the other side of the line (L'). This circuit is the actuating circuit for the relay, and therefore it is seen that by moving any one of the station switches into the proper position the relay may be actuated so long as contacts (k k') on the controller remain in engagement, preferably during the low-running positions, in which the motor is protected by considerable resistance.

If the arm of the station switch is brought into engagement with contact (10) instead of contact (9), a circuit in shunt to the controller is established from wire (5) to wire (7), and thence through resistance (r), through switch (S), as before, back to the line. This latter circuit is the maintaining circuit for the relay; but by reason of resistance (r) the current in this circuit is at no time sufficient to operate the relay, but only great enough to maintain it after it has been operated through the energization of the actuating circuit.

The operation is as follows: Assuming that the controller has been moved into its first running position and the station switch (1) has been operated so as to bring arm (8) into engagement with contacts (9), the actuating circuit for the relay will be completed and the relay will operate to bridge contacts (o'), thereby completing a circuit to the motor from line (L) through switch (S), contacts (o'), shunt field (c), and back to line (L'), through switch (S). Another circuit passes from contacts (o') through the series field (b), through the armature (a), wire (12), resistance (R), controller contacts (k^5, k^4, k^2 and k^3), through switch (S) to line (L'). As long as the controller is in on one of its first four positions the handle of the station switch may be released to cause the motor circuit to be interrupted without making it necessary to operate the controller to again start the motor; but if the controller has been moved past its fourth position, then upon release of the handle of the station switch it becomes impossible to actuate the relay again until the controller is returned to one of its first four positions. At any time when the operator desires to let go of the handle of the station switch without opening the motor circuit he may throw the handle into the final position—namely, that position wherein the arm (8) engages with contact (10)—and the maintaining circuit for the relay is established. The arm is now held against the tension of the spring (11) by electromagnet (13), which is included in the following circuit: Line (L), through switch (S), upper relay contacts, wire (14) and thence through the actuating coil of electromagnet (13), through push button (p) and the actuating coils of similar electromagnets on the other stations, through switch (S) to line (L'). It is evident that as long as push buttons (p) remain closed the station switch will be held in its relay-maintaining position, and the controller may be operated to vary the speed of the motor without affecting the station switch, unless the controller is moved into its "off" position. If at any time it is desired to stop the motor, either from a point adjacent the station switch or from some other point, the nearest push button is pressed, and the circuit of electromagnet (13) is interrupted. As soon as the electromagnet is de-energized the movable member of the switch flies into its inoperative position, the relay is de-energized, and the motor armature is short-circuited upon itself. Thus the motor may be started and stopped from any one of several station switches at the will of the operator, and may be stopped from any point by simply pressing one of the push buttons.

Pay-as-you Enter Cars In Use In Chicago.

On Sunday morning, November 24th, the Chicago City Railway Company put into regular service on the Cottage Grove Avenue line 131 of the new pay-as-you-enter cars, the first to be used in this city. From indications so far the new system is a success, it being estimated that 75 persons can be loaded in a minute. Passengers seem willing to co-operate with the company in bringing into effect better service.

As will be noted in the picture of the rear end of one of the new cars, the rear platform is divided by a rail into entrance and exit passageways. The picture shows the conductor in proper position to collect fares until 80 passengers have been taken on. Then he takes his place at the entrance passageway and requests prospective passengers to "Take the next car, please." So far this request is the only one of the new rules which has not met the approval of everyone during rush hours, but with a three-quarter-minute headway it is expected to work out satisfactorily.

REAR PLATFORM OF PAY-AS-YOU-ENTER CAR IN CHICAGO.

Passengers already have become familiar with the new system, which will be rendered sufficiently flexible to meet local conditions. The outside doors of the front platform are under the supervision of the motorman and are used only for exit. Thus passengers may be loaded and unloaded at the same time. When the plan is once thoroughly understood those alighting from the rear platform will not interfere with others getting on.

These cars are one of the results of the franchise-settlement ordinances approved last spring. The first few days of operation indicate that they will accomplish their purpose, which is to reduce the number of accidents, prevent overcrowding, regulate ventilation, and to increase the comfort of passengers and trainmen.

It is rumored that Governor Guild of Massachusetts will recommend in his inaugural next January the enactment of legislation providing for the establishment of a public-service commission patterned after the New York plan. Such a commission would include the existing railroad, gas and electric-light and the state highway commissions.

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CORRESPONDENCE relating to electricity or any of its practical applications is cordially invited, and the co-operation of all electrical thinkers and workers earnestly desired. Clear, concise, well written articles are especially welcome; and communications, views, news items, local newspaper clippings, or any information likely to interest electricians, will be thankfully received and cheerfully acknowledged.

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DEPARTMENTS.

AN INVESTIGATION of great scientific interest to physicists and electrical engineers concerned with advanced problems has been conducted at the National Bureau of Standards at Washington by E. B. Rosa and N. E. Dorsey on a new determination of the ratio of the electromagnetic to the electrostatic unit of electricity. This ratio, commonly designated by V, is of fundamental importance in our system of electrical units, and its numerical value is required in many electrical measurements and calculations. Theoretically, it should agree with the velocity of light. The result (2.9971×10^{10}) found by Professors Rosa and Dorsey agrees with this value within 5 parts in 10,000. With improvements that they contemplate in a future determination, they hope to attain an accuracy of 1 part in 30,000. A detailed report of this research is concluded in the latest number of the Bulletin of the Bureau of Standards. This investigation is an illustration of the accurate scientific work being done by this important government bureau and shows the wisdom of its creation.

PAY-AS-YOU-ENTER CARS are now a feature of street-railway service in Chicago, and they give promise of being a commendable innovation. The rear platform is divided by a railing into "Entrance" and "Exit" spaces. In the latter the conductor stands at all times and receives the fare of the passenger before he enters the body of the car. An exit is also provided from the front platform, but no ingress is permitted there. To get the greatest advantage from the new system the passenger should have the exact fare ready before boarding the car. At any rate he should have his money in his hand and not stop to fumble in his pocket for it, which would cause the loss of valuable time, especially where a group of persons is striving to get on. Hence the cry of the conductor in case of a crowd is apt to be: "Have your nickel ready." The public seems willing to heed this injunction to a reasonable extent, but the new cars have still to withstand the test of a great concentrated rush, say at the close of a largely attended baseball game. On Cottage Grove Avenue, where the "pay-first" cars are in use, they are operated on three-quarter-minute headway during the rush hours.

Another desirable feature hoped to be attained by the new cars is the doing away with the deplorable overloading at certain parts of the day in the past. The conductor is now placed in a position to control the loading of the car. Whenever there are more than 80 passengers inside, the conductor will step to the outer edge of the platform, and, with arm extended to bar the "Entrance" step, will request prospective passengers courteously to "Take next car, please." This is something of a revolutionary change in Chicago, and the plan is more pleasing to the man comfortably inside than to those outside watching car after car go by. Nevertheless, this is a most salutary improvement, and if sufficient cars are provided, the public will no doubt adopt it and in the end be thankful for it. The new cars are no doubt superior in comfort of traveling to any heretofore used in this city, and with the exercise of some care and forethought the passengers can co-operate with the company to benefit by their advantages.

IN MR. L. L. ELDEN'S interesting and exhaustive paper on "The Boston Edison System in 1907," read at the annual meeting of the Association of Edison Illuminating Companies last September, some interesting figures on efficiency of the distributing system were given. It is to be noted that, so far as the generation and distribution of current is concerned, the operation of the entire system is primarily controlled by the generating department. This department directs the operation of all stations owned by the company with the exception of two, which, owing to their not requiring attendance, are under the supervision of the maintenance-of-lines department. "Economical results and good service are the two results desired," says Mr. Elden, "and to that end careful attention is paid to the use of the station equipments, for it will readily be realized that with the large amount of apparatus in use, it would be very easy to acquire inefficient methods of operation if intelligent supervision was not exercised. The results attained may perhaps be plainly presented by stating that out of the generated output for the last year, amounting to 84,516,076 kilowatt-hours, 59,409,402 kilowatt-hours, or 70.29 per cent., was sold to customers, 3,060,040 kilowatt-hours, or 3.62 per cent., was used by the company in its various buildings and advertising features, making a total of 73.91 per cent. of the current generated delivered to the meters on the system. This leaves a total of 22,046,634 kilowatt-hours, or 26.09 per cent., to be accounted for by losses in the various transmitting and translating devices in use on the system, a result comparing favorably with the best practice of today, but truly startling when the amount of the losses is compared with the output of the early stations, or, in fact, with many of the present stations in operation."

It would be instructive if this record of 74 per cent. efficiency in distribution could be compared with records from other stations. Other things being equal, who can make a better showing?

WE REGRET to learn, by a circular letter from the Verein Deutscher Ingenieure (Society of German Engineers) of Berlin, that work on the Technolexicon has been discontinued. It seems that the work turned out to be much more expensive than had been expected, and the pecuniary means available to the society for the accomplishment of the task within the allotted time were not sufficient for the purpose. The undertaking was an ambitious one, and if carried out would have been of much benefit to the engineering fraternity. It was to have been a universal technical dictionary in English, German and French, and work on the project was begun in 1901. In 1905 it was reported that about two thousand firms and individual collectors throughout the world were assisting in the task and that 2,700,000 word-cards had been collected. Perhaps the lexicon was planned on too elaborate a scale, but it was a fine effort, worthy of the best traditions of engineering, and the German society will receive a tribute of genuine respect from technical men everywhere, although it has been forced to abandon the project after six years' effort. Mr. Th. Peters, director of the society, requests that all communications in relation to the Technolexicon be sent to the Verein Deutscher Ingenieure in Berlin hereafter.

APPLIED MATHEMATICS is of course of the greatest value in very many branches of scientific work. But one scarcely realizes the extent to which the affairs of daily life are affected, in a direct or remote degree, by mathematics, unless the subject is especially investigated. This is done in a rather forcible manner in a recent article on "The Demand for Mathematics," by Dr. Samuel G. Barton of the Clarkson School of Technology. "Imagine, if possible," says this writer, "that we be suddenly deprived of all the amenities of our civilization which at some time and place in their evolution required the introduction of mathematical principles. Our fate would be even more pitiable than that which befell the 'Connecticut Yankee.' Words are inadequate to depict the transformed conditions. I can only offer as suggestions that all transatlantic and other foreign commerce would cease, for without astronomy no navigation, and no astronomer without mathematics. America itself could not have been discovered. Columbus could not have conceived of the rotundity of the earth. The potency of commerce alone as a factor in the advancement of civilization cannot be exaggerated. Inland commerce would vanish, for the construction of locomotives, railroads, bridges, tunnels and canals presupposes a considerable knowledge of mathematics. The trolley car and all electrical machines, large buildings, the printing press, power loom, all machinery not of the simplest construction, even our clocks and watches, yes, even the calendar on the wall, would be removed. We have not grasped, and cannot completely grasp, the enormity of this indebtedness, but we must not repudiate it; we must give mathematics the honor and appreciation to which it has a just claim."

There is little danger that the study of mathematics will be neglected in the training of engineers, for it is essential. It is to be remembered, likewise, that practical shop training must be given a place of equal importance, for it, also, is indispensable. And if the professors of mathematics can teach their students to think, to reason, they will confer upon them the greatest benefit of all.

Dr. Steinmetz Lectures in Chicago on Lightning Protection.

On the evening of November 26th the Chicago section of the American Institute of Electrical Engineers held its first meeting of the season in Fullerton Hall of the Art Institute. About 500 persons were present to listen to an extremely interesting lecture by Dr. Charles P. Steinmetz on "Lightning Protection." Mr. H. R. King presided.

In general, the lecture was an enlargement of the second half of his discourse on the same subject before the recent Washington convention of the National Electric Light Association. (See Western Electrician of July 20 and 27, 1907.) The history of the development of the several types of lightning arresters was rapidly traced. The horn type is defective because the arc persists too long to prevent synchronous machinery from getting out of step and shutting down the system. The multigap arrester, with a number of different resistance shunts around most of its gaps, is effective when used with auxiliary protectors, such as a ground line over the transmission system.

All high-tension transmission systems, and particularly underground cable systems, are subject to disturbances akin to lightning, but much worse in their destructive effects. These are termed internal lightning, and are oscillatory surges caused by switching large changes of load, grounds, etc. The multigap lightning arrester is of no service in these emergencies, as it almost invariably is destroyed. To guard against these troubles an arrester is needed that short-circuits not the line but only the excess voltage and that produces no disturbance in the system. This the aluminum-cell arrester does satisfactorily. To avoid a small loss of energy through it when continually in circuit, it need be connected only when troubles may be anticipated, but it should be put in circuit at least once a day to keep the counter-electromotive force up to line value.

The late advances in protective apparatus have been chiefly due to theoretical investigations of what may happen under abnormal conditions. Great credit, however, is due a number of experimenters who have made oscillographic investigations of lightning-discharge waves, among whom should be particularly mentioned Prof. E. E. F. Creighton and his researches along these lines in Colorado.

Western Electric Minstrels.

By its size and prominence and the opportunities it offers, the Western Electric Company has attracted to itself a large number of young men, many of them graduates of technical or other colleges. In this force are many men with musical, histrionic or other talent pleasing in a social way. A mandolin club, a glee club, a dramatic club, besides several educational clubs, flourish among the employes and are encouraged by the management. In addition an elaborate minstrel show has come to be an annual feature of the social life connected with the manifold activities of the company. The "second annual disturbance" of this character was held on November 22d and was a huge success. The annual banquet for officers, heads of departments and their assistants and foremen, was held on November 1st at the Grand Pacific Hotel. As 379 men were present, there was no room for the wives. For the minstrel show the Y. M. C. A. auditorium on La Salle Street was engaged, and the ladies were invited. Every seat had an occupant. An excellent and amusing programme was carried out, and the value of the good-fellowship idea was fully demonstrated. The officers as well as the men enjoyed the jokes at their expense. Among the officers present (many accompanied by their wives) were Messrs. J. W. Johnson, H. A. Halligan, H. M. Sage, A. C. Dodge, P. L. Thomson of Pittsburg and F. B. Uhrig of Kansas City. Messrs. Hibbard, Abbott and others from the Chicago Telephone Company were also in attendance.

Chicago Drainage Canal Power is Ready.

Earlier announcement in the Western Electrician that electric current from the Sanitary District's canal power plant at Lockport would be supplied to the city of Chicago and other customers beginning December 1st are now confirmed by the announcement of the practical completion of the substation at Western Avenue on the canal. Chairman W. G. Clark of the engineering committee has reported to the board that the transmission line to Morgan Park is also completed and ready to begin service on December 1st. The first use of the new current will be made in lighting the entire West Park system. Of the private concern which will use current for light and power the larger manufacturing plants will be supplied first, as a saving in installation cost can be made in this way.

Central Electric Railway Association.

The regular bi-monthly meeting of the Central Electric Railway Association was held in the Claypool Hotel, Indianapolis, on November 21st. President H. A. Nicholl stated that, owing to the fact that Thanksgiving Day came on the regular date for the meeting, it was decided to hold it one week earlier.

Mr. Nicholl announced that the standardization committee would have a meeting early in 1908 to confer with a similar committee of the American Street and Interurban Railway Association.

The first paper on the programme was read by Albert B. Herrick, an electric-railway expert, of Ridgewood, N. J., on the "Analysis of the Cost and Methods of Electric-railway Maintenance." The paper was an elaborate one, well illustrated, and treated the subject in a general way, and then particularized as to the manner in which losses are located and the methods of establishing the relative losses in a system. It embraced a description of the test cars employed in obtaining accurate information as to the physical condition of every rail bond on a traction road. Mr. Herrick next took up the losses in equipment, in the repair shops and conditions of management which affect very materially the cost of maintenance. The paper was listened to with great interest and brought out an animated discussion and numerous inquiries, which Mr. Herrick answered readily.

The afternoon session was opened by the reading of a paper prepared by Fred Heckler, master mechanic of the Lake Shore Electric Railway Company of Fremont, Ohio, on "Foundation Brake Arrangement for Electric Cars." The paper was read by J. D. Hutchens of the Westinghouse Company. Among other things Mr. Heckler said: "When it is realized that the brake equipment is not merely an auxiliary apparatus but a controlling element, not merely a necessary expenditure, but a dividend-earning asset, then sufficient pressure will be brought to bear on the car and truck designers and builders to induce them to consider the brake installation before it is impossible to put one on that will ever merit the name of brake in the true sense of the word." The paper received much praise from Messrs. Sloat of the Cincinnati Northern, Taylor of the Indiana Union Traction, Carpenter of the Western Ohio and Hutchens of the Westinghouse company, who discussed the question freely. All agreed that it was important to secure an apparatus that will stop an interurban car in the shortest space possible.

President Nicholl regarded the paper and discussion of sufficient importance to be turned over to the standardization committee for consideration and lucidation.

There was a general discussion of the subject "Does It Pay Interurban Electrics to Cater to Long-distance Travel?" It was the expressed opinion of the members of the association, practically without a dissenting voice, that long-distance travel pays and is a thing to be catered to. Albert B. Herrick said that when the costs of operating steam and electric lines are compared it certainly will pay to cater to long-distance hauls. F. D. Carpenter of Lima, Ohio, said that the long-distance patronage of his and connecting lines was very desirable. His company frequently carries passengers over its lines who had purchased their tickets in Kansas City or other distant cities. F. D. Norval of Indianapolis said that the Indiana merger lines were catering to long-distance travel with very satisfactory results. He spoke of his experience in transporting a carload of people from Indianapolis to Pittsburg, carrying them all the way to Janesville, Ohio, by trolley and the remaining distance by steam line. They were so well pleased with the long-distance trolley service that they returned the same way.

During the discussion it was asked what constituted long-distance travel on electric lines. It was explained that the term was elastic in meaning; that not many years ago 50 miles was considered a long distance in electric-traction travel, but that at the present time anything less than 150 miles is not so considered. It was agreed that it was only a matter of a few years until long-distance would mean something more than four or five hundred miles, and that it was incumbent upon electric-railway managers to get ready for such service.

The next meeting will be held in Dayton, Ohio, on January 23d, when new officers will be elected and the annual banquet will be held.

A Big Toronto Project.

It has [illegible] of the city of Toronto [illegible] raising $2,?00,000 for the purpose of establishing a power and light distributing plant for the city. This action was decided upon at a conference between independent engineers and representatives of the hydro-electric power commission and the board of control for the city, who were unanimous in the opinion that this sum would be sufficient to give Toronto the plant required. The decision was largely influenced by a report of Mr. Dow of Detroit. Mr. Dow estimated that for a sum not to exceed $2,500,000 the city can construct a distribution system which will provide for the following: Fifteen hundred street lights; power deliveries to pumping station; lighting of public buildings; underground conductors in central area (about three-quarters of a mile square) and main streets leading therefrom; supply of power to factories along railroad lines and all principal factory areas; supply of light and incidental power in suitable manner in all parts of the city where there is reasonable demand; facilities for extension, namely, spare ducts in conduits, spare arms on pole lines and spare floor space in sub-stations. The estimate is based on the receipt of, say, 12,000 horsepower, and these spares being sufficient for an increase to, say, 20,000 horsepower.

Electricity for Japan's Railroads.

Mr. K. Katayama, chief engineer for the government railways of Japan, is on his way home from his mission to Europe and America, where he has been looking into the latest developments of electricity with a view to the introduction of electric power in the operation of the railroads of Japan. Mr. Katayama states that the large cities of the Japanese Empire are now lighted by electricity. He says that Japan is excellently provided by nature with mountain streams and rivers, at which electric power can be produced under economic conditions. The idea is to operate all the government railroads of Japan, which now constitute nearly the whole of the mileage, with electricity. Ultimately, perhaps, the whole of the 25,000 miles of railroads now in operation in Japan will be worked by electric power. In this phase of electrical experiment Mr. Katayama hopes that Japan, after seeing what all other nations have done, will take the lead.

Tantalum Lamps for Alternating Current.

The National Electric Lamp Association has just issued a bulletin on "Tantalum Regular" and "Tantalum Meridian" lamps and units. An interesting announcement made therein is that the tantalum filament has been improved since it was first brought out, so that it can now be recommended for use on alternating currents of any frequency as well as for direct-current lighting. However, the life of tantalum lamps operated on alternating current varies greatly with different conditions. Therefore prospective users are advised to ascertain the life of a small number of these lamps on their particular alternating-current circuits before ordering large quantities. Furthermore, the tantalum lamp can now be used at any angle, instead of straight down only, as was found with the early lamps. The lamps are now made in 40 and 80-watt sizes, having a nominal rating of 20 and 40 candlepower, respectively.

Illinois Traction System to Be Enlarged.

General Manager Fischer of the Illinois Traction Company is busy arranging the plans of operation for the company. The departments of urban street-railway and public utilities are being separated into distinct departments. There is a rumor that as soon as the company's improvements at St. Louis are completed it will make that city the headquarters of the system. The ultimate plans of the company contemplate a through line from Kansas City to St. Louis, a line through Illinois directly east from St. Louis and another line from St. Louis to Cairo through East St. Louis. With these lines built and in operation the central point will then be St. Louis. At present Springfield is the center of the operating lines, and that is where the headquarters are now located.

A combined electric-light and water plant to cost about $25,000 is to be erected at Sulphur Springs, Ark.

Chicago Electrical Show to Excel in Decorative Illumination.

Aside from a large and varied display of individual exhibits which will be shown at the third annual Chicago Electrical Show of January 13-25, 1908, the most artistic and elaborate scheme of decorative illumination ever prepared for a trade exhibition in this country will be shown.

A meeting of exhibitors and others interested in the show was held in the Edison Building on November 22d to see the plans for the booth construction, illumination and decoration. A large perspective drawing in colors of the interior of the Coliseum as prepared by the architects, D. H. Burnham & Co., was shown, and all present agreed with the directors that the decorative-lighting scheme, while it will cost many thousand dollars, will be an attraction of great beauty and merit.

The booth arrangement will be systematic and form part of the general scheme of decoration. The aisle arrangement is such as to afford more comfort and convenience to visitors. There will be many special attractions, and the usual large number of exhibitors, showing the latest appliances in the various branches of the electrical industry.

The management of the Electrical Trades Exposition Company has arranged to do all the booth constructing, wiring, etc., and furnish the chairs, desks, etc., thus relieving the exhibitor of all care except that of getting his exhibit to the building. Mr. Homer E. Niesz, 1006 Monadnock Building, is manager.

Following is a list of exhibitors who have already contracted for space:

Alexander, F., Manufacturing Company.
American Automatic Telephone Company.
American Clock Company.
American Electric Fuse Company.
American Electric Novelty Company.
American Electric Telephone Company.
American Steel and Wire Company.
American Telephone Journal.
Anderson, A. & J., Manufacturing Company.
Atlas Anchor Company.
Automatic Electric Company.
Automatic Igniter Company.
Austin, M. B., & Co.
Barnard, B. S., & Co.
Benjamin Electric Manufacturing Company.
Big Four Manufacturing Company.
Bristol Company.
Buyers' Reference Company.
Central Telephone and Electric Company.
Central Electric Company.
Century Telephone Construction Company.
Chicago Lamp and Reflector Company.
Chicago Telephone Supply Company.
Chicago Fuse Wire and Manufacturing Company.
Chicago Telephone Company.
Chicago Pneumatic Tool Company.
Commonwealth Edison Company.
Cook, Frank B.
Couch, S. H., Company.
Crane Company.
Cullerton, John F., Company.
Crescent Manufacturing Company.
Dean Electric Company.
Dixon, Joseph, Crucible Company.
Dossert & Company.
Electric Appliance Company.
Electrical Review.
Electric Storage Battery Company.
Electrical World.
Electrocraft Publishing Company.
Einstein, A. O., Company.
Federal Electric Company.
Fort Wayne Electric Works.
General Compressed Air and Vacuum Company.
General Electric Company.
International Correspondence Schools.
International Telephone Manufacturing Company.
Jewell Electrical Instrument Company.
Johns-Manville, H. W., Company.
Kellogg Switchboard and Supply Company.
Lang, J., Electric Company.
Lindstrom-Smith Company.
Manhattan Electrical Supply Company.
Manufacturers' Record.
Matthews, W. N., & Bro.
Moline Incandescent Lamp Company.
Monarch Electric and Wire Company.
Monarch Telephone Manufacturing Company.
McDowell-Stocker Company.
McRoy Clay Works.
National Electric Lamp Association.
North Electric Company.
North Shore Electric Company.
Nungesser Electric Battery Company.
Pardee, F. W.
Phœnix Glass Company.
Public Service Publishing Company.
Roebling's, John A., Sons Company.
Roth Bros. & Company.
Shelton Electric Company.
Solar Electric Company.
Sterling Electric Company.
Stoltz Electrophone Company.
Stromberg-Carlson Telephone Manufacturing Company.
Swedish-American Telephone Company.
Swedish Electric Vibrator Company.
Telephony Publishing Company.
United Clock Company.
Universal Manufacturing Company.
Vivax Storage Battery Company.
Vote-Berger Company.
Wagner Electric Manufacturing Company.
Western Electric Company.
Western Electrician (Electrician Publishing Company).

The Hawks Electric Company has nearly completed its new power plant on the canal bank at Goshen, Ind. The waterwheels have been installed and the generator is being connected up. Water may be turned into the flume and the machinery started next week.

Testing Rails, Not Locomotives.

Reports concerning certain tests the Pennsylvania Railroad has been making on the West Jersey and Sea Shore Railroad near Clayton, N. J., should not be confounded so as to make it appear that the company is racing steam and electric locomotives with a view to determining the speed capacity of each type. The company has other more accurate and much less dangerous methods of testing the speed of locomotives than trying them out in such a manner as this. Furthermore, the types of electric and steam locomotives which have been used in these experiments were not designed primarily for speed, and any inference based on their performance in this respect would be incorrect.

What the company is doing is this: Experience indicates that the operation of electric locomotives, owing to their lower center of gravity, has an effect upon the track entirely different from that due to the action of steam engines. In order to ascertain the exact nature and extent of this pressure upon the rails the motive-power department has devised the apparatus which is being utilized at Clayton.

A stretch of track about 166 feet in length has been equipped with rails and cast-steel ties, designed and made especially for this purpose. Instead of attaching the rail to the ties by spikes, a special form of block has been substituted which allows a slight movement of the rail as the engine goes over it; this movement registers the force with which the flanges of the wheels strike or press against the rails. It is expected that a large number of experiments with this apparatus will show the company quite accurately what the effect is of either steam or electric locomotives moving at different speeds over either straight or curved track.

Necessarily to make these tests the engines must move at different speeds, and at times each attains its maximum speed.

An electric apparatus has been devised to measure the precise amount of time elapsing while the different locomotives pass over this 166 feet of track in order that in computing the effect upon the track the exact speed attained may be known. The steam and electric locomotives, however, go over the track at different times, and there is no element of contest as to speed between the two types. The matter of speed is purely incidental to the main purpose of the tests, which is to enable the company, in planning its electric installations in New York, to design a track so safe as to be secure against any form of locomotive that may be utilized.

Statistical Record of Progress.

"Statistical Record of the Progress of the United States, 1800-1907," is the title of a publication just issued by the Bureau of Statistics of the Department of Commerce and Labor, and while composed exclusively of columns of figures, the record of progress which it shows for the United States and its industries and commerce is encouraging. Among the many interesting facts which it presents is that the money in circulation in the United States on July 1, 1907, was 2,773 million dollars, against 2,736 millions in 1906 and 1,640 on the corresponding date of 1897, a decade ago. The public debt per capita was $10.26 in 1907, against $11.46 in 1906 and $13.78 in 1897. The merchandise imported into the country is given at 1,434 million dollars in the fiscal year 1907, against 1,227 millions in 1906 and 765 millions in 1897, while exports of domestic merchandise are set down at 1,854 millions in 1907, against 1,718 millions in 1906 and 1,032 millions in 1897. Evidences of activity among the manufacturers are shown by increased importations of material used by them. The popularity of American merchandise in foreign markets in various parts of the world is illustrated, to some extent at least, by the two pages devoted to the foreign commerce of the principal countries of the world and the share of that trade with the United States.

Cleveland Street-railway Situation.

Mayor Johnson and 43 of the 47 city councilmen and councilmen-elect of Cleveland, acting as a Council committee of the whole, on November 14th refused to give the Cleveland Electric Railway Company a 25-year franchise over all its lines in consideration of a three-cent passenger fare to be granted by that company if a six-month test proved that rate sufficient to yield six per cent. profit. The Council, led by Mayor Johnson, demanded that the corporation name the lowest figure at which it would turn its stock into a holding company's hands. Mayor Johnson already has let it be known that he will consider no figure for the Cleveland Electric stock that is not below 46, and 42 is the figure commonly supposed to have been given the mayor's ratification in tentative proposals. This figure is known to be far below what the Cleveland Electric directors have thought should be allowed in a transfer of their company.

BOOK TABLE.

Men Who Sell Things. By Walter D. Moody. Chicago: A. C. McClurg & Co. 1907. Pp. (4¾ by 7 inches), xi., 283.

Commercial literature is reaching voluminous proportions, and this bright little book, the latest addition, is one of the best of its kind. Written by the sales manager of a large Chicago business house, it is thoroughly practical and a valuable handbook for employers, managers and salesmen. "Pure Grit," "The Order Taker," "The Know-it-all Salesman," "Letters to the Trade," "Dress and Orderliness," "The Salesmen's Relation to Credits" —these are the titles of a few of the 22 chapters, and they indicate the character of the work. Mr. Moody's style is sprightly, and he makes his points in a bright, forceful manner, which is withal orderly and sensible. He has written a helpful book which deserves a wide reading.

The Motorman and His Duties. By Ludwig Gutmann. Sixth edition, revised and enlarged by Lawrence E. Gould. Chicago: The Wilson Company. 1907. Pp. (5 by 7½ inches), 195, with 138 illustrations and drawings. Price, $1.50.

This is a handbook of the theory and practice of electric-railway car operation. First a good account of the essential parts of an electric-railway is given and then the car shops are taken up, mentioning briefly the various parts of the whole system and the devices that are necessary to operate it. Such of these devices as come under the control and care of the motorman and conductor are described in detail, and the principles by which they operate are explained. The book is a good one for the motorman of a mechanical turn of mind who desires to know more than just enough to run his car over the line.

A clear description of the intricate details of the motive power and brake equipment of an electric car is introduced in the second chapter. The third chapter considers the generating and distribution of power, outlining the essential parts of a power station and defining the method now most generally used for distributing current. The working conductor and the use of transmission lines are outlined in Chapter Four. There follows, in Chapter Five, a discussion of the constructional details of electric-railway motors of standard types. Car wiring and parts, including such features as the various types of current collectors, fuses, lightning arresters, and sketches showing the various wiring circuits, are introduced in Chapter Six.

The next three chapters are devoted to a detailed discussion of the principles, construction and methods of operation of controllers of various standard types. It is noted that the latest types of multiple-unit control and drum control using auxiliary contactors are considered. Chapter Ten describes the various types of hand and power-operated brakes and brake parts, comprising complete brake systems of the most modern types. The concluding chapter of the book comprises a number of instructions to show how troubles on the road may be prevented or remedied. A glossary describing the principal terms and individual parts mentioned is a valuable part of this work.

Faraday Society.

At the ordinary meeting of the Faraday Society in London on October 29th Mr. N. T. M. Wilsmore was in the chair. A paper on "The Electrolysis of Salt Solutions in Liquefied Sulphur Dioxide at Low Temperatures," communicated by Dr. Bertram D. Steele, was read in abstract by the secretary. This was a preliminary account of the results arrived at in the course of a general study of the electrolysis of salts in liquefied gases. The paper dealt with the case of a solution of potassium iodide in sulphur dioxide. Electrodes of various materials were used and the changes at anode and cathode were carefully studied. With platinum or mercury cathodes a very rapid diminution of current (depending on the initial current density), due, in the author's opinion, to a film of sulphur, was observed. Potassium sulphite with an admixture of sulphur was, after continued electrolysis, found to be deposited on these cathodes. Using silver, copper or iron cathodes of large area, a constant current was maintained, the sulphides being formed in these cases. Iodine was formed at the anode, being either liberated or found in combination, depending on the metal employed. No potassium as metal was found to be deposited on the cathode.

A paper by Mr. F. E. Weston, B. Sc., and Mr. H. Russell Ellis, B. Sc., on "The Action of Aluminum Powder on Silica and Boric Anhydride," was read in abstract by Mr. Weston, who showed, on a small scale, some of the reductions described. Dr. R. Seligman suggested that some of the heat required in these reactions was furnished by the aluminum or boron, as the case may be, burning in the air. The fireproof slags obtained in many cases were being used for making acid-resisting crucibles and for other industrial purposes.

Dr. F. M. Perkin and Mr. L. Pratt read a paper on "The Reduction of Metallic Oxides with Calcium Hydride," and illustrated some of the reductions.

ELEMENTS OF ELECTRICAL ENGINEERING.

By Geo. R. Metcalfe.

XLIV. Electric Railways.

The Single-phase System.

The single-phase alternating current system has been generally accepted in the United States as the solution of those traction problems which lie beyond the limits of the direct-current system, and there are at present a number of roads in this country using single-phase equipments. As a single-phase current requires but two conductors, the track can be used for one side of the circuit and the trolley wire for the other.

The use of single-phase current for traction service was made possible only by the recent development of the commutator type of alternating-current motor. It had been known for some time that a direct-current motor of the railway type would operate when supplied with alternating current and would develop similar characteristics to the direct-current motor. The cast-steel field frame of such a motor, however, would become very hot, due to the presence of eddy currents, and the commutators sparked so excessively when using alternating current that they would be quickly destroyed. Recent improvements, however, have made this motor entirely practicable for traction service, and the modern single-phase railway motor operates as smoothly and efficiently as a direct-current motor.

The frame of the motor consists of a cast-steel shell which is designed to contain the field magnet. The latter is composed of laminations of thin sheet steel which are varnished so as to insulate all the laminations from each other. These laminations are packed close together within the outer case and form the field magnets of the motor. The outer case is used simply for mechanical protection and strength and does not form any part of the magnetic circuit. The lamination of the field prevents the passage of eddy currents and the consequent heating of the iron, thus permitting the machine to run cool.

The armature core is laminated in the same way as the field, and the armature winding is continuous. Instead of bringing out the ends of each armature coil to a commutator segment, as in the direct-current armature, taps of high-resistance wire are taken off the armature winding at regular intervals, and these taps are connected to corresponding commutator segments. The introduction of this resistance between the armature coils and the commutator bars prevents sparking at the brushes and makes the commutation entirely satisfactory.

It will be apparent that the alternating-current motor with its laminated fields is a more expensive machine to build than a direct-current motor, and it is also heavier for equal capacities. The increased weight, however, is not sufficient to form any appreciable detriment, and the extra cost of the motors is insignificant in comparison to the saving effected throughout the system by the use of alternating current.

Some Advantages of Alternating Current.

One of the most important features of alternating current is the ease with which it may be transformed from one voltage to another. It is for this reason that it is not necessary to have the same voltage on the trolley wire that is used on the motors. In different single-phase roads the trolley-line voltage runs from 6,600 to 11,000 volts. By using a lowering transformer on the car the trolley voltage may be reduced in any desired ratio for use at the motors. By bringing out taps from different parts of the car-transformer winding different voltages are available for regulating the speed of the car.

The alternating-current series motor has the advantage of being able to operate almost equally well whether supplied with alternating or direct current, and this fact is of great advantage in some conditions of railway work. In many cases interurban lines have to pass over direct-current roads in traversing cities and towns in which the latter system has been established, and the single-phase motors can be readily adapted to operate on either system. This means some additional complication in the car equipment, as two systems of control must be furnished—voltage control for the alternating-current operation and rheostatic control for direct-current operation. This method is entirely feasible, as some important roads are equipped for alternating-current-direct-current operation, but, owing to the increased cost and complications it involves, a straight alternating current equipment is preferable where possible.

As the trolley voltage is limited only by the possibility of providing adequate insulation for it, it will be seen that the single-phase system affords a means of operating even the heaviest cars and trains from a trolley wire of ordinary size without any additional feeders; and it is in the matter of overhead distribution that the single-phase system shows its special adaptability to long-distance traction service. The generating-station current may be distributed at any commercially practicable voltage, however high, and this current is reduced to a voltage suitable to the trolley line by means of transformer stations situated at intervals along the line. There is no low-tension distribution whatever. The transformer stations are cheap, consisting merely of a transformer and a suitable structure in which to house it, and they require only an occasional inspection.

[To be continued.]

Note.—This series of articles, intended to survey, briefly, the whole field of applied electricity for light, power and heat, was begun in the Western Electrician of February 2, 1907.

QUESTIONS AND ANSWERS.

Reading a Meter.

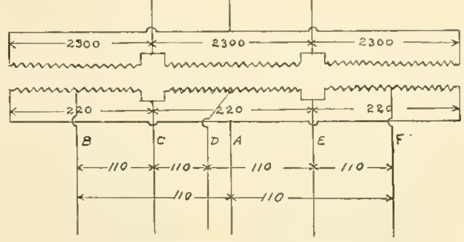
A. F. L., Oakland, Cal.: Will you kindly tell me how to read the ordinary electric-light meter.

Answer.

Recording watt-hour meters, such as are ordinarily used, have numbers marked above their dials in either one of two ways: (A) 100,000, 10,000, 1,000, 100, 10, or (B) 10,000's, 1,000's, 100's, 10's, 1's. Method A means that a complete evolution of each index hand gives the number of kilowatt-hours marked above the corresponding dial. Method B is fully described on page 219 of the Western Electrician of September 21, 1907. If the meter shown there had been marked by method (A) the numbers above the dials would be 10,000, 1,000, 100, 10, but the reading would still remain 2,852 kilowatt-hours. There is therefore no difference in reading the figures by either method, the difference being in remembering the factor 10 in putting down the result.

Alternating-current Problems.

C. H. S., Southbridge, Mass.: (1) I have three 25-kilowatt transformers with the primaries connected up in delta on a 2,300-volt three-phase line and with their secondaries connected up and giving the voltages as shown in the accompanying drawing. I would like to know if it is possible to connect up the secondaries so as to have only three line



TRANSFORMER CONNECTIONS.

wires instead of six and so as to obtain a voltage of 220 volts between outside wires and 110 volts between the middle wire and either outside wire.

(2) How can I ring a vibrating bell on an alternating-current circuit?

(3) How can a magnetic chuck be worked on a 110-volt alternating-current circuit.

Answers.

(1) The system of distribution desired is essentially a three-wire single-phase system. It cannot be obtained from any direct connections of the secondaries shown that would result in a balanced system. Thus the load could be taken from any one of the secondaries, but the other two would then be idle. The desired system could be obtained by substituting for the transformers now installed special phasing transformers that would change the three-phase currents to single phase and at the same time step down the voltage to the value wanted.

(2) The ordinary vibrating electric bell does not work satisfactorily on alternating-current circuits. The polarized bell, such as is used on telephones, is especially suitable for alternating-current work.

(3) A magnetic chuck or magnetic clutch will work nearly as well on alternating as on direct current, except that the voltage will have to be higher in the former because the inductance of the coils increases the impedance of the magnet and thus cuts down the current much more than it would be on a direct-current circuit of the same voltage. The increase in voltage required on alternating current depends on the number of turns and the quantity and quality of iron used in the device. Objections to using these devices on alternating-current circuits are that they will take slightly more power to operate and that the iron will become heated, due to hysteresis.

Selenium.

Selenium, one of the rarer elements, is closely related in many ways to tellurium and sulphur, with both of which it often occurs in nature. As is well known, electrical inventors take advantage of its peculiar property of being almost a non-conductor of electricity in the dark, while under the influence of light its conductivity immediately becomes greatly increased. This characteristic has led to its use in instruments designed for lighting and extinguishing gas buoys automatically; for guiding and exploding torpedoes by a ray of light; for telephoning along a ray of light; for transmitting sounds and photographs or other pictures to a distance, and for measuring the quantity of Roentgen rays in therapeutic applications. A general or practical use of any of these instruments would result in an increased demand for selenium.

At present the metal is variously quoted at from $13.33 per kilogram (2.2046 pounds) to $2 per ounce, as there is no steady market, and the prices vary with different dealers.

No selenium is known to be produced commercially in this country, but during 1906 one copper refinery made some in an experimental way, and it is possible that it was produced at other refineries also. At this refinery the selenium was obtained from the anode slimes or mud, where it is left with gold, silver and other residues in the electrolytic refining of copper.

Metals containing selenium are of rare occurrence in the United States, but a demand for the metal could probably be supplied by utilizing the small quantities found in the copper-refinery slimes.

A note on selenium, prepared by Frank L. Hess, geologist, is published in an advance chapter from "Mineral Resources of the United States, Calendar Year 1906," where the production of antimony, arsenic and bismuth in 1906 is also reported.

The "Degradation" of Copper.

Recent experiments of Sir William Ramsay, the English chemist, are not likely to result in the artificial manufacture of copper, according to Dr. Ira Remsen, who recently addressed the Scientific Association of Johns Hopkins University on "The Work of Sir William Ramsay on the Action of Radium Emanation on Copper." Dr. Remsen said in part:

"Ramsay has made it appear very probable that when what is called radium emanation is allowed to stand in contact with a solution of copper sulphate or copper nitrate a very minute quantity of lithium is formed. If this is true, it is evident that the substance we call copper, which we have hitherto regarded as a stable elementary form of material, is capable of undergoing at least a very slight decomposition. While Ramsay has made it extremely probable that a minute quantity of the element lithium can be obtained from copper by the action of radium emanation, the fact should be emphasized that this change takes place only to a very slight extent, and it does not seem probable that any method can be devised by which it can be markedly increased. To the chemist and physicist Ramsay's results are of special interest because they promise to throw light upon that important problem, the constitution of matter. Those who are looking for practical results in the sense in which that expression is commonly used will be disappointed."

Annual Meeting of "Mechanicals."

The twenty-eighth annual meeting of the American Society of Mechanical Engineers will be held at 29 West Thirty-ninth Street, New York, on December 3d, 4th, 5th and 6th. A good programme has been arranged. Gas power will be discussed on the morning of Wednesday, the 4th, by Messrs. F. E. Junge and J. R. Bibbins and Profs. C. E. Lucke and S. A. Reeve. The tunnels under the Hudson River will be inspected on Wednesday afternoon. On Thursday foundry practice will be taken up, and on Friday morning, superheated steam will be the subject of Prof. C. C. Thomas and Mr. M. E. R. Toltz. Other papers and social events are on the programme. Mr. Calvin W. Rice, 29 West Thirty-ninth Street, New York, is secretary of the society.

SELLING ELECTRICITY.

Under this heading will appear, from time to time, articles, suggestions and examples which will be of assistance in the constant effort to increase the existing demand for electric current and to create new demands.

The Business-getting Campaign of the Baltimore Electric Company.

A notable example of central-station campaign work is afforded by the recent activities of the Baltimore Electric Company, which organization was incorporated last spring to take care of the electric business of the Maryland Telephone Company. Alive to the possibilities for increasing its field afforded by the more recent electrical developments, the new company determined to prosecute in a more vigorous manner the business-getting methods established by the older company and at the same time to broaden the scope of its work.

Under the able management of Mr. H. M. Cosh, the contract manager, the campaign, though still in its vigor, has already borne fruit beyond the most sanguine expectations. It has not only added to the company's circuits a large number of new customers, but has awakened many old customers to the advantages of electricity for new purposes and induced them to become larger consumers. Many in the commercial district who used current for lighting only are now using it for all of their power purposes; many who used it for part of their lighting only are now using it exclusively; many who did not use it at all for lighting, because they thought it too expensive, have been won over to become its strongest supporters; many in the residence districts have been educated up to using it for washing, ironing, sewing, cooking, etc.

The campaign which the company has been conducting so successfully is characterized by good organization and systems, and by vigor rather than by novel methods, for it embraces the same items of demonstration, follow-up advertising, solicitation, etc., that would naturally suggest themselves to any central station. Founded upon efficient and far-sighted management and oversight, each feature of the campaign has been made to perform its

BUTTON DISTRIBUTED FREELY IN NEW-BUSINESS CAMPAIGN IN BALTIMORE.

part in getting results. Backed by the knowledge that the generating station could give the most satisfactory service to customers, that the apparatus to be pushed was the best for getting full value out of the current, that what was being attempted was not only for the good of the company but for the improvement of the city and for the advantage of those who joined the ranks as well, those who entered into the work were inspired by an enthusiasm that was bound to bring results.

After the organization was completed and a definite plan of campaign established, but three steps remained—to show people; to influence them to the point of wanting to see, and to convince them that it was to their advantage to become possessed of what they saw.

For the purpose of showing in an attractive manner what the company had to offer, a commodious demonstration room was established on the main floor of the company's office building, known as the Maryland Telephone Building. This was filled

GENERAL DEMONSTRATION ROOM OF THE BALTIMORE ELECTRIC COMPANY.

with electrical appliances of all kinds for both commercial and domestic use, arranged in such a manner that the attention of the visitors could not fail to be attracted. As a lesson in attractive display it is worth a visit from any central-station man. Courteous attendants are at hand to explain the various appliances, ranging from curling irons to power motors, and to demonstrate their uses, and the visitor who does not pick out something for his own convenience or that of his family must be well satisfied with conditions as they existed before the electrical age.

The next step was to attract more visitors, and to this end classified live mailing lists were carefully compiled. Attractive literature in various forms is sent out to the names on these lists, and once a month they all receive the bulletin of the company, a handsomely gotten-up 16-page magazine printed in two colors. To follow up the initial work of the demonstration room and mailings, a competent corps of solicitors is employed, under the personal supervision of the contract manager. So far the results have been highly gratifying, no less so to those who have been won over to electricity than to the company, and the demonstration room is becoming more popular every day.

After this branch of business getting had been firmly established, the company determined to apply similar methods for increasing its lighting load in the commercial field, and upon careful consideration of the various modern systems, the Nernst lamp was adopted as covering a broad field with great satisfaction. To facilitate the introduction of the lamps, an arrangement was made with the Nernst Lamp Company to furnish part of its own trained selling force and to co-operate in handling the campaign. Another demonstration room, for the exclusive purpose of affording an easy comparison of various illuminating systems, was established. The campaign was started the first of July with 14 solicitors in the field, under the leadership of Mr. C. S. St. John, a veteran Nernst campaigner. "Brighter Baltimore" was adopted as a slogan, and through the liberal use of newspaper space, circular letters, mailing cards, buttons reading "Me for Brighter Baltimore" and car cards it soon aroused the users of light to the fact that a strenuous effort was to be made to make Baltimore brighter.

Before the campaign was three months old Nernst lamps became popular to the extent of winning over 1,200 stores, large and small. Most of the number were gas users, which is one of the most gratifying results of the campaign. Baltimore is a large city, and the lighting campaign, like the power campaign, is still in full swing, but "Brighter Baltimore" has already acquired a distinctive meaning, which to be understood requires only a walk along any of its principal streets at night. The brilliant illumination afforded by electricity confronts the passer upon all sides, and the contrast is more striking when one pauses to consider that but a short time ago the same stores were indifferently lighted by gas or gasoline.

Baltimore merchants have the reputation for being conservative, but this campaign demonstrates most conclusively that they are not conservative to the extent of refusing to improve their stores by adopting good light which costs no more than poor light.

Much of the success of the campaign is due to the enthusiasm of Mr. St. John and his corps of

STREET-CAR CARD USED IN BALTIMORE CAMPAIGN.

assistants, to the advertising and to the evidence of the Nernst demonstration room, while, of course, the excellent quality of the illumination of the lamp itself had much to do with it.

Shortly after the campaign was started came the announcement that Marshall Field & Co. of Chicago had adopted the Nernst system for lighting the largest and finest store in the world, and a month later the announcement that the Scruggs-Vandervoort-Barney Dry Goods Company had adopted it for lighting the largest and best store in St. Louis. These two events, besides stimulating the salesmen, had a decided influence upon the merchants of Baltimore. They at once felt that the

Division for Various Nernst Units.

Division for Lamps Other than Nernst.

LIGHTING DEMONSTRATION ROOM OF BALTIMORE ELECTRIC COMPANY.

action of the company in selecting Nernst lamps had received an indorsement of great weight and that the gain by their adoption would be quite as much theirs as the company's. Moreover, the demonstration room showed upon the wattmeter dial exactly how Nernst light stood in point of current consumption; so if they could save money and get at the same time the light that Marshall Field & Co. pronounced best, they wanted it.

As a result of what has so far been done in these campaigns, Baltimore is a more up-to-date and brighter city; its citizens who have been won

C. S. ST. JOHN

over are strong advocates of electricity, the load of the Baltimore Electric Company has risen with astonishing rapidity, and, best of all, from the company's point of view, it's a load that won't come off.

Domestic Electricity Demonstrated in Grand Rapids.

By the co-operation of the Grand Rapids (Mich.) Press and the Muskegon Power Company, with the expert assistance of Mrs. F. Violet Sanborn, who has a well-established reputation as an authority on domestic economics, a series of lectures and demonstrations on cooking by electricity was given in the Press Building, Grand Rapids, Mich., in the fortnight ended November 9th. The course was a great success and was attended by many thousands of ladies and gentlemen. One of the features was a four-room apartment—living room, dining room, kitchen and bedroom—furnished complete with equipment for electric housekeeping. It was called "the cottage without a chimney."

Lectures and demonstrations were given every afternoon. In one of her talks Mrs. Sanborn said: "During recent years there have been many inventions to lighten the work of the housewife. For years women have longed to get away from the drudgery of the kitchen, and now, with the coming of the fireless cooker and cooking by electricity their wishes are in a large degree being realized. Cooking should not be regarded as a drudgery, but, under proper conditions, this part of a woman's work should be really pleasant." The lecturer arranged various menus, several being for special occasions, as a "witches' supper" for Hallowe'en, cooked the various dishes with electric utensils, and her recipes were printed next day in the Press. She also gave practical instruction in laundering, washing, hanging out and ironing clothes, showing the best methods of doing work of this kind with the aid of electric power and electric heat.

One day was set aside for bread baking. A contest was arranged, and the newspaper gave four prizes ($10 order for furniture, $3 in cash, $2 in cash and a dozen roses) for the best loaves of bread of the participant's own baking. Another feature was an evening lecture on the possibilities of the chafing dish. Gentlemen were especially invited to this lecture; a well-known man cooked a steak, while others made the coffee, panned oysters and did other culinary "stunts."

Grand Rapids, with its hydro-electric power, is well situated to enjoy the advantages of electricity supplied at a moderate price, and the local company is making a successful effort to extend the domestic uses of electricity. The plan of co-operating with a prominent daily paper in making the demonstrations seems to have worked well and may be worthy of imitation elsewhere.

The committee having in charge arrangements for the proposed electrical show in Joliet, Ill., has given up the project on account of the high rents asked for public halls, owing to the great demand for roller skating. Nearly 40 electrical companies had asked for space, but the committee did not feel warranted in proceeding with the show.

Selling Current for Warships.

It isn't often that vessels of the United States Navy are central station customers. With ships at sea there would be some difficulty in connecting with the street mains of any electric light station at home, while during the stay in port the isolated plants on shipboard are still relied upon. But in the case of the U. S. S. Newark and Granite State, turned over to the New York State Naval Militia and moored to a pier in the Hudson, the situation is different. The state of New York has recently made a contract with the New York Edison Company to supply electric light and power to these vessels, and this is the first instance in history where a warship has abandoned its own plant for central station service. A cable of the underground type is run from the street connection out on the pier and through a standpipe which is raised about eight or ten feet above the pier. From the end of the standpipe flexible cables are extended in the case of each vessel, and through these the current is led to the switchboard on board ship.

The Newark is a new-old 4,000-ton steel cruiser 17 years old and was considered a crack ship in its day. It still belongs to the navy, and, should it be required by the government, must be ready to put to sea on 48 hours' notice. The Granite State, formerly the New Hampshire, is a survivor of the days when there were wooden line-of-battle ships. It was launched in 1864, in time to see service in the Civil War, and was one of the largest three-deckers ever built in the country. Of late years, with masts and spars removed and housed over—a mere reminder of its former stateliness—the hulk has served as a recruiting ship or armory.

Grounded Neutral in High-tension Systems.[1]

By P. Junkersfeld.

In November, 1900, the Commonwealth Electric Company of Chicago in one portion of its territory put into commercial service the first extensive system of four-wire, three-phase distribution at 4,000-2,300 volts. This 60-cycle system was soon installed in all of the company's outlying and suburban territory and has since grown to such an extent that the total length of three-phase or equivalent lines or feeders today aggregates 525 miles, of which 55 miles is underground, with the remainder overhead. The neutral of this 60-cycle system has always been connected solidly to ground from the beginning.

In May, 1902, the Chicago Edison Company raised the voltage of its three-phase, 25-cycle transmission system from 4,500 to 9,000 volts and put into service its first Y-wound generator, delivering 9,000 volts directly to the bus-bars without step-up transformers. This system now aggregates 270 miles of three-conductor cable and is practically all underground, only nine miles being overhead. The neutral of this 25-cycle system has been connected to ground from beginning. During the last year a part of this system has, however, been connected to ground through resistances. The remainder of the system during the last year and all of the system during the previous four years has been connected solidly to ground.

In June, 1907, the Chicago Edison Company put into commercial service its first 25-cycle underground line, operating at 20,000 volts. The transformers were connected in delta at the receiving end and in Y at the sending end. The neutral at the latter has been connected solidly to ground from the beginning.

The two companies mentioned above have recently been consolidated into the Commonwealth Edison Company, which thus operates a total of about 800 miles of three-phase overhead and underground lines at voltages of 4,000, 9,000 and 20,000 volts in the various zones, and for different purposes, but on all of which the neutral is connected to ground either with or without a resistance. The experience in operating high-tension systems with neutral grounded has, therefore, been considerable, and the engineering policy on this matter has been rather definite for several years. The experience, however, in grounding such neutral through a resistance has still been very limited. The various steps in this experience and development and some of the reasons, together with the conditions now existing, may be of interest in this discussion.

The 4,000-2,300-volt, four-wire, three-phase system of distribution in the outlying and suburban sections permits standard 2,080 to 115-230-volt line transformers, thus giving a single-phase, three-wire lighting and small power service at 115-230 volts. It was felt that such a system of distribution would be unstable and would permit annoying and serious voltage fluctuations if the neutral were not grounded. After considerable discussion the neutral was finally grounded under the writer's direction just before the line [illegible], the [illegible] feeder was put into [illegible].

Among those who, [illegible] November, 1900, argued most [illegible] the grounding of neutral, but who [illegible] permanently became one of the most [illegible], was Mr. George N. [illegible], who, [illegible] 1901, had occasion to make certain [illegible] led to a series of very careful investigations at a time when accurate information on this subject was very meager. Some of the results of these investigations were presented by him in a paper before the Boston convention of the National Electric Light Association in May, 1904. These investigations, together with the first few years of actual experience, practically fixed the engineering practice on this particular matter of the two Chicago central station companies, which have, since 1900, continued to develop their three-phase transmission systems with the neutral grounded.

We have no direct comparative experience with an ungrounded system under exactly similar conditions. The results from this grounded system have, however, been very satisfactory. There have been practically no underground cable burnouts on this 60-cycle system, and comparatively little trouble on pot heads or on the other overhead construction. The total number of transformer burnouts, from all causes, including lightning, overloading and defects in the apparatus during the last two years has been about 1.4 per cent. and 1.2 per cent. of the total number of line transformers in service. The percentage expressed in kilowatt capacity connected has thus far been slightly less. Similar four-wire, three-phase systems with grounded neutral have during the past few years been installed in so many cities of the country that this practice has become quite well known. The grounding of neutral on three-phase systems for general distribution has also become very common, at least in parts of Europe.

The 9,000-volt, 25-cycle transmission system in Chicago is used exclusively for transmission to sub-stations and not for general distribution. With the exception of a few induction-motor-driven exciters, all equipment consists of rotary converters or synchronous motor generators.

The present total continuous capacity of the two principal and two subsidiary generating stations is about 110,000 kilowatts. The neutral of the 25-cycle, 9,000-volt system is, however, grounded directly only in the Harrison Street and the Fisk Street stations. The latter at present contains 10 turbo-generator units, the first four of which were originally rated at 5,000 and the last six at 9,000 kilowatts each, with the usual overload guarantee. The transmission lines from the two stations are operated normally as "radial" systems; that is, outgoing lines are independent of each other and are not tied together at the sub-station ends.

The neutral of this system was connected solidly to ground in May, 1902, when the first 25-cycle, 9,000-volt generators were started at the Harrison Street station. After the Fisk Street station was put in service the transmission system has at times been operated all in multiple and at the other time sectionalized. In the latter case each part or section of the system had a grounded neutral so as to avoid having two non-synchronous sections without a grounded neutral on each.

At present and during a large part of the last year the entire 25-cycle system has been operated in two approximately equal sections, designated "System A" and "System B." Previous to this time the Fisk Street station contained but four turbo-generator units, to which have since been added six units of a larger type with slightly different characteristics.

Partly for this reason and partly for the reason that with the rapidly increasing generating capacity it might be well to limit, in case of accidents, the possible flow of current to ground, there was installed a ½-ohm resistance between the neutral of each of the four new generators and ground. The four older generators are left with the neutral grounded solidly on each. Normally the two sets of generators are operated on separate sections of the system, one of which was thus operated with and the other without a resistance in the neutrals.

During the previous four years, or since May, 1902, the neutral had always been grounded solidly, and on the whole with very satisfactory results. In case of a cable breakdown between conductors and ground each cable was usually disconnected from the bus-bars by the overhead relays and oil switch before the remaining two conductors became involved, thus permitting a quick and accurate location test by the Murray loop method.

As the generating capacity of the system increased and as it became necessary to have heavier overload and longer time-limit setting of relays on outgoing lines the destructive effects of cable breakdowns have apparently been somewhat greater, although this may be characteristic of any Murray setting of relays. This indicated the desirability of limiting in some manner the current flow in case of accidents to decrease the destructive effects. It was also desirable to secure some comparative data on this matter of resistance or no resistance.

Four possibilities naturally presented themselves: (1) The design of generators with a lower short-circuit current; (2) grounding the neutral on only one of the group of generators running in parallel,

1. Part of the discussion at the meeting of the American Institute of Electrical Engineers in New York on October 11, 1907.

leaving the neutral open on the remainder so as to limit the flow of current to ground to the short-circuit current of the one generator; (3) the introduction of one large resistance between the neutral bus-bar from a group of generators and ground; (4) the introduction of a separate resistance between the neutral of each generator and ground. Partly for reasons previously stated the last-named alternative was adopted.

Both of the first two methods mean holding the neutral where it belongs, while both of the latter two methods will cause displacement of the neutral with attendant rises in potential, as has been pointed out in Mr. Lincoln's paper.

In the four cases of trouble, each affecting from 10 to 30 per cent. of the total service at this time, during the two years previous to the installation of resistances and during the one year since, the effects might or might not have been modified if the neutral had been grounded with instead of without a resistance. In all the other cases of trouble during this period and in most of the cases during the three years previous the use of resistance in neutral would probably not have effected any improvement. In most instances the overload relays on feeder oil switches were set at 100 per cent. overload for six seconds, although in some cases they were set at 100 per cent. for three seconds. The generator switches are all non-automatic and are opened only by the switchboard operator.

During the last five and one-half years, even after eliminating all cases of trouble which have no bearing on this subject of grounded neutral, there have been, in addition to the four serious cases above mentioned, quite a number of minor cases which have a strong bearing on the matter of grounded neutral. Especially is this true of cable troubles, which, during the last three years, have averaged only two cases per 100 miles per year. This includes all troubles on 9,000-volt cables from known or unknown causes, except those due to external injury to the lead sheaths.

Notwithstanding these results we have started some investigations with the oscillograph and have also installed for purposes of observation some spark-gaps at different points on the system, all with special reference to securing more accurate information for guidance in the development of the 20,000-volt underground system into suburban districts. These investigations have not yet progressed sufficiently to afford much definite information. There are some indications that in the Fisk Street station the spark-gaps, when set for 100 per cent. above normal, discharge occasionally when the oil switch on the distant sub-station end of the line is opened. This instantaneous rise of potential occurs even with the neutral grounded and may be due to the stored energy of the line. We have thus far not been able to find rises of potential coincident with any other switching or other operation.

Our investigations and experience in Chicago with one system for five years and another system for seven years lead us to believe, as between operating with the neutral grounded or not grounded, that the neutral grounded is the better policy. As to whether any additional benefits would be secured by grounding the neutral through a resistance, our experience is still too limited to say, and we are in need of further investigation and further experience.

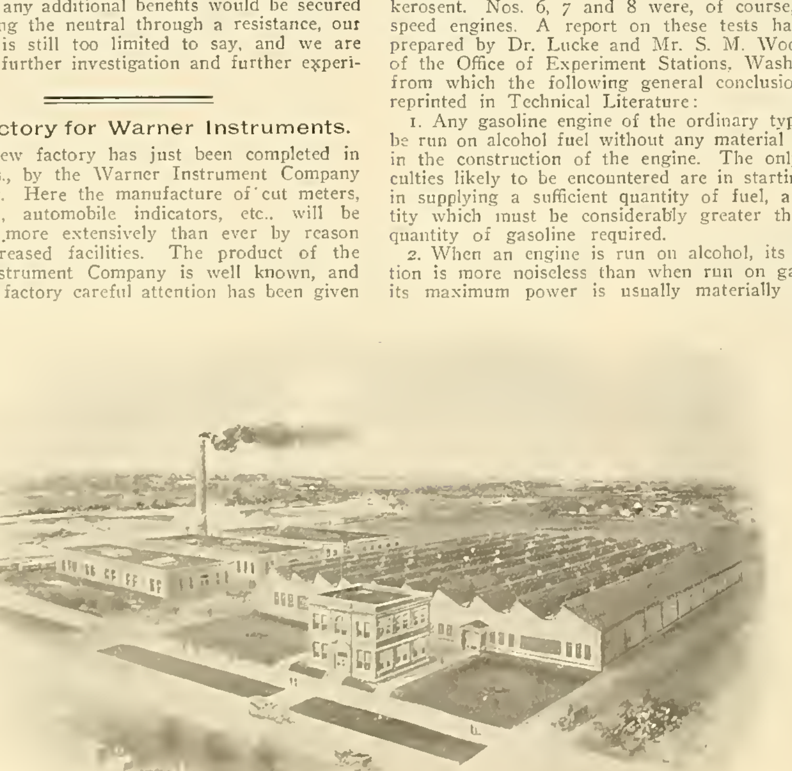
New Factory for Warner Instruments.

A fine new factory has just been completed in Beloit, Wis., by the Warner Instrument Company of that city. Here the manufacture of cut meters, tachometers, automobile indicators, etc., will be carried on more extensively than ever by reason of the increased facilities. The product of the Warner Instrument Company is well known, and in the new factory careful attention has been given to every detail in order to insure the highest quality of instruments.

Construction of the buildings is of the Kahn system of reinforced concrete, the main shop being 100 by 200 feet. A feature is the provision made for light. The roof is of prism glass supported by steel-concrete frames built on the saw-tooth principle, there being 10 sections.

The equipment of the factory is also modern, the machinery being of the best. Provision for the shafting brackets was made in the concrete during construction of the buildings. Everything in the interior is painted with a specially prepared white paint, giving a clean effect as well as light. In providing for heating and ventilation, special care was taken to eliminate dust. Pure air, heated or cooled, according to the season of the year, and filtered through a spray of water, is conducted to the various departments by the blast system.

A view of the plant as it will appear when entirely complete is given herewith.



WARNER INSTRUMENT PLANT IN BELOIT

Alcohol Fuel in Internal-combustion Engines.

About a year ago Prof. Charles E. Lucke of Columbia University was called upon to undertake an elaborate series of tests on internal-combustion engines using alcohol fuel for the United States Department of Agriculture. The objects of this investigation were:

First, to determine whether the gasoline and kerosene engines at present on the American market can run on alcohol as fuel. This involved as related matters the determination of the manipulation to be followed in making the engines run on alcohol, the measurement of the relative maximum powers of the engines when using alcohol and the fuels for which they were originally made, and, lastly, the relative consumptions of the different fuels. Second, to determine, so far as the limited time and means available permitted, the improvements which might be desirable in the design of engines manufactured especially for alcohol.

Most of the engines used were loaned by their makers for the purpose of these tests. Each of the eight engines was run on alcohol as well as on the gasoline or kerosene for which it was designed. The engines used were:

No. 1. Fifteen-horsepower two-cylinder vertical four-cycle engine.

No. 2. Six-horsepower horizontal four-cycle engine.

No. 3. Six-horsepower horizontal four-cycle engine.

No. 4. Six-horsepower vertical four-cycle engine.

No. 5. Six-horsepower horizontal two-cycle engine.

No. 6. 40-horsepower four-cylinder automobile engine.

No. 7. 40-horsepower four-cylinder automobile engine.

No. 8. Two-horsepower vertical two-cycle marine engine.

All of these engines were gasoline engines, except No. 5, which was constructed to operate with kerosene. Nos. 6, 7 and 8 were, of course, high-speed engines. A report on these tests has been prepared by Dr. Lucke and Mr. S. M. Woodward of the Office of Experiment Stations, Washington, from which the following general conclusions are reprinted in Technical Literature:

1. Any gasoline engine of the ordinary types can be run on alcohol fuel without any material change in the construction of the engine. The only difficulties likely to be encountered are in starting and in supplying a sufficient quantity of fuel, a quantity which must be considerably greater than the quantity of gasoline required.

2. When an engine is run on alcohol, its operation is more noiseless than when run on gasoline, its maximum power is usually materially higher than it is on gasoline, and there is no danger of any injurious hammering with alcohol, such as may occur with gasoline.

3. For automobile air-cooled engines, alcohol seems to be especially adapted as a fuel, since the temperature of the engine cylinder may rise much higher before auto-ignition takes place than is possible with gasoline fuel; and if auto-ignition of the alcohol fuel does occur no injurious hammering can result.

4. The consumption of fuel in pounds per brake horsepower, whether the fuel is gasoline or alcohol, depends chiefly upon the horsepower at which the engine is being run and upon the setting of the fuel-supply valve. It is easily possible for the fuel consumption per horsepower-hour to be increased to double the best value, either by running the engine on a load below its full power or by a poor setting of the fuel-supply valve.

5. The investigations also showed that the fuel consumption was affected by the time of ignition, by the speed, and by the initial compression of the fuel charge. No tests were made to determine the maximum possible change in fuel consumption that could be produced by changing the time of ignition, but when near-the-best fuel consumption it was shown to be important to have an early ignition. So far as tested, the alcohol fuel consumption was better at low than at high speeds. So far as investigated, increasing the initial compression from 70 to 125 pounds produced only a very slight improvement in the consumption of alcohol.

6. It is probable that for any given engine the fuel consumption is also affected by the quantity and temperature of cooling water used, and the nature of the cooling system by the type of ignition apparatus, by the quantity and quality of lubricating oil, by the temperature and humidity of the atmosphere, and by the initial temperature of the fuel.

7. It seems probable that all well-constructed engines of the same size will have approximately the same fuel consumption when working under the most advantageous conditions.

8. With any good, small, stationary engine as small a fuel consumption as 0.70 pound of gasoline, or 1.16 pounds of alcohol, per brake horsepower-hour may reasonably be expected under favorable conditions. These values correspond to 0.118 and 0.170 gallon, respectively, or 0.95 pint of gasoline and 1.36 pints of alcohol. Based on the high calorific values of 21,120 B. T. U. per pound of gasoline and 11,880 per pound of alcohol, these consumptions represent thermal efficiencies of 17.2 per cent. for gasoline and 18.5 per cent. for alcohol. But, calculated on the basis of the low calorific values of 19,660 B. T. U. per pound for gasoline and 10,620 for alcohol, the thermal efficiencies become 18.5 for the former fuel and 20.7 for alcohol. The ratio of the high calorific values used above is, alcohol to gasoline, 1.66 by weight, or 1.44 by volume.

Allis-Chalmers Machinery Shipments

In view of the existing condition in business circles throughout the country, a statement of shipments made from the works of one of the great engineering and machinery-building companies of the United States, for the six months preceding November 1st, has more than ordinary interest. During this period Allis-Chalmers Company sent out machinery on orders as follows:

May	23,772,242 lbs.
June	22,139,757 "
July	24,225,760 "
August	26,006,434 "
September	26,268,764 "
October	27,821,682

While there has recently been some cessation in "new business," viz., contracts for future fulfillment, the receipt and installation of machinery by industrial, lighting and power companies indicates continued progress. It required nearly 5,000 cars to transport the 150,234,630 pounds of machinery mentioned above from the works of Allis-Chalmers Company to the various places where it was to be operated, and, of course, even more than this number of cars was used for bringing in the raw materials necessary in the manufacturing process.

High-voltage Motor-generators.

[From the Question Box of the American Street and Interurban Railway Engineering Association.]

What success have you had with motor-generators wound for 6,600 to 16,000 volts on the alternating-current side? Is any difficulty experienced due to direct exposure of windings to lightning?

ANSWERS.

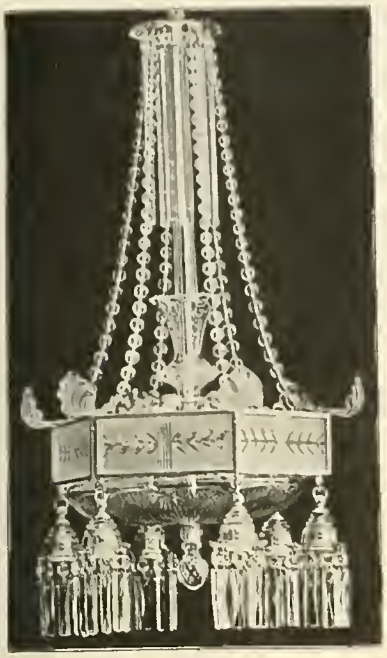
Fort Wayne and Wabash Valley Traction Company, Fort Wayne, Ind.: We have operated 13,200-volt generators for four years and have had no breakdowns or disturbance from lightning.

Alfred Green, Brooklyn, N. Y.: With a proper lightning arrester I think no great difficulty need be experienced with motor generators wound for 6,000 to 16,000 volts on the alternating-current side.

H. R. Fothergill, Greenville (S. C.) Traction Company: Have had no trouble. The high tension is turbine-driven

A Rock-crystal Electrolier.

The handsome electric-lighting fixture illustrated is made of rock crystal and is a good example of the more elaborate class of electroliers, the glittering crystal and brilliant electric light making a



A ROCK-CRYSTAL ELECTROLIER.

striking combination. This electrolier comes from Germany and is imported by Ralph E. Rickenbaugh of Grand Rapids, Mich.

Electric-railway Competition with Steam Railroads.

The great center of interurban development in this country is Indianapolis, where the steam railroads are much harassed by the competition of the long, fast interurban lines. Next to Indianapolis probably comes Dayton, then Detroit, then Toledo, then Cleveland, Columbus, Boston and Cincinnati in the order named, and the steam railroads most interested in the suburban and interurban traffic in the vicinity of these cities have not in a single instance made any strong effort to get the trolley lines into their own hands. It seems almost inevitable that the tendency of development for the next 10 or 15 years will be for this form of combination between steam and street railways to take place, so long as the laws remain open and permit it. In England it is impossible for a steam railroad to own and operate a street railway, and it may be only a few years before similar restrictions are placed in this country. In the meantime there are undoubtedly a very large number of places in this country where it would be much to the ultimate profit of the steam railroads to control the electric lines.

As regards the general tendency of interurban development, it is noteworthy that all the important trolley groups of the present day lie between the Great Lakes and the Ohio River, and that they have all arisen as a result of the process of coupling up short local lines originally built in cities and towns and then gradually extended until their ends met. This characteristic is, of course, radically different from that which characterized the growth of the steam railroads in the country. The steam railroads were almost always pushed out to connect distant points, while the trolley lines, at least until very recently, always started as local enterprises and then outgrew their bounds and crowded one another.

Assuming, therefore, that this process of coupling up short lines is the chief characteristic of American interurban development, it is noteworthy that the process is about completed in the state of Indiana. There are almost no isolated small lines left in the state, where there are some 41 operating street-railway companies, all but three or four of which connect with each other. No such complete development has taken place in Illinois, or even in Ohio as yet, although these two states perhaps come next to Indiana in interurban importance, and, after mentioning a fairly active state of interurban development in Michigan, and also in New York, Massachusetts, Pennsylvania, New Jersey and Connecticut, of the eastern states, and also in the more densely populated part of the state of Washington, the noteworthy fact is that the rest of the country has scarcely begun building interurban lines at all.

Even a casual review of the facts and figures which have been stated in this paper must show that the interurban business in this country is one of very great promise which has as yet barely begun to be developed. The conclusion is irresistible—that the steam railroads most affected should work in line with this movement and not contrary to it, and make of the trolley lines useful friends instead of competitors. Ray Morris, in the Railroad Gazette.

The Art of Telephone Talking.

In the October issue of its house organ the Southwestern Telegraph and Telephone Company of Dallas, Tex., gives some advice in relation to the art of talking over the telephone. It says:

"Much of the difficulty experienced by users in making themselves understood when talking over the telephone would be obviated if more care were taken by them in articulating clearly and speaking distinctly and not too rapidly, with the lips quite close to the mouthpiece of the transmitter.

"Loud talking should be avoided, as this causes the diaphragm to vibrate too violently, while a voice pitched too low will fail to produce the desired effect. An easy conversational tone will be found to bring about the most satisfactory results.

"It is something of an art to talk over a telephone line so that the sound of the voice reaches the distant end sharp and clear; but it is an art easily acquired and one which practice is almost certain to bring to perfection. This will be noticed in the better class of trained telephone operators, and nothing is more pleasing than to listen to one of these, especially when the voice is tempered with cheerfulness and good nature."

Telephone News from the Northwest.

The Chippewa Valley Telephone Company is installing a local exchange at Ingram, Wis. It will have about 40 connections.

The Pomona Valley Telephone Company has been granted a franchise to build a line from Jamestown to Streeter, N. D.

The Minnesota Central Telephone Company has dismantled the local exchange at Kerkhoven, Minn.

A local exchange is being installed at Palermo, N. D.

The Automatic Telephone Company of Sioux City, Iowa, is expending $20,000 on additional equipment for its system.

The Owen Telephone Company has been incorporated at Cartersville, Iowa, with a capitalization of $10,000. Henry Cahill is president of the company and C. J. Elliott secretary.

The Rural Union Telephone Company of Humboldt, Iowa, will install a new switchboard.

W. E. Reed has sold the Wellsburg (Iowa) Telephone Exchange to H. A. Schmitt. R.

Telephone Ordinance Accepted.

Directors of the Chicago Telephone Company at a meeting on November 23d voted to accept the franchise extension ordinance passed by the council a few weeks ago. The new rates will go into effect on December 1st. Many improvements in service are looked for. Abolition of all 10-cent coin boxes and the reduction of all local toll charges within the city limits from 10 to 5 cents was made by the company on November 25th. On December 1st all toll charges in the city limits, except from neighborhood exchange telephones, will be done away with. The neighborhood exchange subscribers, who are now paying 10 cents for toll connections with subscribers in the "Chicago exchange system," will then be charged only five cents.

GENERAL TELEPHONE NEWS

The Ozark Telephone Company of Pocahontas, Ark., has been incorporated with a capital stock of $25,000 and succeeds to the business of the Pocahontas Telephone Company.

Among the recently incorporated telephone companies are the following-named: Driftwood Valley Telephone Company, McCook, Neb.; Halloman-Coraba Independent Telephone Company, Duke, Okla.; Farmers' Union Telephone Company, Green Forest, Ark.; Buffalo County Telephone Company, Gann Valley, S. D.; Clinton Mutual Telephone Company, Clinton, Okla.

The new automatic telephone system which has been under construction by the Rushville Co-operative Telephone Company for seevral months in Rushville, Ind., is now completed at a cost of $49,000. The plant has been inspected by committees from other cities and is considered a model one. Two girls will be all that will be required to operate the plant during the day and one girl can easily handle it at night.

Controversy with the New York and New Jersey Telephone Company is said to have decided the residents of Westbury, Mineola and Wheatley Hills, L. I., to establish a municipal service. For this purpose a committee of five men has been appointed. High rates, inadequate service and lack of interest in the welfare of the towns on the part of the telephone company are the reasons assigned by the residents for this move.

CORRESPONDENCE.

Continental Europe.

Paris, November 12.—Paris is to have a new subway railway in a north and south direction across the city. It will be altogether in tunnel and its construction will follow the general lines of the Metropolitan subway, except where the road passes under the Seine. At this point there will be a double tube constructed under the river, each of the tubes carrying a single track. The concession for the subway was granted to Messrs. Berlier and Janicot by the Municipal Council in 1901, and this concession was afterward retroceded to a company known as the North South Subway Company. Its capital stock is $6,000,000. As to the general features of the line, the tunnel will have a total length of 8½ miles, counting two branches from the main line. On this distance there will be 29 underground stations. The work on the tunnel has already been commenced and the steel tubes on the Berlier system are being run under the Seine by the compressed air shield system. Not far from the river is installed an underground station of considerable size which contains motor-driven air compressors and pumps for operating the shield. The motors are supplied from transformers placed on the spot and the latter receive high-tension current from one of the large stations of the city.

In Switzerland concessions have been asked by a number of companies for an electric railroad which will connect the present Jungfrau electric line with Brigue, and therefore to the Simplon Railroad. On the southern side the proposed line would have two parts, comprising an electric railroad from Brigue to the Aletsch glacier running to Fenbachen at 7,000 feet altitude, and from this point there would be a cable incline which ends at the present line on the Jungfrau. Each of the two sections would be about 10 miles long. The estimated cost of the project is about $400,000.

Tests were recently carried out in Indo-China with the view of connecting the land telegraph line from Saigon to Hanoi with the coast stations by means of a radio-telegraph system. This will allow vessels which pass along the coast of Annam at a distance of 100 or 200 miles to have a constant connection with land by wireless. The French government is taking measures to equip the system and will no doubt erect two coast stations of some size at Tourane and Phu-Yen.

For some time past the State Railroad Department of Switzerland has been considering the feasibility of running the main lines on the electric system. It is stated that owing to the favorable reports of the engineers' commission, and especially after the good results obtained on the Simplon line, the government intends to operate all the lines in the country on the electric system in the near future and will proceed with the erection of hydraulic plants for this purpose in different parts of the country. The Federal Council recently made arrangements for the use of hydraulic power from the Reuss River, and for this purpos there will be 50,000 horsepower available. This will afford a supply for the St. Gothard Tunnel section, on which it is proposed to run electric locomotives.

A 1,000-horsepower engine operated by blast-furnace gas has been installed by the German firm of Korting Bros. in one of the large ironworks of Dinsburg-Hochfeld. The gas from the furnaces has a value of 000 calories per cubic meter, and the engine cylinder is 0.9 meter in diameter with 1.5-meter stroke.

The Municipal Council of Toulouse is considering a project for a tax upon motive power which will replace the present city tax upon coal used in power stations. The new tax will be $3.60 per horsepower on engines, steam turbines or hydraulic machinery, and all forms of electric generators in use within the city, the tax being applied upon the maximum capacity. Gas motors, which pay a special rate, are not to be included, nor electric motors which receive current from generators which have already been taxed. However, should the motors take current from the outside they will be included in the list. According to a recent census there is a total of 6,600 horsepower in the city, of which about one-half can be taxed. A. DE C.

Great Britain.

London, November 16.—It is now some 15 months since the London Electrobus Company was formed and met with such a hostile reception, first, from the financial press, because of the unsatisfactory nature of the prospectus, and, second, from the technical press, on account of the character of the estimates, which were regarded as excessively optimistic. Eventually the directors refunded all the money subscribed by the public. Nothing daunted, however, sufficient capital was subscribed privately to go forward with the venture of putting upon the streets of London a service of electrically driven omnibuses. At present five electric omnibuses have become familiar in the streets of London. Tudor and Gould batteries are employed, each consisting of 44 two-volt cells of 500 hours' capacity each, and it is stated that the mileage of these batteries, allowing for 30 per cent reserve, is 36. The much maligned prospectus put the cost of running one 'bus 120 miles at about $22. This included driver's and conductor's wages, cost of tires, electrical energy, upkeep of garage, insurance, maintenance and depreciation, and it worked out at about 18 cents per car-mile, and now, after six months' working, the actual cost works out at 19 cents per car-mile. During this period 227,000 passengers have been carried, the cars have run 20,416 miles, and the earnings have worked out to an average of about 28 cents per car-mile.

Another matter of interest in connection with methods of locomotion in London this week has been the opening of a new garage by the London Electromobile Company. This company has now been in existence for three years, and has been the first to make a town electric carriage a commercial success. The new garage consists of three floors, each of half an acre in extent, the building being covered with a flat asphalted roof, to which carriages can be raised by hydraulic lifts for washing and inspection purposes. Three hundred cars can be stored and attended to. Electrical energy is taken from one of the local electric supply companies, a motor-generator having been installed on the premises. There is a large installation for charging the batteries, and complete repair shops for both chassis and bodies. The carriages are all moved inside the building by an ingenious system of trolley ways, and a carriage can be brought from any part to the entrance door and have a battery put on it in two minutes. The company hopes before next spring to put on the streets a large number of four-seated electric cabs.

Objections continue to roll in against the rules relating to the use of electricity in factories, recently issued by the Home Office. The latest are by the Tramways and Light Railways Association, whose members are affected in so far as their generating stations and sub-stations are concerned.

It is interesting to learn that, in spite of the statements to the effect that it is perfectly feasible for a surface-contact tramway system to be made intercommunicating with other forms of electric traction, and which have to some extent disarmed criticism of the G. B. surface-contact system in London, the highways committee of the London County Council now states that it is not the intention to fit its cars upon the section of the line using the G. B. surface-contact system with either plows or trolley poles. During the probationary period of the system very careful records are to be kept as to the current consumption, and so on, and it will therefore be a little while before the question of linking up other districts will be taken into account. The line in question, however, is quite self-contained, and little harm will be done.

An arbitration will shortly be held to determine as to who shall bear the cost of fuses and heat coils in telephone exchanges in districts served by electric tramways on the trolley systems. Hitherto the postmaster-general has contended that this expense should fall upon the tramway authorities, while the latter, of course, have held the contrary view.

Little has been seen or heard of the Marconi wireless-telegraph service across the Atlantic during the last week or so, but interest is now shown in the transatlantic station of the Amalgamated Radio-telegraph Company, which has recently erected a number of 360-foot masts at Tralee Bay on the west coast of Ireland with the same object in view. Good progress has also been made with the buildings and plant generally. Some time will elapse, however, before serious work will be commenced, for the site of the station on the other side is, I understand, not yet settled. The company in question uses the Poulsen system.

At a meeting of the Victoria Falls Power Company, held in London this week, it was stated that the profits of the business in South Africa were at the rate of upward of $400,000 a year, and the only deduction from this would be an allowance for depreciation. It was further stated there was a very good hope that within a comparatively short time there would be considerable demands for power for industries to be established close to the falls. In this case the erection of the waterpower station there would be realized quicker than was originally anticipated. G.

Dominion of Canada.

Winnipeg, Manitoba, November 23.—The Canadian Pacific Railroad is planning the electrification of the Columbia and Western Railroad in the Boundary district of British Columbia in order to recover the large volume of coal, coke and ore transportation secured in recent years by the Great Northern Railroad. The motive power will be supplied by the West Kootenay Light and Power Company, control of which is now vested in interests friendly to the Canadian Pacific Railroad. By electrifying the company would lower the haulage rates to a great extent, it is said.

Application is being made by Andrew T. Thompson, Trust Building, Ottawa, Ont., for the incorporation of the Ontario and Michigan Power Company with power to develop electrical energy on the Pigeon, Nepigon and Black Sturgeon rivers in the District of Thunder Bay, New Ontario. The charter also provides for the building of all the necessary dams, transmission lines, etc. American and Canadian capitalists are interested, although their names have not yet been made public.

The Saskatchewan Power Company is applying to the provincial government for incorporation to do a general business in Saskatoon, Sask., as an electric power company. Straton, Sutherland & Jordan, Saskatoon, Sask., are representing the applicants. R.

New York.

New York City, November 25.—The Marconi wireless station at Siasconset, which was destroyed by fire recently, was the first to be established on this side of the ocean for commercially reporting vessels approaching the American coast. During the first years of its service its sphere extended only to Nantucket Shoals Lightship, anchored 44 miles to the southeast, where steamers bound for New York from European ports turn. The news was then sent from this station by the ordinary telegraph lines to New York. Two years ago the government established its own wireless plant on the lightship, with Newport as its shore station. Since that time the Marconi station has been developed and used for communication directly with incoming and outgoing steamers, the range of communication being about 100 miles. After the fire new equipment was immediately ordered, and cable advices are to the effect that the station, although temporarily equipped, is at present ready to reestablish permanent communication with passing ships. The Siasconset station was fully covered by insurance.

The first train of cars has now been run through the East River tunnel from the Battery and consisted of two motor cars and four flat gondolas heavily laden with steel rails. General Superintendent of the Interborough company Thomas Brown, Engineers Snyder and Carter and City Inspectors Hannan, Walsh and Nichols and Assistant Superintendent Merrill, representing the Rapid Transit Tunnel Construction Company, accompanied the inspection party, Mr. Merrill superintending the trip. At the Brooklyn end the tube is still supported by joist, and at this section the party halted. Power was supplied by the company's big power house at Fifty-ninth Street, Manhattan. Within a few days all of this strengthening will be completed and the tube opened, and the only real work which remains to be done is to install the electric connections with the Brooklyn end of the tunnel. All energy is being devoted to get this tunnel ready by December 1st.

The Borough Council of Smithfield, Pa., has granted a franchise to the Brownsville, Masontown and Smithfield Street Railway Company, which is projecting an electric line with connections from Morgantown to Pittsburg, 59 miles long.

The construction of an interurban electric railway between Boston and Providence has been authorized by the railroad commissioners. The road will run through the towns of Hyde Park, Dedham, Westwood, Norwood, Canton, Sharon, Foxboro, Mansfield, Attleboro, Seekonk, to the Rhode Island line.

Privy Councillor Whitfield, the electrical expert of the Prussian Railway Ministry, has just returned to Berlin after an inspection of American electric railways. He has been particularly interested in the operations of the Westinghouse single-phase alternating-current apparatus and has expressed the belief that it has a brilliant future.

On behalf of a large stockholder of the Metropolitan Street Railway, the United States Circuit Court has been asked to appoint receivers for the Metropolitan street railway other than Douglas Robinson and Adrian H. Joline, who first were appointed receivers of the New York city railway by Judge Lacombe. In asking that independent receivers be appointed, the petition charges that Thomas F. Ryan has been and is the dominant individual in the Metropolitan and New York city railways; that the affairs of the company leading up to the receivership were managed with the idea of "freezing out" the stock of the Metropolitan, in the bonds of which it is alleged Ryan had a large investment. E. H. S.

Ohio.

Toledo, November 23.—On account of the new eight-hour law that will go into force in March, railroads are already increasing the working forces at the various telegraph stations. The Pennsylvania lines have already begun putting three men in all telegraph stations and the operators are now working eight-hour shifts between Crestline and Loudonville. This new law will create a demand for more men.

A new electric canceling machine and back stamping machine has been placed in the Marion (Ohio) postoffice. It will greatly facilitate work.

During the last week two unsuccessful attempts have been made to enter the plant of the Phoenix Electric Company, located just outside the Ohio State Reformatory at Mansfield. The attempts were made by armed burglars and in both instances shots were exchanged between the would-be thieves and the watchman at the plant.

Common Pleas Judge Quale of Allen County recently decided in the mandamus case of Henry W. Beckman vs. the Delphos Electric Light and Power Company that notwithstanding the terms of its franchise such a concern is a public-service corporation and is, as a matter of law, bound to serve all of the inhabitants alike. The defendant was ordered to again connect up the hotels of the plaintiff, and his demand that he be permitted to have an expert present at the reading of the meter was held to be reasonable. H. L. S.

Michigan.

Detroit, November 23.—The Trenton council has postponed the day for the special election to vote on the proposed sale of the electric-light plant and waterworks to the Detroit Edison Company until December 2d.

The 22,000-volt transmission line to Mt. Clemens was put in service this week. The Mt. Clemens plant will receive power from Detroit except during the peak load.

The village of New Haven has granted a franchise and street-lighting contract to the St. Clair Edison Company. A locally owned plant furnished service until October 1st, when the plant was shut down, the council refusing to renew the contract. The St. Clair Edison Company will operate the plant until July 1st, by which time a transmission line from Mt. Clemens, a distance of eight miles, will be finished. The street-lighting contract calls for 36 incandescent lamps on a 11:30 p. m. standard moonlight schedule. D.

Indiana.

Indianapolis, November 23.—A restraining order was granted the Terre Haute, Indianapolis and Eastern Traction Company at Terre Haute to prevent the residents of Youngstown, Vigo County, from cutting down certain poles of the Sullivan interurban lines said to be on the property of the defendants. It is alleged by the traction company officials that the property owners agreed that the poles should be erected. The property owners allege the company agreed in turn that the fare between Youngstown and Terre Haute should never be more than 10 cents. The company disclaims any such agreement and has recently raised the fare to 15 cents.

The City Council of Bedford has granted to the Grand Central Traction Company a franchise for the construction and operation of an interurban electric railway through the city and to operate an electric-lighting and heating plant in the city. The traction company has also asked for a franchise through the city of Bloomington and the ordinance has been placed on its first reading.

The Indiana Supreme Court has decided that a railway company is liable in damage for the injuries of a passenger shot by another passenger in an attempt to kill a third one. The offending passenger was intoxicated, and the ground on which the traction company was held liable was that he walked back and stood so close to the trainman when he drew the revolver and shot that the trainman could have easily prevented the injury. "It is the duty of a carrier to protect passenger from insult and injury under such circumstances," the court said.

It is officially announced that the contract for lighting the city of Kokomo has been awarded by the Board of Public Works to the Kokomo, Marion and Western Traction Company.

The application for a new franchise by the Terre Haute, Indianapolis and Eastern Traction Company is being considered by the City Council of Brazil. In purchasing the property of the Terre Haute Traction and Light Company in Brazil the traction company obtained a franchise which does not expire for several years, but the legality of this franchise has been questioned. The Terre Haute, Indianapolis and Eastern asks for a 25-year franchise and the right to string high-tension wires from its power plant at Terre Haute through the streets of Brazil to its sub-station. S. S.

Illinois.

Peoria, November 23.—The Citizens' Gas and Electric Company of Pekin presented its bid for lighting the streets at the last meeting of the City Council, agreeing to furnish 125 or more of the new General Electric arcs of 2,000 candlepower for $65 per light per year, and $12 per year for incandescent lamps, furnishing 50 lights for the City Hall free, all other lights in the building to be $6 per year. The bid was referred to the gas and light committee.

The Wabash Railroad is putting in an electric power and light plant at Decatur, and will soon connect the roundhouse and yards with the plant. As soon as this plant is finished the railroad will be supplying all its own light.

The Clinton Gas and Electric Company has been incorporated with a capital of $10,000, with the principal office in Clinton, to manufacture and sell gas and electricity. Incorporators are James M. Surdam, John W. Smith and others.

The Rockford Edison Company has certified to a change of name to the Rockford Electric Company. The capital is increased from $350,000 to $1,000,000 and the number of directors from four to eleven.

An ordinance has been presented to the City Council of this city compelling the street-railway company to place all its feed wires underground. Another ordinance would require the company to replace the wooden poles with steel or iron poles.

The outlook for the building of the Mattoon-Shelbyville-Pana-Hillsboro electric railway is very favorable now. All the towns through which the line passes have granted franchises, and an Indiana concern promises to finance the line as soon as the right-of-way is secured.

H. B. Manson of Milwaukee has purchased the Tremont Electric Light and Power Company's plant at Tremont and will operate it. Charles Gerstner, who formerly owned and operated the plant, will be retained to manage the plant. V. N.

Northwestern States.

Minneapolis, November 23.—Work on the new concrete power dam at Fergus Falls, Minn., has been suspended for the winter.

Mrs. Alice Butler, a prominent interurban-railway promoter, has filed a petition in bankruptcy at Davenport, Iowa.

The Sherman-Luedtke Electrical Construction Company of Menasha, Wis., has been dissolved.

The survey for the proposed line of the Northwestern Interurban Railway Company from Moorhead to Detroit, Minn., has been completed.

There is talk of building a trolley line from Kilbourn, Wis., to Reedsburg and Richland Center.

The proposition that the village buy the electric-light plant at Sherburn, Minn., was defeated by three votes.

The McKittrick Brick and Tile Company has been granted a franchise and will build a trolley line at Carlisle, Iowa.

H. E. Zimmerman has resigned as superintendent of the electric-light plant at Ada, Minn., to accept a similar position at Hudson, Wis.

A right-of-way is being secured for the proposed Boone-Webster City (Iowa) interurban railway. R.

Pacific Slope.

San Francisco, November 20.—The City Electric Company is now operating its new electric power station at North Beach for a regular commercial business. The load has been increased by supplying 4,000 kilowatts for the operation of electric cars for the United Railroads. Connection with the underground mains on Market Street were made this week, opening up a number of lighting circuits in the downtown mercantile district. The contract for an additional generating unit for the new power station of this company was closed through Hunt, Mirk & Co. of San Francisco, who are the Pacific Coast agents for the Westinghouse Machine Company. The new equipment ordered includes one Westinghouse-Parsons turbo-generator of 6,000 kilowatts, 11,000 volts, 1,200 revolutions per minute. The present installation consists of two 2,500-kilowatt 11,000-volt turbo-generators of the same make, supplied with steam by Babcock & Wilcox boilers capable of carrying 200 pounds pressure. One end of the reinforced concrete power-station building has been left unfinished so that the structure can be lengthened readily so as to furnish room for the additional unit.

The San Francisco Gas and Electric Company has taken steps to increase the generating capacity of the local electric power stations. A 5,000-kilowatt turbine-generating set was ordered some time ago for Station A, and a 1,200-kilowatt direct-current generating set that survived the fire at the Jessie Street station has been installed at the Mutual electric plant.

The municipal electric-lighting plant at Alameda, Cal., is being remodeled and increased in capacity. Hunt, Mirk & Co. are installing an additional 250-kilowatt Westinghouse-Parsons turbo-generator on a part of the ground site that is to be covered by the new two-story reinforced concrete power house of mission architecture. This will be erected by Couchot & Thurston.

The United Railroads of San Francisco, which has been at a great disadvantage owing to lack of sufficient electric power to operate its cars for nearly a year past, has been short on power for several days, owing to the breaking of the shaft of one of the two large triple-expansion vertical engines direct-connected to a 13,200-volt generator at its power station in the North End. The Union Iron Works, which built the engine, is making a new shaft and will rush the repair work to completion.

Secretary Cortelyou has awarded to William Butler of San Francisco the contract for installing a duplicate telephone system in the new Custom House at San Francisco.

The Hadley Land and Water Company of Whittier, Cal., has leased the Laguna ranch of [illegible] acres, owned by Mrs. Arcadia B. de Baker, just beyond the Los Angeles River, and will put in three power plants, develop water for the entire tract, put down artesian wells and put in a 5,000,000-gallon reservoir. The company will spend about $20,000 in power plants and pipe line and $10,000 additional in drilling wells.

Shortly after the first of the year the Edison Electric Light Company will expend from $100,000 to $150,000 in a new plant at Long Beach, Cal. Whether the present site will be used or not is under discussion.

Professor Cory of the California State University has submitted a report on the electric-light system of Pasadena, Cal. He states that $200,000 additional should be expended on the municipal plant, providing no underground system is built. If underground conduits are included an additional $50,000 should be provided for the work. The total cost of the lighting system without underground system, if the Cory report is adopted, will be $350,000. The City Council after a discussion of the report decided to ask for additional bond issues on two propositions aggregating $200,000 to carry out recommendations of the report. One proposes to issue $50,000 for completing the lighting plant as it now stands, the second to vote $150,000 to equip the plant for commercial lighting. The date for the election has been left for the regular session of the council to decide.

The Ventura Gas and Electric Company has been incorporated with a capital stock of $250,000 by F. B. Cole, R. H. Brunham, D. H. Steele, H. C. Norris and others, who have subscribed $7,000 in all.

L. D. Macy has been awarded a franchise to construct and operate an electric-light, heat and power system in Chico, Cal.

A franchise for an electric railway has been awarded by the Board of Supervisors of Kings County to F. S. Granger of Hanford, Cal. A.

PERSONAL.

Mr. J. E. Hanan of Minneapolis, Minn., has been made manager of the Northwestern Telephone Exchange Company at Fargo, N. D.

Mr. E. B. Knight of Kamloops, B. C., has been appointed superintendent of the White Valley Irrigation and Power Company of Vernon, B. C.

Mr. R. F. Blount, one of the pioneers in the Indiana Independent telephone service, who organized the Home Telephone Company of Wabash, has retired from the presidency after 15 years of service. He has been prominent in Independent telephone meetings in Indiana for a decade.

Mr. E. P. Nussbaum, who for many years was general manager of the National Electric Supply Company of Washington, D. C., and who for the past year has been connected with the Harris oil concern, has resigned to accept a position as special sales representative of the Jones Speedometer Company, New York.

Mr. John W. Corning of Boston, the new secretary of the American Street and Interurban Railway Engineering Association, is electrical engineer of the Boston Elevated Railway Company. He graduated from Johns Hopkins University in 1894 and has been engaged in technical electric-railway work in Boston ever since.

Mr. L. H. Taylor, who for several years was in charge of the reclamation work in California and at the head of all geodetic surveys in Nevada, has accepted a position with the California-Nevada Power Company as supervising engineer. He has been in San Francisco to submit plans for reservoir sites owned by his company in Nevada.

The Nobel prize for chemistry will be awarded to Sir William Crookes of London. Sir William Crookes discovered thallium in 1861 and invented the radiometer in 1874. He was knighted in 1897 and has been closely identified with many of the most important advances in science. The vacuum tube bearing his name attests the value of his contribution to skiagraphy, while his investigations into the artificial production of nitrogenous compounds are also well known and important.

ELECTRIC LIGHTING.

Wixon & Brenner will add an electric-light plant to their flour mill at Stella, Neb.

James Bright has obtained a franchise for supplying Steelville, Mo., with electric lights.

Bonds to the amount of $1,500 are to be issued by the village of Westerville, Ohio, to enlarge and improve the municipal electric-light plant.

The San Antonio (Tex.) Gas and Electric Company will soon begin installing an entirely new arc-lighting system, including four new generators.

One of the stockholders of the Holton Electric Company of Holton, Kan., asks the court to dissolve the company. It is alleged that since the company sold out to the city of Holton the company [illegible]. The stockholders are [illegible], E. J. [illegible], Charles D. [illegible] and [illegible].

Fire starting on the roof of the city [illegible] light plant at Washington, Ind., [illegible] ago threatened the destruction of the plant. The damage will exceed $[illegible],000.

The cost of arc lights in [illegible], has been reduced from $70 to $[illegible] a year. The Council will not cut the appropriation for street lighting proportionately, but will add more lights.

The North Shore Electric Company of Evanston, Ill., has re-elected the following named directors: Samuel Insull, Charles H. Randle, Charles F. Spalding, Edward P. Russell, William A. [illegible], Louis A. Ferguson, Frank J. Baker.

The Polar Star Electric Company's plant in Faribault, Minn., has been sold by the receiver to F. C. Nelson of St. Paul. The payment of an equity of $1,000 and bonds against the property worth $30,000 is assumed by the purchaser.

With a view to improving its service in Allegan, Mich., the Allegan Light and Power Company has employed A. S. Butler to manage the business, thus permitting Superintendent Van Auken to devote his entire time to the operation of the plant.

The business men and other citizens of Freeman, S. D., are urging that the City Council take early steps to provide the town with an electric lighting system. In the event that outsiders cannot be induced to establish and operate such a system, it is proposed that the residents of Freeman organize a stock company and establish the plant themselves.

The report of the city treasurer of Batesville, Ark., shows an overdraft of $2,517.82 paid out of the general fund for the expenses of the water and light plant. The sum represents a deficit in the expenses of maintaining and operating the water and light plant, which has been growing for some months and has lately been augmented by the cost of extending the water mains and repairing the old boilers, the two items amounting to about $1,200.

It is said that the sultan of Turkey has decided to light the tomb of the prophet Mohammed at Medina with electricity, but considerable difficulty has resulted from the fact that the tomb is so holy that Christian workmen may not be employed in it, while Turks have little knowledge of electrical installation. The order to install electricity for the holiest place of Islam is somewhat puzzling, since it is said that the sultan refuses to allow this or any other modern thing such as electric traction, telephones or motor cars in Constantinople. However, he seems to make an exception of provincial towns, since modern utilities are permitted in Smyrna, Salonika and Beirut.

During the month of October 342 families, all of whom had been in the state less than six months, made contracts with the Denver Gas and Electric Company of Denver, Colo., for gas and electricity. This is taken as an index of the rapid growth of Denver. W. J. Barker, vice-president and general manager of the company, says that details of the new consumers, compiled by employes of the company, show that 30 of the patrons made contracts with the company on the day they arrived in the city. One hundred and sixty-two of the contracts were made before the persons had been in Denver three weeks.

The electric-light and water plant of the city of Bartow, Fla., under the superintendency of Eugene Bivins, is said to have experienced an unusually prosperous growth. Within the last two years the number of patrons has more than doubled, and at the present time the plant capacity is taxed to its utmost. The central-station equipment includes an Allis-Chalmers direct-connected generator installed four years ago. The plant gives a night service only of 14 hours' duration, and there has been but a single shutdown in two years, chargeable to the engine. Practically no repairs have been required since installation, a single set of new brushes for the exciter covering everything chargeable to the electrical equipment. This record has made it possible to operate profitably in a city of 2,000 population, the size of Bartow.

In order to improve the distribution of light from enclosed arc lamps and adapt them to particularly severe requirements, the General Electric Company, Schenectady, N. Y., has introduced the concentric light diffuser. Bulletin No. 4542, recently issued by the company, describes the device and illustrates many of its applications. A suitably designed metal diffuser is attached to a lamp casing in the same manner as an ordinary reflector or shade. In place of an outer globe a screening shade is used, which performs the double function of subduing the light directly under the lamp and reflecting a portion of it on to the diffuser. Some of the advantages claimed for this method of illumination are that the light is white, even and well distributed; that it does not tire the eyes; that the illumination is particularly adapted to the matching of colors, and that the nature or color of the ceiling does not affect the character of the illumination. Inverted diffusers have been designed to meet the demands which exist for a reflector producing a more concentrated illumination, and are used without the lower screening shades.

ELECTRIC RAILWAYS.

Henry Negus and associates are seeking a franchise for an electric railway in Iowa City, Iowa.

The Washington-Oregon Traction Company of Walla Walla, Wash., has recently been incorporated with a capital of $1,500,000 and will build an interurban line.

Judge Dunklin of the District Court at Fort Worth, Tex., has appointed John W. Broad and W. E. Kauffman receivers for the Mineral Wells electric-railway system.

The weekly bulletin of the Health Department of the city of Chicago says that the health commissioner will recommend to the traction companies that an open trailer be attached to each of the large cars, even in winter, for the benefit of open-air advocates.

Two cars fitted out for fire protection in the car-storage yards of the South Side Elevated Railroad of Chicago have recently been equipped. The cars were built from old flat cars at the company's shops, and are equipped with chemical engines and other apparatus necessary in fire fighting. Corrugated asbestos fiber was used to cover the car bodies, which are mounted on old trailer trucks. Besides affording additional protection, it is understood that these cars will effect a reduction in insurance rates.

Local papers of Golden, Colo., say that the old Lakewood steam road has been taken over by a new company which will convert it to electric traction and extend the road over the hills of Mt. Lookout and through the Vidler tunnel, with final destination at San Diego, Cal. This is said to be part of the project of the Denver and Transcontinental Railroad Company to build a road over the line surveyed from Denver over the range to the Rio Grande. This company owns the Lookout Mountain resort. Along its proposed route is abundant waterpower, which will be developed to generate electric power to operate trains from Denver to the Vidler tunnel. Work on Vidler tunnel is being pushed from both ends.

POWER TRANSMISSION.

A transmission line is being constructed from Ozark, Ark., to Altus and Denning for the purpose of lighting these towns from the Ozark power plant. The line may be extended to Webb City.

The Denver Post says that an electric power scheme, which will cost $1,000,000 to complete and will permit the generation of 20,000 horsepower on the South Platte River a short distance from Denver, is being carried out by A. E. Wilson of Denver.

At a meeting of the Dominion Marine Association held in Toronto a strong protest was voiced against the damming of the St. Lawrence below the Long Sault Rapids as a part of the waterpower development projected at that point by a United States syndicate. The deep waterways commission has been waiting to get an expression of opinion from the marine men before passing on the project.

PUBLICATIONS.

The Beardslee Chandelier Manufacturing Company, 176-180 South Clinton Street, Chicago, is preparing a new catalogue of electric and combination lighting fixtures, containing its latest designs in this class of goods. This catalogue will be sent prepaid to dealers who will write requesting it.

In a little folder the Trumbull Electric Manufacturing Company calls attention to its panel boards. The company recently shipped several carloads of its panels to Brazil, Mexico and the Philippines. From its thoroughly equipped panel department the company can furnish any kind of board desired.

The revised List of Electrical Fittings approved by the Underwriters' National Electric Association has just appeared. This list is revised every six months, and the present issue is dated October, 1907. Copies may be obtained by writing to the Underwriters' Laboratories, 382 Ohio Street, Chicago.

The October number of the Bulletin of the Bureau of Standards contains the second half of the paper on "A New Determination of the Ratio of the Electromagnetic to the Electrostatic Unit of Electricity," by E. B. Rosa and N. E. Dorsey, and a paper by the same authors on "A Comparison of the Various Methods of Determining the Ratio of the Electromagnetic to the Electrostatic Unit of Electricity." Other papers are "Preliminary Specifications for Clark and Weston Standard Cells," by F. A. Wolff and C. E. Waters, "Calorimetric Resistance Thermometers and the Transition Temperature of Sodium Sulphate," by H. C. Dickinson and E. F. Mueller, and "On the Standard Scale of Temperature in the Interval 0° to 100° C.," by C. W. Waidner and H. C. Dickinson.

With the November issue the publishers of the Canadian Electrical News announced a change of ownership. For seven years the journal has been owned by the C. H. Mortimer Publishing Company, which has now sold the entire interests and good will to Mr. Hugh C. McLean, who will direct the publication.

"Do unto the printed matter of others as you would have them do unto yours." It is the practice in the Dixon office to examine carefully all printed matter that comes into the office. It is done by long-experienced employes who are familiar in a good, general way with all the company's departments and wants. Some of the stuff goes into the waste basket; some is passed to superintendents; some to the officers, and some is filed away for future reference.—Graphite.

Beginning with the issue of November 19th of the weekly Official Gazette of the United States Patent Office, the claims of all patents having five claims or less are printed in full. Where patents have more than five claims each, only the first five claims are printed, and the number of claims omitted is indicated in each case. This plan will be followed in each succeeding number of the Gazette. The new plan makes the Gazette less bulky and enables the Government Printing Office to publish it more promptly.

Allis-Chalmers Company of Milwaukee has issued a bulletin on "Testing Alternating-current Generators." The method described was perfected by the chief electrical engineer of the company, Mr. B. A. Behrend. It has taken many years to evolve this manner of testing, which enables the company to obtain with comparative ease the most important data of the performance of alternating-current generators while they are yet in the shop, the machines being subjected to full-load conditions without actually putting them under full load. This bulletin will be sent to any electrical engineer on request.

To meet the demand for various types of fixtures to suit varying conditions met in the rapidly extending use of the Nernst lamp a fixture catalogue has just been prepared by the Nernst Lamp Company of Pittsburg. Its 44 pages are replete with elegant designs of pendants, ceiling bowls and brackets. This lamp, being a downward lamp, makes these fixtures welcome departures from the old-style chandelier. A number of combination gas and electric fixtures are also shown using the inverted type of gas burner which harmonizes so well with the Nernst lamp that even a second glance may deceive a person. A system of intermediate and large units like the Nernst requires less elaborate fixtures than a system of small units like the incandescent, and the designs shown have therefore been prepared to secure simple elegance rather than elaborate ornamentation. This feature has been generally approved by architects and accounts for some of the popularity of the lamp among them.

"The Electric Locomotive in Heavy Passenger and Freight Work" is the title of Bulletin No. 4537, recently issued by the General Electric Company, Schenectady, N. Y., in which is described a large number of present and proposed representative types of electric locomotives built by that company. Sketches are given of locomotives ranging from 17 to 150 tons for all classes of service, including mining, high-speed passenger, slow-speed freight, mountain-grade trunk lines, etc. Electrical and mechanical data are given and characteristic curves for each locomotive shown. A short preface briefly describes the reasons for the growing demand of electric traction, and gives interesting facts regarding the construction and characteristics of the General Electric heavy-traction motors and locomotives, with figures relative to the saving effected by the substitution of electric for steam traction in both passenger and freight work. Bound in a flexible brown cover, the publication forms a ready reference book on the subject.

A handsome new storage-battery catalogue has just been issued for the Westinghouse Machine Company, entitled "Westinghouse Storage Battery for Portable Use." While the Westinghouse Machine Company has been in the storage-battery business for several years, all the literature issued up to the present time has been devoted to stationary storage batteries. This is the company's initial publication devoted exclusively to storage batteries for portable use. The catalogue takes up the various types and goes thoroughly into the details of construction, giving sizes, weight, capacities, prices, etc. The various parts are well illustrated, also the complete product for railway signal work, for auto-truck use, car lighting, for electric locomotives, electric vehicles, etc. Accessories are listed and some attention is given to the Westinghouse storage-battery regulator and storage-battery booster. An interesting curve is shown of results obtained by the Westinghouse system of regulation, a constant load being maintained on the generator through most severe load fluctuations. The new catalogue is a valuable addition to storage-battery literature.

SOCIETIES AND SCHOOLS.

An automobile school was opened recently in the Bedford branch of the Young Men's Christian Association, Brooklyn, N. Y. Clarence B. Brokaw, the first principal of the West Side Young Men's Christian Association in this city, delivered the opening lecture. The course will include lectures, shop work and road instruction.

Proceedings of the Traffic Club of Chicago have been printed in pamphlet form, giving the addresses at the recent banquet in Chicago. Following the remarks of President Frank T. Bentley, Hon. E. E. Clark, Mr. E. B. Boyd and Mr. Arthur Hale delivered interesting addresses from the viewpoint, respectively, of the shipper, the carrier and the government.

The trustees and faculty of Thomas S. Clarkson Memorial School of Technology, Potsdam, N. Y., have made the usual careful preparations for the Founder's Day exercises, eleventh anniversary, on Saturday evening, November 30th, at Assembly Hall. The address will be delivered by the Rev. Richard M. Sherman, A. M., rector of Trinity Parish, Potsdam.

The next meeting of the American Institute of Electrical Engineers will be held in the auditorium of the Engineers' Building, 33 West Thirty-ninth Street, New York city, on Friday, December 13th, at 8 p. m. Mr. Walter S. Finlay, Jr., of the Interborough Rapid Transit Company will present a paper on "The Ratio of Heating Surface to Grate Surface as a Factor in Power-plant Design."

MISCELLANEOUS.

In the department store of Woodward & Lothrop, Washington, D. C., a fully furnished seven-room apartment is on exhibition, primarily to show the uses of electricity in the household. All the electrical appliances for lighting, heating, cooking and power are shown. The Washington Herald remarks that "many of these new inventions will be installed in many homes of Washington in the near future, as it is the opinion of all who have seen them in operation that they are indispensable to any well-regulated household, on account of the comparatively little expense attached and the amount of labor that is saved by their use."

W. S. Barstow & Co., New York city, are consulting engineers for the Nairn Linoleum Company in the erection of an entirely new plant at Kearny, N. J., on the banks of the Passaic River. A feature of the power-house equipment will be a 1,000-kilowatt, 60-cycle Allis-Chalmers steam turbine and alternator wound for three-phase, 600 volts. The power house where this unit is to be installed will have an ultimate capacity of 4,000 kilowatts, and the Passaic River will furnish the necessary cooling water. The Nairn Linoleum Company is one of the largest, if not the largest institution of its kind in the world. The company is largely owned by Sir Michael Bairn, whose main works are located at Kilcady, near Edinburgh, Scotland. The American company is, however, operated independently of the one in Scotland.

The field for the use of single-phase motors of moderate capacity is constantly growing by reason of the increasing tendency of central stations to generate polyphase current and feed a large portion of the lighting load through single-phase distribution. The General Electric Company, Schenectady, N. Y., has perfected a simple and substantial motor for this class of service. It is known as the type JS, form KG, and is described in Bulletin No. 4545. The bulletin illustrates various sizes, describes the details of construction and operation, shows forms of starting boxes, and gives a large amount of general information, useful and important to power users. The motors are well adapted to the operation of all kinds of machines by the use of belts and gears, and may be directly connected to loads requiring moderate starting torque, such as generators, blowers, etc. Clutch couplings and pulleys are used where the apparatus is required to be started under load. The motors are wound for standard voltages and frequencies.

TRADE NEWS.

Walter P. Ambos, manufacturers' agent, of Cleveland, and H. H. Cudmore, formerly associated with the Cleveland Electrical Supply Company, announce the incorporation of the Ambos-Cudmore Company, selling agent, 1016 Citizens' Building, Cleveland, Ohio. The Weston Electrical Instrument Company and a large number of other first-class concerns are represented.

A New York business house has written to the Bureau of Manufactures, Washington, D. C. (file No. 1639), that it is about to promote the exporting of American goods, and is desirous to get in touch with first-class manufacturers seeking a foreign market, particularly in Austria-Hungary, the Balkan States, and farther east, for a variety of articles, including electrical machinery and electrical specialties, electric railway cars, etc.

The American Battery Company of the village of Cedarhurst, Nassau County, N. Y., has been chartered to deal in storage batteries and other electrical materials, machinery, etc. The capital stock is placed at $200,000, and the directors are W. H. Orr, I. T. Kartz and H. F. Khatigan of Brooklyn.

The Oshkosh Electric Manufacturing Company of Oshkosh, Wis., has been incorporated by Warren G. Maxey, William F. Meter and William L. Rideout. Besides dealing in electrical appliances the company will make a specialty of manufacturing and selling an automatic cut-out invented by Messrs. Meter and Rideout. The device automatically prevents excessive currents from entering buildings wired for electrical service.

Sealed proposals will be received at the office of the supervising architect, Washington, D. C., until 3 p. m., December 20th, for the installation of a conduit and electric-wiring system for the extension to the Postoffice and Court House at Fort Worth, Tex., in accordance with the drawings and specifications, copies of which may be obtained at the above office, or at the office of the superintendent of construction at Fort Worth. Bids will also be received for the low pressure steam heating apparatus and for installation of plumbing, gas piping, etc.

BUSINESS.

In the Superior Court of Hartford County, Conn., Judge Ralph Wheeler recently confirmed the appointment of Ernest McC. Stage as temporary receiver of the Electric Switch Plate Company of Hartford.

The Western Electric Company reports largely increasing business in the Sunbeam tantalum lamp. Many users are substituting this lamp entirely for the old-style carbon-filament lamp. It is interesting to compare the service of these two lamps. The tantalum gives 20 candlepower and consumes only 40 watts, whereas the regular lamp gives 16 candlepower and consumes anywhere from 50 to 64 watts. While the first cost of the tantalum lamp is much higher, the saving resulting from its use will soon more than pay its entire cost. The light produced by the tantalum lamp is of a whiter and more beautiful quality than that of the old-type lamp, and it has been the general experience that those who once try these lamps are not satisfied to use any other thereafter. During the last few months more than 125,000 tantalum lamps were ordered for the sole purpose of replacing an equal number of the old-type carbon filament lamps, which in itself is a very significant fact. It means that the tantalum lamp is to play an important part in the future of electric lighting. The Western Electric Company will be glad to quote prices and discounts upon applications. It has offices and stocks in all large cities.

The Excello Arc Lamp Company of 24 East Twenty-first Street, New York, announces that the large contracts placed lately by the United States Department of the Interior on behalf of the Ellis Island immigration service include among others a considerable number of Excello flaming arc lamps. These contracts are part of the large contracts involving a total expenditure of more than half a million dollars, necessitated by the improvements the department is making. The Excello lamps, which have been decided upon after exhaustive trials, are used both for outdoor and indoor use and are of the Excello "snowball" type, the recognized type of lamp producing the pure white light of high candlepower. Repeated orders for Excello lamps have been received since the first lamps were installed at Ellis Island, indicating that the lamps give satisfaction to the department.

ILLUSTRATED ELECTRICAL PATENT RECORD.

Issued (United States Patent Office) November 19, 1907.

871,098. Means for Driving Motor Road Vehicles. Martin Albrecht, Friedberg, Germany, assignor to Felten & Guilleaume-Lahmeyerwerke Actien-Gesellschaft, Frankfort-on-the-Main, Germany. Application filed February 20, 1907.

The vehicle carries a gasoline engine direct connected to a generator. This supplies current to two electric motors geared to the wheels of one axle. The wheels on the other axle are connected by spur and differential gearing to the shaft of the generator.

871,112. Individual Electric Gas Lighter. William K. Davidson, Boston, Mass. Application filed March 4, 1907.

A portable case has a dry cell in one chamber and a spark coil in the other. Sparking terminals are on top of the case and a push button near the bottom.

871,124. Sounding Apparatus. Otto M. Knoblock and James Dushane, South Bend, Ind. Application filed January 2, 1906.

A reel has wound on it the sounding wire which carries a sinker provided with contacts at its lower end. When this strikes bottom an electric circuit is closed through the wire and an electrically operated brake is applied to the reel.

871,139. Electrical Switch. Franz Orzel, Frankfort-on-the-Main, Germany, assignor to Voigt & Haeffner, Frankfort-on-the-Main, Germany. Application filed December 19, 1904.

This is a rotary snap switch that can be turned in either direction.

871,153. Electric Heater. Hugh M. Wicker, Brooklyn, N. Y. Application filed January 26, 1907.

Coils are mounted in sockets of the end plates which are held together by tie rods. A housing covers the whole unit.

871,155. Insulating Device. George E. Wood, Plantsville, Conn. Application filed February 28, 1905.

A screw-driver has a wooden handle and a rubber bushing covering the metallic ferrule and part of the shank.

871,160. Stem-making Machine. Mark H. Branin, Newark, N. J., assignor to the General Electric Company, Schenectady, N. Y. Application filed March 26, 1906.

A rotating frame carries a number of rotary holders for the glass tubes and means for adjusting the distance between ends of the leading-in wires extending through each tube. A heater softens the glass and a pinching device effects the seal.

871,161 and 871,162. Art of Producing Pigments by Electrolysis. Edwin D. Chaplin, Boston, Mass., assignor to the International Lead Companies. Applications filed February 3, 1906.

Lead is electrolytically dissolved in each of these processes. In the first one white lead is finally made therefrom; in the second, lead chromate is formed.

871,168. Electric Bell. Henry J. Heeney, Boston, Mass., assignor to the Holtzer-Cabot Electric Company, Boston, Mass. Application filed February 12, 1906.

The striker moves longitudinally along the electromagnet. The mechanism is protected by a hermetically sealed cover.

871,171. Vapor-rectifier System. Osias O. Kruh, Schenectady, N. Y., assignor to the General Electric Company, Schenectady, N. Y. Application filed March 13, 1907.

An induction coil with sparking terminals in the secondary has its primary connected in series with an interrupter so as to take current from the mercury rectifier. A non-inductive resistance is connected across the primary circuit to protect the rectifier from reactive oscillations in the primary.

871,189. Alternating-current Motor. Leo Schuler, St. Louis, Mo., assignor to the Wagner Electric Manufacturing Company, St. Louis, Mo. Application filed April 22, 1904.

A single-phase motor of the commutator type has a number of auxiliary poles that can be cut in or out so as to shift the resultant magnetic field.

871,191. Electrically Operated Fountain. Arthur D. Southam, Hartford, Conn. Application filed August 4, 1906.

A rotary pump within the basin is driven by an electric motor below it.

871,192. Outdoor Receptacle. James S. Stewart, New York, N. Y., assignor to Annie Stewart, New York, N. Y. Application filed June 6, 1906.

This lamp receptacle comprises a housing having a pair of holes for the wires which are embedded in cement, and a fuse chamber having connections for one of the wires.

871,193. Arrangement for Motor Drives. Emmett W. Stull, Norwood, Ohio, assignor to Allis-Chalmers Company and the Bullock Electric Manufacturing Company. Application filed June 30, 1906.

A number of motors are arranged on a platform for driving a machine. Means are provided for moving the platform to simultaneously connect any one of the motors mechanically to the machine and electrically to the controller.

871,199. Controller for Electrically Operated Machine Tools. John R. Back, Worcester, Mass., assignor to the F. E. Reed Company, Worcester, Mass. Application filed May 1, 1906. Renewed September 30, 1907.

The controller is provided with adjustable means for limiting the speed during cutting operations and on reversal.

871,205. Controlling Mechanism. Herbert W. Cheney, Norwood, Ohio, assignor to Allis-Chalmers Company and the Bullock Electric Manufacturing Company. Application filed June 28, 1906.

This is a starting controller for an induction motor and comprises a switch for the stator circuit, a variable resistance in the rotor circuit and means for tripping the stator switch if the rotor resistance is varied either too slowly or too rapidly. (See cut on next page.)

871,214. Reversible Galvanic Battery. Thomas A. Edison, Llewellyn Park, N. J., assignor to the Edison Storage Battery Company, Orange, N. J. Application filed October 31, 1900.

This storage battery has an alkaline electrolyte, a positive plate of nickel with perforated pockets holding finely divided cadmium, and a suitable negative plate. (See cut on next page.)

871,220. Controller. Thomas Gilmore, Jr., Norwood, Ohio, assignor to Allis-Chalmers Company and the Bullock Electric Manufacturing Company. Application filed October 31, 1906.

A drum type series-parallel controller in its final parallel position has all the current pass through one contact finger.

871,238. Device to Disclose Shunting of the Circuits Around Electric Meters. William L. Saunders, Denver, Colo., assignor of two-thirds to Daniel K. Hickey, Denver, Colo. Application filed June 27, 1905.

A reversing switch is interposed between the meter and the load. A solenoid operates this every time the current is interrupted. Thus, if the meter has been shunted, the shunt will short-circuit the line.

871,239. System of Motor Control. William F. Schneider, Norwood, Ohio, assignor to the Bullock Electric Manufacturing Company. Application filed November 11, 1905.

The system comprises a motor and a converter that are governed by a series of electromagnetic switches. These in turn are controlled by a master controller.

871,273. Electric Furnace and Method. Paul L. T. Héroult, La Praz, France, assignor to Societe Electro-Metalurgique Francaise, Froges, Isère, France. Application filed May 3, 1907.

This furnace has a pair of fixed electrodes and a false electrode which is adapted to form part of the path of the current though the charge, and is adjustable to vary the length of such part.

871,278. Brake Mechanism for Loom Warp Beams. Frank Johnson, New York, N. Y. Application filed February 26, 1907.

A controller operated by a moving portion of the loom makes and breaks the circuit for an electrical brake on the beam.

871,298. Magnetic Separator. Alfred Schwarz, New York, N. Y. Application filed February 1, 1906.

A table has a series of step-like riffles having electromagnets above and below each one. These are successively energized so as to cause magnetic material to pass from one riffle to the next lower one.

871,301. Magnetic Separator. Alfred Schwarz, New York, N. Y. Application filed April 7, 1906

This is a modification of the device above.

871,338. Electric Furnace. Paul L. T. Héroult, La Praz, France, assignor to Societe Electro-Metallurgique Francaise, Froges, France. Application filed April 21, 1906.

A special stuffing box is provided for the electrode where it enters the furnace. Divided conical rings surround the electrode which are clamped to make more intimate contact with it.

871,348. Panel Board. Hubert Krantz, Brooklyn, N. Y. Application filed July 6, 1905.

Fuse-plug receptacles are mounted directly over the bus-bars. Cross connections extend over the bar of opposite polarity to connect with the other terminal of the receptacle.

871,360. Electric and Pneumatic Governor. William K. Rankin and Thomas F. Kelly, Philadelphia, Pa., assignors to John E. Reyburn, Philadelphia, Pa. Application filed February 11, 1907.

A diaphragm moves some horizontal spring catches which engage and support a movable cylinder having carbon contacts on its foot.

871,365. Magnetic Separator. Alfred Schwarz, New York, N. Y. Application filed February 1, 1906.

This separator is similar to that of Patent No. 871,298, except that the riffles and magnets are side by side and the material is moved across the table.

871,367. Magnetic Separator. Alfred Schwarz, New York, N. Y. Application filed April 7, 1906.

A reciprocating movement is given the table and the magnets are jarred at intervals to dislodge magnetic particles therefrom.

871,378. Railway Signal. Louis H. Thullen, Edgewood, Pa., assignor to the Union Switch and Signal Company, Swissvale, Pa. Application filed March 18, 1905.

A hollow plunger connected with the signal moves it when attracted into a coil. A catch pivoted to the plunger is at the same time moved out of the way of a fixed stop. (See cut on next page.)

871,393. Apparatus for Assembling Storage Batteries. Louis H. Flanders, Wilkinsburg, Pa., assignor to the Westinghouse Machine Company. Application filed February 12, 1904.

This machine holds the battery plates in proper position and places pairs of bars with recesses in their upper sides and notches in their edges about the terminal lugs of the plates, so as to form molds into which the connecting strap is cast.

871,405. Electrically Heated Soldering Iron. Harry Hertzberg and Maurice J. Wohl, New York,

N. Y., assignors to Abbott Augustus Low, Horseshoe, N. Y. Application filed February 11, 1907.

A core has bare resistance ribbon wound on it and this is placed tightly within the head of the iron and separated from it by a thin layer of insulation.

871,407. Electric Clock. Frank Hope-Jones, London, England. Application filed March 20, 1906.

One feature of this clock is a device which rings an electric bell when the battery approaches exhaustion.

871,424. Surface Electric Railway. Timothy Mahoney, San Francisco, Cal. Application filed July 6, 1906.

A sectional third-rail system using alternating current for car propulsion has electromagnetic switches for connecting successive sections to the feeder cable. These switch magnets have a large reactance to oppose excitation by alternating current, but are susceptible to direct current, which is supplied them by the car.

871,431. Means for Collecting and Delivering Mail. William H. Mozingo, Hurdland, Mo., assignor of one-half to Harley J. Mozingo, Pulaski, Iowa. Application filed June 10, 1907.

This is a telpherage system in which one supporting and one guide cable and a trolley wire are provided. The carriage has an electric motor and a trolley engaging the trolley wire.

871,434. Recorder. Ernest A. Oakes and Peter A. Cooney, Chicago, Ill. Application filed July 26, 1906.

A chart-holding drum revolves in front of a number of electromagnets operating marking devices.

871,490. Insulator-pin Mounting. John D. E. Duncan, New York, N. Y. Application filed January 21, 1907.

This support for metallic insulator pins is a sheet metal saddle with flanges engaging the arm and U-bolts holding the pin against the saddle and that against the arm.

871,496. Protection of Railway Trains. Abel R. A. Gérard, Pontgivart, near Reims, France. Application filed May 1, 1906.

This is an interlocking block signaling system wherein the passage of a train operates the circuits of signals in adjacent blocks.

871,501. Bond for Rails. Charles Y. Haile and George M. Hugus, Uniontown, Pa. Application filed May 17, 1907.

The bonding wire passes through the fishplates and webs of the rails on each side of the joint and has its ends riveted into the webs beyond the fishplates.

871,513. Alternating-current Motor. Carl A. Lohr, Schenectady, N. Y. Application filed September 7, 1905.

The rotor and stator may each be connected to the source individually or together simultaneously. Each part can have its windings short-circuited when the other part is connected to line. The machine may run as a synchronous or as an induction motor.

871,519, 871,520. Party-line Telephone Exchange. Samuel A. Norstrom, Chicago, Ill., assignor to Casper L. Redfield, Chicago, Ill. Applications filed July 14 and August 21, respectively, 1905.

A selective lock-out switching mechanism for party lines is referred to, the detailed mechanism of which is covered in the second patent.

871,652. Air Purifier. Frank A. Ward, Los Angeles, Cal. Application filed August 23, 1906.

A tube of dielectric material has an electrode with a large number of points within the tube and a smooth perforated sheet-metal electrode on the outside of the tube.

871,671. Time-controlling Device. Charles E. Campbell, Lynn, Mass. Application filed September 22, 1905. Renewed September 26, 1907.

The alarm-winding mechanisms of two alarm clocks are connected to a rotary switch so as to open and close a circuit at predetermined times.

871,675. Office Indicator. Henry P. Davis, Hot Springs, Ark. Application filed December 29, 1906.

A push button closes a bell circuit and lights an electric lamp.

871,686. Platinum Contact. Anton Freier, Boston, Mass., assignor to the Holtzer-Cabot Electric Company. Application filed May 13, 1907.

This contact has a tip with a thin surface coating of platinum. The compound tip is frictionally secured in an opening of the contact member with the platinum exposed.

871,724. Electric Warp Stop-motion for Looms. John W. Moran, Adams, Mass. Application filed March 29, 1907.

An apparatus for wiping the casing tube of an electrical stop-motion is described.

871,726. Telegraphone System. George Morin, Habana, Cuba. Application filed January 30, 1907.

A telegraphone is controlled from a distance by sound waves for connecting it into and out of action at will.

871,729. Electric Fan. William C. McChord, Jr., Springfield, Ky. Application filed June 14, 1906.

To the main blades of a ceiling fan auxiliary blades are adjustably attached.

871,737. Telephone Transmitter. Elias E. Ries, New York, N. Y. Original application filed June 23, 1900. Divided and this application filed January 11, 1904.

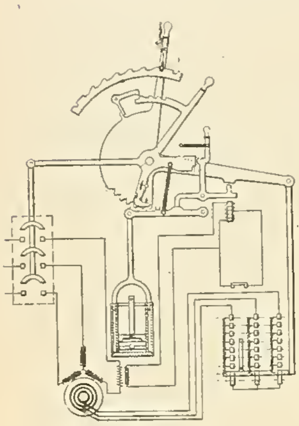
Two plate electrodes are separated by a liquid film adapted to vary the resistance of the circuit by changes of capillary action when one of the plates is vibrated by sound waves.

871,758. Bridging Blocks for Dynamo-electric Machines. Edward Heitmann, Montclair, and Frederick W. Young, East Orange, N. J., assignors to the Crocker-Wheeler Company, Ampere, N. J. Application filed October 18, 1906.

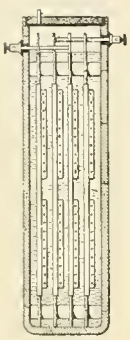
These are cast-iron blocks mounted above the windings in the slots of a rotor core. The blocks have parallel contacting members transversely slotted and joined by thin webs.

871,766. Process for Extracting Gold and Silver from Ores. Gilbert Gurney, Berkeley, Cal. Application filed May 23, 1904.

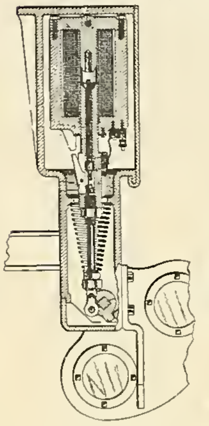
This process is used with sulphide ores. These are subjected to the action of a solution containing a perchloride, a chloride and a mineral acid, from which the metals are precipitated by electrolytic action.



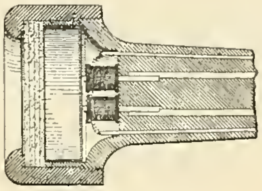
NO. 871,205.
CONTROLLING MECHANISM.



NO. 871,214.
REVERSIBLE BATTERY.



NO. 871,378.
RAILWAY SIGNAL.



NO. 871,470.
TELEPHONE RECEIVER.

871,442. Trolley-pole Attachment. Robert P. Rever, Newark, N. J., assignor of two-fifths to Everett Irving Rever, Newark, N. J., and one-fifth to Francis Van Winkle, Brooklyn, N. Y. Application filed November 26, 1906.

This attachment consists of three members hinged together. The upper-middle hinge swings at right angles to the middle-lower hinge.

871,457. Electrically Propelled Vehicle. Russell Thayer, Philadelphia, Pa. Application filed April 4, 1907.

A trolley is mounted in an adjustable frame for engaging a contact rail.

871,459. Boat-propelling Mechanism. Thomas Thorsen, Menomonie, Wis., assignor to the Submerged Electric Motor Company, Menomonie, Wis. Application filed March 1, 1907.

The propeller is mounted directly on the shaft of a submerged gas engine. The sparking plug of the latter has an adjustable electrical contact device.

871,468. Telephone Mouthpiece. Anna Bebout, St. Louis, Mo. Application filed January 28, 1907.

A collapsible mouthpiece that can be carried in the pocket consists of a number of sections, one of which is provided with an aseptic cloth.

871,470. Telephone Receiver. Hiram E. Booth, Salt Lake City, Utah. Application filed September 8, 1902.

In front of the regular diaphragm is placed an auxiliary diaphragm consisting of two finely perforated sheets of hard rubber separated by fibrous material. (See cut.)

871,479. Electrogenic Body Device. Albert R. Cooper, Findlay, Ohio. Application filed February 14, 1907.

Inside the heel of [illegible] shoe is placed a battery [illegible] of copper, carbon and acetic acid.

871,484. Electromechanical Power Governor. George H. Davis, West Orange, N. J. Application filed February 13, 1906.

[illegible] controlling individual actuators [illegible] for regulating the resistance in [illegible] when the several solenoids are [illegible].

871,485. Telephone Wall Set. William W. Dean, Chicago, Ill., assignor to the Kellogg Switchboard and Supply Company, Chicago, Ill. Application filed June 15, 1902.

[illegible] mounted on [illegible] brackets and a front [illegible] bracket [illegible] that, [illegible]

871,535. Electric-wire Connection. Frederick B. Thatcher, Providence, R. I. Application filed January 31, 1907.

A wire loop, which has a narrowed portion to engage a binding post, is fastened to a clip secured to the end of the wire.

871,537. Voltage Regulator. Max J. E. Tilney, South Kensington, England. Application filed October 17, 1905.

A generator that supplies current to a varying load has its field regulated by a motor which has three sets of field coils, one carrying a part of the load current, another connected across the load, and the third across the generator. The three fields normally neutralize each other.

871,538. Apparatus for Insuring Safety of Traffic on Single Lines of Railway. Edward Tyer, Dalston, London, England. Application filed November 15, 1905.

Each station has an absolute and a permissive locking magnet. The circuit of the first is broken at a distant station during permissive working.

871,553. Electric Time Alarm. Frederich J. Arndt, Minneapolis, Minn., assignor to the American Bank Protection Company, Minneapolis, Minn. Application filed August 1, 1906.

The hands of a clock close an alarm circuit at periodic intervals during the night and every seventh day.

871,556. Shoal Indicator. William Bangs, Fort Fred Steele, Wyo. Application filed March 25, 1907.

The vessel carries an attachment projecting downward and forward through a well in its bottom, which closes an alarm circuit when it is forced inward by striking a shoal.

871,578. Controlling Mechanism for Clutches. Archibald H. Ehle, Philadelphia, Pa., assignor to Burnham, Williams & Co., Philadelphia, Pa. Application filed September 12, 1905.

Air cylinders cause the movement of the clutch. The valves for the cylinders are controlled by electromagnets.

871,587. Street-car Signal. George S. Henninger, Linton, Ind. Application filed April 4, 1907.

The motorman can cause a signal arm to extend rearwardly from the car, which act causes a bell to ring under the rear platform and a lamp to light on this arm.

871,616. Trolley-pole Controller. Clarence Norland, Los Angeles, Cal. Application filed November 19, 1906.

The trolley pole is moved to engage the wire by means of an air cylinder, the valves of which are under electrical control. If the wheel leaves the wire the pole is automatically lowered.

Reissue.

12,722. Trolley Retriever. Alfred W. Knutson, Brookfield, Ill., assignor to the Trolley Supply Company, Canton, Ohio. Original No. 711,428, dated October 14, 1902. Application for reissue filed August 19, 1907.

A case contains a rotatable reel with a spiral groove for winding up the slack rope. Spring devices engage the reel with a retriever head.

PATENTS THAT HAVE EXPIRED.

Following is a list of electrical patents (issued by the United States Patent Office) that expired November 25, 1907:

441,127. Manufacture of Incandescent Electric Lamps. A. Bornholdt, Brooklyn, N. Y.
441,128. Incandescent Electric Lamp. A. Bornholdt, Brooklyn, N. Y.
441,130. Electric Battery Connections. H. J. Brewer, New York, N. Y.
441,157. Electrical Call, Lighting and Alarm System. C. A. Hale, Cleveland, Ohio.
441,210 and 441,211. Electric Street-railway System. M. Wheless, Nashville, Tenn.
441,212. Conduit for Electric Railways. M. Wheless, Nashville, Tenn.
441,213. Auxiliary Contact for Electric Railways. M. Wheless, Nashville, Tenn.
441,214. Electric Railway Cut-out. M. Wheless, Nashville, Tenn.
441,215. Insulated Brake. M. Wheless, Nashville, Tenn.
441,216 and 441,217. Electric Railway System. M. Wheless, Nashville, Tenn.
441,218. Electromagnetic Switch for Electric Railways. M. Wheless, Nashville, Tenn.
441,219. Electric Railway System. M. Wheless, Nashville, Tenn.
441,220. Trolley for Underground Electric Railways. S. E. Wheatley, Washington, D. C.
441,221. Conduit for Electric Railways. S. E. Wheatley, Washington, D. C.
441,246. Armature Body. C. A. Lieb, New York, N. Y.
441,248. Means for Hanging Electric Lights. T. J. Lynch, Danvers, Mass.
441,258. Conduit for Electric Railways. N. Seibert, Malden, Mass.
441,305. Electrically Propelled Vehicles. R. M. Hunter, Philadelphia, Pa.
441,330. Method of Operating Electric Brakes for Electrically Propelled Cars. W. M. Schlesinger, Philadelphia, Pa.
441,401. Method of Electric Welding and Metal Working. M. W. Dewey, Syracuse, N. Y.
441,403. Galvanic Battery. O. A. Enholm, New York, N. Y.
441,413. Secondary Battery. G. E. Hatch, Cambridge, Mass.
441,542. Device for Transforming and Controlling Electric Currents. O. A. Enholm, New York, N. Y.
441,543. Arc Lamp. O. A. Enholm, New York, N. Y.
441,565. Electrically Propelled Vehicle. R. M. Hunter, Philadelphia, Pa.
441,571 and 441,572. Electric Railway. H. W. Libbey, Boston, Mass.
441,622. Electrical Thermostat. C. H. Shaffer, Rockford, Ill.

WESTERN ELECTRICIAN

EVERY SATURDAY

Vol. XLI. CHICAGO, DECEMBER 7, 1907. No. 23

Light and Power in the Commercial National Bank Building.

The new Commercial National Bank Building at the corner of Clark and Adams streets, Chicago, has in its large sub-basement probably as complete an electric-light and power plant as is to be found among the isolated plants of Chicago. The building itself, fronting about 180 feet on Clark Street and 190 feet on Adams, is a model steel structure presenting many interesting features; particular attention, however, will be given in this article to the electrical equipment. The building is 280 feet high, there being 18 stories and an attic. All machinery and appliances, together with the workmanship, both as to construction and equipment of the building, are of the best.

The ground floor of the structure is designed for stores of various kinds, and the upper floors are for offices. The bank quarters are located on the second floor, which includes a gallery floor and a mezzanine floor. They afford a good illustration of artistic illumination and effective lighting. The building is wired for 16-candlepower incandescent lights and arc lights on 110-volt circuits, no more than 660 watts being allowed on any tap circuit. At present there are installed throughout the building about 12,000 16-candlepower lamps, 12 arc lights and 20 motors ranging from one horsepower to 35 horsepower. Provision has been made in the banking quarters for an increase of 600 16-candlepower lamps on the bank floor, 300 on the gallery floor and 100 on the bank mezzanine floor.

The entire electrical plant is operated on the two-wire system, but the wiring of all mains, feeders and sub-feeders is arranged for a three-wire convertible system; all cut-out cabinets and sub-centers are provided for three-wire connections, the middle wire having cross-section equal to the combined area of the two outside wires.

The electric-light and power plant is located in the large sub-basement, the floor of which is 27 feet below the ground floor, giving an unusual amount of clearance. The drawing on page 442 shows the plan of the plant. There are four generating units, shown in the accompanying illustration, two of 200 kilowatts capacity each and two of 125 kilowatts each. The generators are of the direct-current multipolar engine type, wound for 115 volts. They were furnished by the Western Electric Company and each is direct-connected to a vertical cross-compound automatic-cutoff engine of the Bates Machine Company pattern furnished by Chalmers & Williams. One continuous foundation of cement concrete supports the four generating units, there being a continuous cast-iron base arranged to carry the engines, generators and field frames.

Each engine was required to regulate within one per cent. in speed from full load to no load, the maximum speed of the 200-kilowatt engines being 200 revolutions per minute and that of the 125-kilowatt engines 250. Water consumption of the larger units does not exceed 34 pounds per kilowatt-hour at full load and 45 pounds at half load, and for the smaller units not to exceed 36 pounds at full load and 47 pounds at half load per kilowatt hour.

The generators are compound-wound and have ironclad armatures, the carbon brushes being designed to carry not to exceed 30 amperes per square inch of surface contact. They operate in multiple, an equalizer cable being run from each generator to the middle pole of the respective switch.

The switchboard, illustrated on page 443, is located directly in front of the generators and is of black enameled slate. It is mounted on ornamental bronze legs and is trimmed with bronze molding, the entire board being supported by a japanned iron frame, while the sides and rear are enclosed in an electro-bronze wire grating. The board was furnished by the Western Electric Company.

All instruments, switches, etc., on the board are of the best, and wherever possible attention was given to artistic design. The board is equipped with the following instruments and switches: Four illuminated dial station-type ammeters complete with shunts, lamp and connections, two having a capacity of 3,000 amperes each and two of 1,800 amperes each; one station-type illuminated-dial voltmeter of 125 volts capacity, including a swinging bracket for mounting; one portable voltmeter; one portable ammeter; one recording voltmeter; one direct-reading recording wattmeter; one ammeter switch provided with a point for each feeder; one voltmeter switch with connections for each generator and ground detector; one field rheostat for each generator; one triple-pole single-throw knife switch for each generator, and one triple-pole single-throw knife switch for each of the numerous feeders supplying sub-centers.

In addition to these there is mounted on the board a double-pole single-throw knife switch for each of the 17 motor installations; and there are four switches for future use, two of 10 horsepower capacity each and two of 15 horsepower. The rheostats are mounted on the back of the board with the necessary shaft extending through to the handwheel.

The bus-bars and connections on the back of the board are of the best quality Lake copper of 98 per cent. conductivity, all heavy bars and connections being laminated and of ample dimension to carry 800 amperes per square inch of cross-section without increasing in temperature over 60° F. above surrounding atmosphere. All switches are made of the best quality hard-drawn Lake copper and have a capacity of 50 per cent. in excess of the full-load requirements.

The leads from the generators to the switchboard are of stranded cable, rubber and lead covered, and the rheostat wires are also rubber and lead covered. The leads are placed in extra heavy electro-galvanized iron conduit placed beneath the floor and terminating at the generators and in the rear of the switchboard six inches above the finished floor line in insulating bushings of hard rubber.

The system of wire shafts is shown in the accompanying diagram of mains and risers. No wood construction was permitted in this work. A set of mains extends from the switchboard to each of the two load centers in each of four wire shafts supplying current for lights from the fourth floor to the attic, inclusive. From each load center sub-mains are run above and below the centers supplying cut-out cabinets on each floor from the fourth to the attic. There are two sub-centers in each wire shaft for lights above the third floor, one supplying current for lights from the fourth to the eleventh floor and one for the floors from the twelfth to the attic.

Sets of feeders are run from the switchboard to shafts for supplying current to lights as follows: One to the safety deposit vaults, two to outside offices on third floor, four to sub-basement and basement, four to first floor, two for corridor lights above third floor, four for corridor lights below fourth floor. Subfeeders are run from the cut-out cabinets on the second floor to the gallery floor and mezzanine floor.

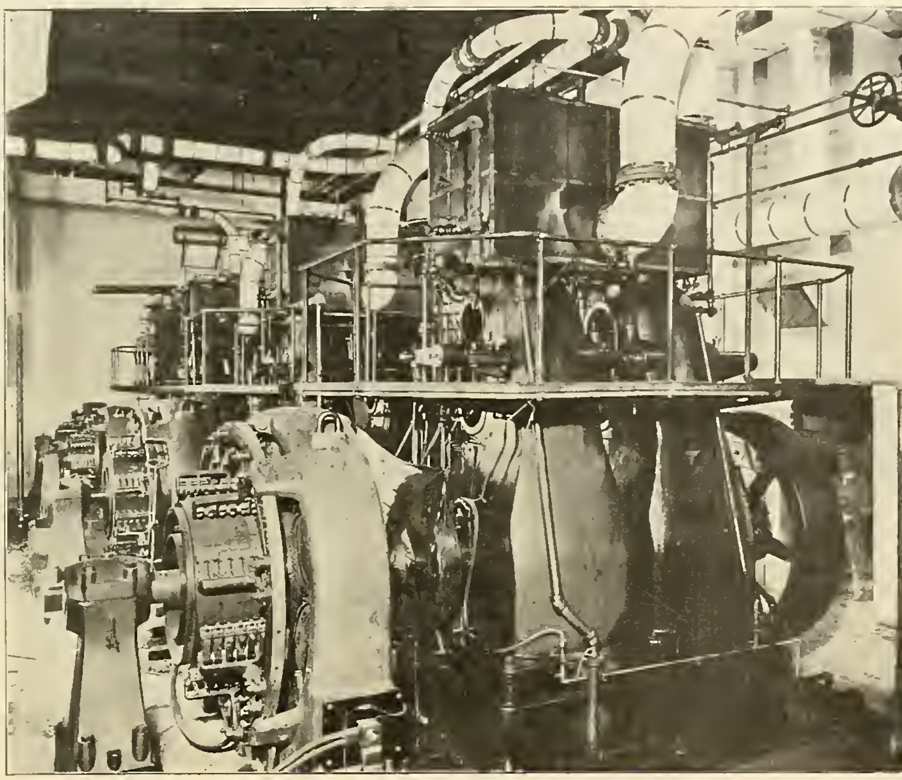
Direct circuits are also run to 17 sub-centers supplying motors in the basement, sub-basement, third floor and attic. No wire smaller than No. 14 B. & S. gauge is used, and wires larger than No. 10 are stranded.

The thickness of the rubber insulation, the minimum resistances of insulation in megohms per mile and the dielectric strength of insulation for the various sizes of wire were points upon which rigid tests were demanded. All wires except cables in the wire shaft are run in wrought-iron pipe conduits, loricated or electro-galvanized, of standard weights and dimensions. All feeders, mains and sub-mains are run one wire to a tube and only one circuit is run in any one conduit.

Twelve conduits are provided for the accommodation of telephone service throughout the building. The conduits terminate in outlet boxes located directly behind the wire molding.

All conduits in the floors are run in such a manner as to allow 1¼ inches of fireproofing on top of all floor beams. It was planned to have all wires of such size that the loss of potential between switchboard and any lighting outlet would not be greater than five volts, with lamp circuits in proportion.

Each outlet is provided with a pressed steel outlet box of No. 12 B. & S. gauge. The conduits are fastened to these boxes through threaded connections, with sufficient room for insulating joints and wires and bushings. All switches other than those in cut-out cabinets are provided with similar boxes



ENGINES AND GENERATORS IN THE COMMERCIAL NATIONAL BANK BUILDING.

The cut-out cabinets are of handsome and substantial design, one being placed in every shaft on every floor, including the basement, sub-basement and attic. Each cabinet is of sufficient size to contain all cut-outs for controlling the circuits on its floor. The cabinets are made of No. 10 sheet steel provided with suitable lugs and lined with an interior box, set off at least three inches in all directions, made of black enamel slate. Cut-outs are of the panel-board type and connections are made through machine copper strips. The panel boards, cabinets, etc., were furnished by the J. Lang Electric Company.

All centers of distribution at load centers are built up on black enameled slate board two inches thick and mounted on a japanned angle-iron frame. Bus-bars and connections are of a capacity and construction similar to corresponding work on the main switchboard, all enclosed in a No. 10 sheet-metal cabinet.

Current used by tenants is metered, separate meter loops being provided for each tenant, and the meters are located in the wire shafts.

There are at present 20 motors in operation in the building, largely in connection with the numerous mechanical installations in the sub-basement. An accompanying picture shows a 30-horsepower motor driving the automatic pneumatic blower used as a carrying system in the bank. When more than the ordinary amount of air is used in the blowing system a valve is released, producing a corresponding water pressure which cuts out resistance and speeds up the motor to the necessary speed.

A large number of fans in the ventilating system are also motor-driven, and there is a motor for driving machine tools in the basement shop, a motor for the elevator signals, two on the refrigerator system, two on the ejector compressors, etc.

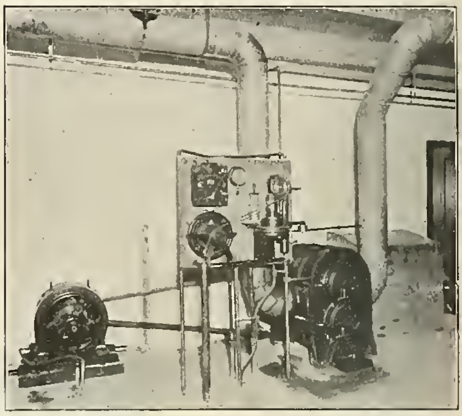
The building is equipped with 15 hydraulic passenger elevators and a freight elevator. These are of the plunger type and were furnished by the Otis Elevator Company. To operate these elevators two high-duty flywheel type Reidler pumps are required and three Platt direct pumps. Quite an elaborate system of piping is required for this system, but the elevators are easily controlled, safe and smooth riding. The plunger which supports the car fits into a cylinder which extends into the ground a distance equal to the height of the elevator travel. The car is raised by hydraulic pressure in the cylinder and lowered by releasing the pressure.

The boiler-room of this building is perhaps the finest of its kind in the city. There are four Sederholm horizontal return tubular boilers of 350 horsepower each, furnished by Chalmers & Williams. The boilers are equipped with Green traveling chain grates and automatic stokers. In addition to this a Tilden automatic stoker controller, which acts on the dampers and controls the speed of the stoker, makes combustion almost perfect. It is seldom that any smoke can be seen issuing from the 340-foot steel stack.

No. 3 and 4 Illinois washed free-burning coal is used. Storage is provided directly in front of the boilers for 600 tons of coal. Bucket conveyors deliver the coal to the various bins, from which it is delivered to the furnace hoppers by screw conveyors. Connection has been made with the tunnels of the Illinois Tunnel Company, through which some of the coal has already been delivered, and all the ashes are removed through the tunnel. An automatic scale is being installed in connection with the furnace hoppers by which all the coal burned under each boiler will be recorded.

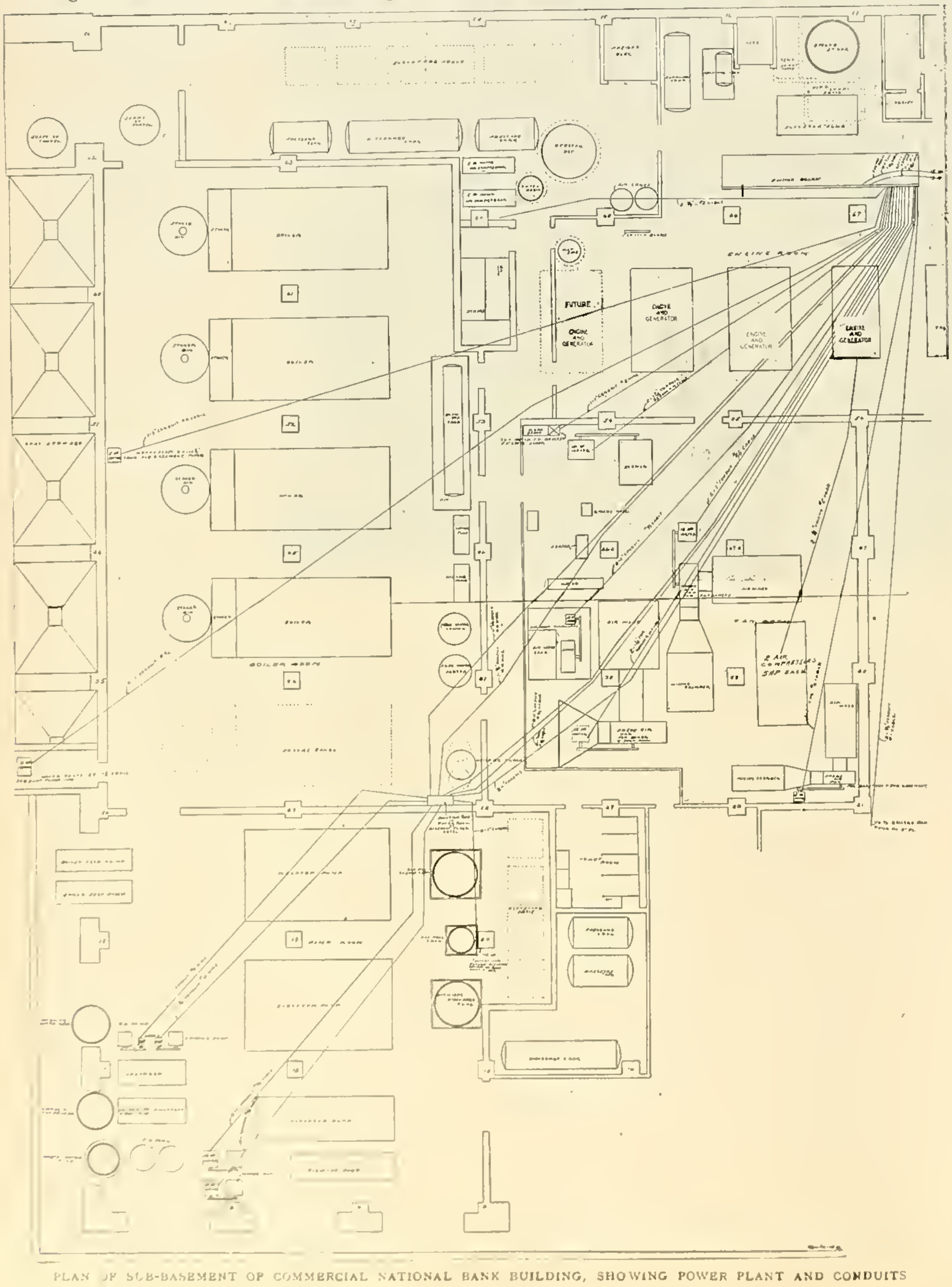
The building is heated by exhaust steam from the engines, provision having been made for live steam connection if necessary. An elaborate system of ventilation provides for the delivery of tempered fresh air to all parts of the building. This system is motor-driven and is very interesting.

Cool drinking water is supplied throughout the building by the small refrigerating plant known as the Carbondale absorption system. This plant is motor-driven. Another motor-driven installation is the Shone ejectors, by which the waste and drippings from all over the building are pumped to the city sewer.



MOTOR-DRIVEN PNEUMATIC BLOWER FOR THE CASH-CARRIER SYSTEM IN COMMERCIAL NATIONAL BANK.

D. H. Burnham & Co. of Chicago were the architects and engineers for the building, and the electrical installation was done by the Brennan Electric Construction Company of Chicago. The building is one of the finest in Chicago, and the electric-light and power plant, for completeness and convenience, is probably second to none.



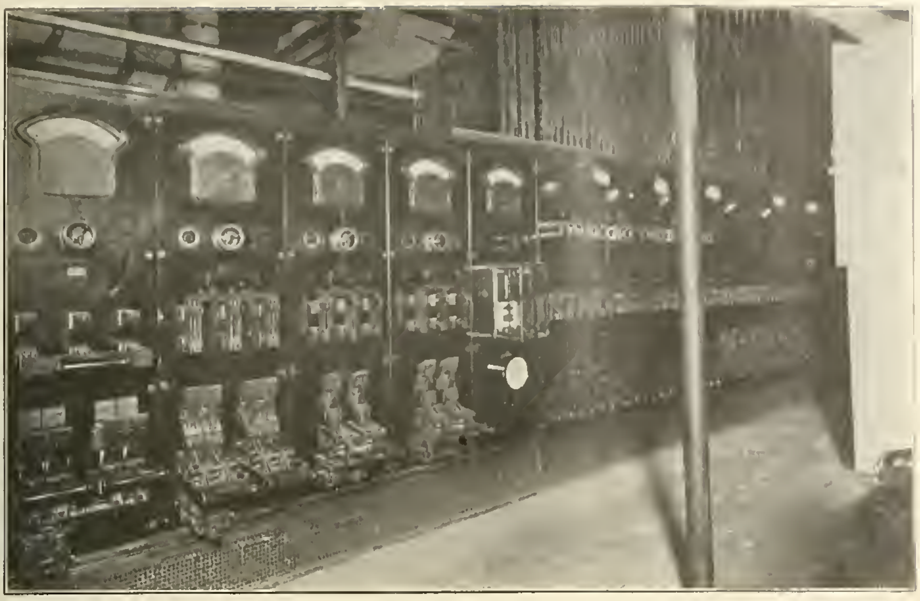
PLAN OF SUB-BASEMENT OF COMMERCIAL NATIONAL BANK BUILDING, SHOWING POWER PLANT AND CONDUITS

Three-phase Generating Plants.

The use of three-phase circuits in long-distance power transmission has long been favored practice in comparison with two or single-phase line construction, chiefly because three-wire, three-phase transmission results in a saving of 25 per cent. in copper and insulators. Maintenance cost is reduced in the same proportion. Not so widely are the advantages of three-phase generation appreciated. In some quarters there is still a tendency to install two-phase generators, resulting largely from the early standard practice in power-system design for relatively short distances and moderate voltage work. It is sometimes difficult to appreciate the ease with which three-phase generators can be added to an existing plant in which the generation is two-phase, with three-phase line construction, or the facility with which even a complete two-phase system can be modified to suit the economics of the three-phase line in the broad handling of an expansion problem.

It cannot be denied that, from the operating viewpoint, a two-phase system is somewhat simpler to handle for distribution purposes. The independent control of each phase is undoubtedly easier, and in case of motor connections on two-phase power circuits no questions of transformer polarity enter to disturb the flow of current in the motor. Even the impedance of the transformers need not be the same for the correct division of the load, as is the case with three-phase connections. Experience shows, however, that the difficulties of balancing loads close enough for all practical purposes are far from serious. In combined lighting and power systems the power load has an equalizing tendency on the balancing of the system, and in straight railway service the use of three-phase sub-stations throughout introduces no complication whatever in balancing, provided standard apparatus of accepted characteristics be installed.

For a given rated capacity in kilowatts, speed, voltage and frequency, the three-phase generator will usually be the more efficient machine. Its frame and punchings will probably be the same as those used in the two-phase unit, and with the same core loss, higher efficiency and lower heating are readily insured. For the same cost in materials the three-phase machine should be more efficient, or less expensive to manufacture for the



SWITCHBOARD IN COMMERCIAL NATIONAL BANK BUILDING.

same efficiency. As Mr. M. A. Sammett pointed out last year in a paper on "Polyphase Systems of Generation, Transmission and Distribution" before the Canadian Society of Civil Engineers, the selection of the same density in the copper of the three-phase as in the two-phase machine enables the magnetic flux to be reduced by virtue of the larger number of turns that can be accommodated in the same slots, thus reducing the core loss. In machines of large capacity the core loss is considerably greater than the copper loss, so that this results in a material increase in generator efficiency which is multiplied back to the coal pile or water flowage.

The advantages of a three-phase switchboard are, in brief, 25 per cent. less complication in main wiring, bus-bars and oil-switch components; lower cost of installation and greater ease of handling with less repairs for the same capacity. Although 15.6 per cent. more cross-section in individual bus-bars and cables is required for the same capacity, the space requirements are in general lessened, both on the rear of the switchboard, and in conduit construction under floors. Individual three-phase transformers also have an advantage in point of compactness, and the dangers of resonance can be much decreased by straight three-phase delta connections. In the distribution circuit itself, the three-phase induction motor is on the whole superior to the two-phase machine in power factor, efficiency and temperature rise. H. S. K.

Union Traction Reorganization Materializing.

The Chicago Railways Company has filed in the United States Circuit Court its petition for an order of possession of the Union Traction properties. This is the final important step toward reorganizing these properties and placing them in a position to accept the traction settlement ordinance. The bondholders who objected to the former order which was overthrown are now friendly to the revised plan of reorganization, and it is said that all opposition has been overcome. The petition for possession, which will be heard by Judge Grosscup on December 9th, asks for a lease by the receivers to the new company of all the tracks, cars and other property. The lease is to be operative pending a sale by foreclosure proceedings. The plan is to have the Chicago Railways Company bid them in and thus acquire actual and permanent ownership.

Winter Programme of the Chicago Section, A. I. E. E.

The topics for discussion at the future meetings of the Chicago Section, American Institute of Electrical Engineers, for the season 1907-1908 are announced as follows: December meeting, "Maintenance of Telephone Equipment;" January meeting, "Application of Storage Batteries to Alternating-current Systems;" February, "Extensions and Improvements of the South Side Elevated Railroad, Chicago," by Mr. Seeley of that railroad company; March, "Interference of Power Currents on Telephone Circuits," by J. G. Wray of the Chicago Telephone Company; April, "Electrification of Steel Mills;" May, "Waterpower Developments in Michigan;" at extra meetings, "The St. Clair Tunnel Electrification" and "Application of Steam Turbines to Electrical Equipment." Where no name is given the author has not yet been chosen.

To Stop Subway Crush.

A preliminary report on means of improving service in the New York subway has been issued by Bion J. Arnold, who is investigating conditions in the subway for the New York Public Service Commission. Mr. Arnold is not yet ready to answer all the questions of the commission, but his report indicates that he favors side-door cars as one means of relieving congestion, and he also urges a change in train-starting methods. Before installing side-door cars he desires to see the effect of minor changes, and to this end proposes the starting of trains from express stations at exact intervals, and he would move some of the block signals. The policy of holding the trains at the stations until the doors are jammed in an effort to clear the platforms should be superseded by a system which would start the trains within 45 seconds after they have stopped.

MAINS AND RISERS IN COMMERCIAL NATIONAL BANK BUILDING.

Varieties of Coal Produced in the United States.

The coal produced in the United States is reported to the United States Geological Survey as consisting of two classes—anthracite and bituminous. The bituminous product includes coal that may be classed as semi-anthracite, semi-bituminous, cannel, block, splint, and lignite, or sub-bituminous.

In addition to the anthracite produced in Pennsylvania, 50,408 short tons were mined in Colorado in 1905, and 60,248 tons in 1906. New Mexico produced 24,415 short tons of anthracite in 1905, but reported none in 1906.

Semi-anthracite was reported from Pennsylvania, Colorado, Indian Territory, Virginia, Montana and Arkansas.

Bituminous coal was produced in 27 states and territories in 1905 and in 24 in 1906, and forms by far the largest part of the total production.

Semi-bituminous coal is mined in 17 states and territories, with West Virginia first, followed in order by Pennsylvania, Maryland, Illinois, Virginia and Montana.

Wyoming leads in the production of lignite, or sub-bituminous coals, over 70 per cent. of the production of the state being so classed. The so-called black lignites of the Rocky Mountain States are entirely distinct from the real lignites, or brown coals. They are not lignites in chemical composition, in color, or in physical characteristics, and as they lie between the lignites, or brown coals, and the true bituminous coals, the term sub-bituminous has been adopted by the United States Geological Survey to designate them. In the production of this variety of coal Wyoming leads, Colorado is second, and New Mexico is third. A part of the product of California and Oregon should also be included under this head.

The principal producers of true lignite, or brown coal, are Texas and North Dakota.

The comparatively small production of cannel coal was obtained from nine states in 1905 and seven in 1906, of which Kentucky, Indiana and West Virginia are the principal ones. West Virginia is also credited with nearly all the splint coal.

An advance chapter from "Mineral Resources of the United States, Calendar Year 1906," on the production of coal in 1906, by E. W. Parker, will soon be ready for distribution.

The Use of the Tee Rail in Cities.[1]

By C. Gordon Reel.

In the horse-car days the equipment was so light and speeds so leisurely that the problem of a proper track was easy of solution. It was expected that wagon traffic of all kinds would follow along the car tracks, and so city ordinances usually required that the electric-railroad companies make proper provision for the accommodation of

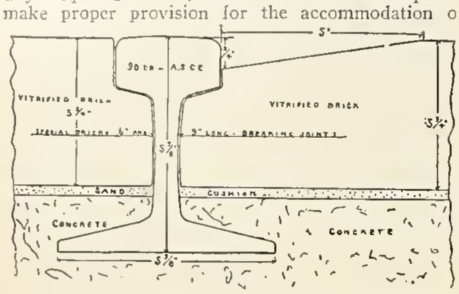


FIG. 1. LATEST TRACK CONSTRUCTION IN KINGSTON, N. Y., SHOWING SPECIAL BRICK OUTSIDE OF RAIL.

vehicular traffic. With the introduction of electricity weights and speeds were increased enormously. The trend of development has been steadily to approach nearer and nearer to steam-railroad standards.

With the increase in weight of equipment and increase of speed the grooved and girder rail sections soon demonstrated their inability to carry the car traffic without rapid deterioration. The inefficiency of these sections was due not to the light weight so much as to their unscientific design. The vertical web of the rail was usually directly under the flange of the wheel, so that the weight of the car would be carried on a sort of projecting shelf. This unsymmetrical unloading was more than the rails could stand. They pounded down rapidly at the joints and could not be held to gauge. Our companies were unfortunate enough to build with 7-inch grooved and girder sections. These rails were structural wrecks at the joints long before they were worn appreciably.

In other cities similar sections have been used which overcome the inherent weakness in design by brute strength so to speak; that is, they are rolled in weights up to 150-pounds per yard, which would seem absurd to steam railroad men, especially in view of the very much heavier rolling stock used by the steam roads. It is self-evident that a proper section should not be inordinately

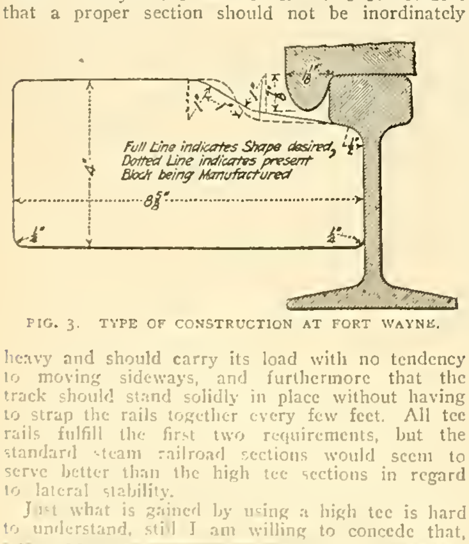


FIG. 3. TYPE OF CONSTRUCTION AT FORT WAYNE.

heavy and should carry its load with no tendency to moving sideways, and furthermore that the track should stand solidly in place without having to strap the rails together every few feet. All tee rails fulfill the first two requirements, but the standard steam railroad sections would seem to serve better than the high tee sections in regard to lateral stability.

Just what is gained by using a high tee is hard to understand, still I am willing to concede that, in view of the experience in some of the larger cities which use this rail, there is a chance for an argument between high tee sections and standard tee sections. Personally I would prefer to pay more per ton for standard sections than for high tee sections, although under ruling prices the high tees cost considerably more per ton than standard tee sections.

When it became necessary to renew the tracks in Kingston, I looked over the experience of other companies and concluded that the tee rail was in every way more desirable than the grooved or girder rail, and proceeded accordingly. To make sure we laid an experimental piece of track using 90-pound A. S. C. E. standard rail. This gave such good results that we placed an order for several hundred tons in 60-foot lengths with a view to extending the construction. After the rails were delivered opposition developed. It was argued that it was necessary to use an iron lip; that unless we used the iron lip, ruts would form along the track. The only difficulty about this point was that it was not necessary, in the first place, to use any iron lip because experience proves that there is no greater tendency for a rut to form along a tee rail than along the outer edges of a groved or girder rail.

We finally got consent from the city to lay tee rails in two rather important streets with the stipulation that if, after the end of a year, the city authorities so desired we would remove them and substitute the old rails.

Since the installation of this 90-pound standard construction in the two streets referred to, we have been granted permanent permission without any restrictions to use this 90-pound standard tee rail in Broadway, Main Street and Fair Street, which are the most important streets in the city. The present construction is shown in Fig. 1.

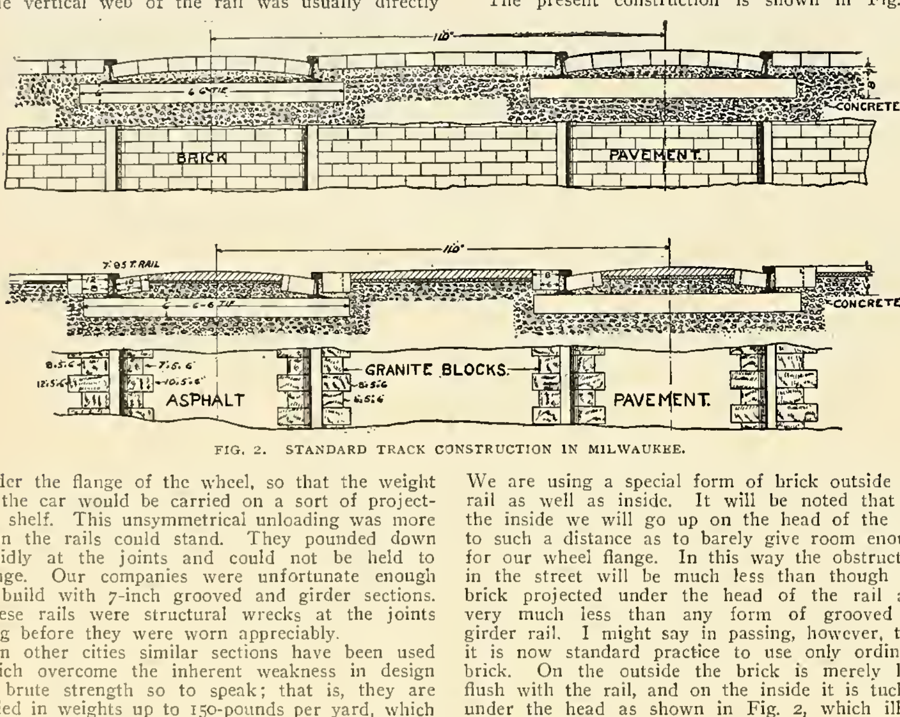


FIG. 2. STANDARD TRACK CONSTRUCTION IN MILWAUKEE.

We are using a special form of brick outside the rail as well as inside. It will be noted that on the inside we will go up on the head of the rail to such a distance as to barely give room enough for our wheel flange. In this way the obstruction in the street will be much less than though the brick projected under the head of the rail and very much less than any form of grooved or girder rail. I might say in passing, however, that it is now standard practice to use only ordinary brick. On the outside the brick is merely laid flush with the rail, and on the inside it is tucked under the head as shown in Fig. 2, which illustrates the construction now standard in the streets of Milwaukee.

The "Nose" brick extensively used heretofore has not been entirely satisfactory. By referring to Fig. 3, which illustrates the type of construction adopted in Fort Wayne, it will be noted that the designer desired a somewhat different form than the market provided. We think that the kind we are having made for Kingston, illustrated in Fig. 1, combines many desirable features. In the event of heavier flanges being used experience teaches that they will cut their own way in the brick and will not crack the pavement badly.

In regard to what standard section to use we have found the 90-pound A. S. C. E. most desirable. It would seem though that the open-hearth section used by the Union Pacific and Southern Pacific railroads (Fig. 4) would be most desirable, since it has somewhat more height and better proportions generally. If heavier rail than the 90-pound is used, the Dudley 100-pound section (Fig. 5) would be excellent, as would also the section designed by Capt. R. W. Hunt (Fig. 6).

The gist of the whole tee rail matter seems to be that street-railway tracks are beginning to be built to serve the companies which build them and the patrons of these companies, rather than every Tom, Dick and Harry of a truckman who stubbornly insists on following the car tracks instead of staying out in the roadway where he belongs. If this driving along the tracks served any economic end it might be tolerated, but it does the truckman no good and interferes with the movement and comfortable transportation of countless thousands of more important people. It would

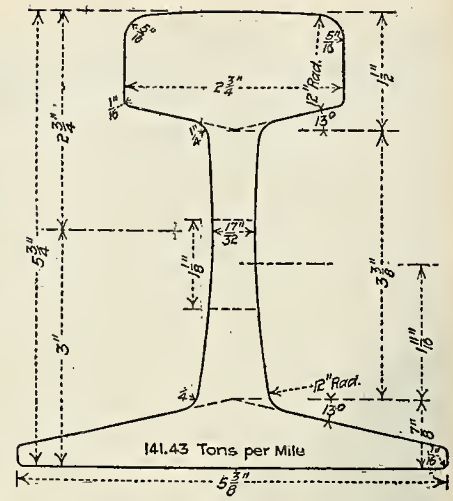


FIG. 4. OPEN-HEARTH TEE SECTION.

seem absurd if it were not true that anyone would argue in favor of having the tracks of a street railroad reserved for the transportation of merchandise at the inconvenience and discomfort of human beings.

The horse car, the wagon on the track, slow speed, light equipment, grooved and girder rails bespeak the past. The electric car, with the wagon in the roadway, high speed, heavy equipment on tee rails belong to the present.

Discussion.

P. P. Crafts, Clinton, Iowa: What is the particular object in using the 90-pound rail over, say,

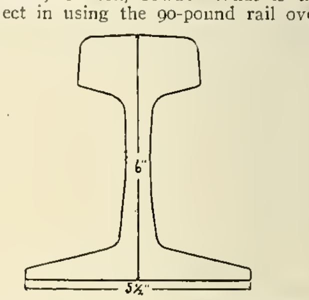


FIG. 5. DUDLEY 100-POUND TEE SECTION.

70-pound rail? I refer to the standard A. S. C. E. section.

Mr. Reel: The height would be insufficient. I think the 70-pound rail is only five inches high.

Mr. Crafts: Four and three-quarters inches.

F. W. Coen, Cleveland: The experience which the Lake Shore Electric Railway Company has had with 70-pound tee rail in paved streets is unsatisfactory. The brick will not stay. We have abandoned that construction entirely, except on some streets where there is little service or very

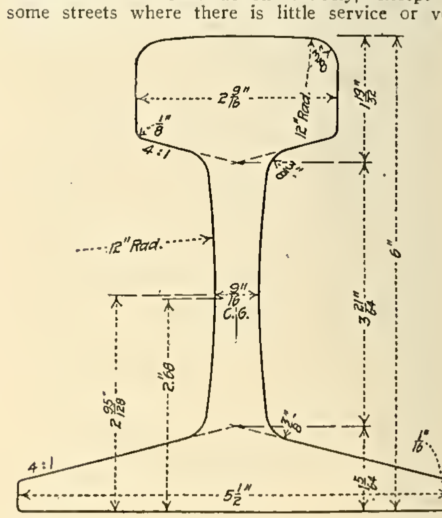


FIG. 6. HUNT TEE SECTION.

light cars. With heavy cars the rail is absolutely unsatisfactory.

Mr. Crafts: Did you find the bricks broke through?

Mr. Coen: If you use "Nose" brick, with the nose under the rail, the other end of the brick will turn out.

The New Castle (Ind.) Light, Heat and Power Company's electric plant has been entirely reconstructed, and is now running in good condition. This plant has been well designed for a town the size of New Castle, and will take care of the largely increasing business there for a number of years.

1. Abstract of a paper read before the American Street and Interurban Railway Association at Atlantic City on October 18, ... The author is vice-president of the Kingston (N. Y.) Consolidated Railroad Company.

Electrical Inspection from the Viewpoint of the Central Station.[1]

By Fred R. Cutcheon.

We may safely assume that regardless of competition with any other illuminant the electric-lighting company desires the very best and safest forms of electrical construction; yet if our consumers, realizing the risks which they run, prefer a cheaper form of construction, we do not wish to antagonize them by stringent rules and regulations, and we are glad to have an inspector who will explain to the public the risk involved without exaggeration, and will insist upon the enforcement of reasonable rules.

The chief trouble that we have had in the past with the inspection department has been due to delay in the inspection when our consumers were clamoring to have their lights or motors connected. However, this trouble has recently been corrected, and we now have no complaint in this regard.

We have had considerable trouble in connection with the sale of appliances, especially heating appliances, which were sold in good faith and afterward condemned because of improper connection with which the lighting company had nothing to do, leaving our consumers under the impression that we had endeavored to sell them an inferior article.

Another source of trouble is the requirement that fuses shall be installed on the neutral wires of a three-wire system. These fuses are frequently blown before the outside wire fuse has blown, due to a momentary short-circuit which clears itself. Under these conditions abnormal voltage is likely to be thrown upon the lamps on one side of the system, burning them out. The same thing results if the neutral fuse plugs become loose. This neutral fuse is also used a great deal as a means of robbing the meter by opening the potential circuit, keeping the load carefully balanced or grounding the neutral wire on a pipe in the building and breaking the neutral wire between that point and the meter. The current thieves have become so expert that where the fuses are placed in a sealed cabinet they use a storage battery to blow the neutral fuse.

The most serious criticism of the present inspection system is that sufficient attention is not given to old wiring. A large share of the old wiring is in unsafe condition. Wooden cleats are still in use in many places, and the insulation is rotten and ready to fall to pieces. In this connection I would state that the rules governing insulation of wires lay too much stress on high-insulation resistance and not enough on durability of the insulation. Rubber insulation, in my experience, is far less durable than some of the cheaper forms of insulation.

The inspectors are very rigid in regard to the fusing of new work, yet within a short time we find the enclosed fuses abandoned, frequently replaced by copper wires wound around the clips or inserted under the terminal screws. Such changes are not discovered until some trouble results, and they neutralize the elaborate precautions taken in the initial inspections.

If the system of electrical inspection were properly carried out it would make electric lighting the safest form of illumination, which would be a strong argument in obtaining new business.

The electrical inspector should be in touch with the newspapers and see that they publish only the facts in regard to the causes of fires, or when the fire is wrongly attributed to defective wiring that the misstatement be corrected at the earliest possible moment.

When rules are changed or new rules made the lighting company should be notified at once in writing. Much confusion has resulted in the past from lack of such information.

It is to be hoped that the rules will soon reach a permanent form, as the frequent changes make it difficult for supply houses to carry an adequate stock of wiring supplies.

The electric-lighting business depends upon the greater safety, cleanliness and convenience to meet the competition of gasoline, acetylene and kerosene. Therefore we should favor any changes which tend to increase the advantages which it has in those respects. We do not expect to get a cheap class of consumers, and the extra expense of installation will not discourage the desirable class.

Where there are competent companies in the field offering different classes of service, such as two-wire versus three-wire, alternating versus direct, single-phase versus polyphase, etc., the shifting of customers sometimes produces unforeseen complications, as the company which is disconnecting has no object in warning the competing company or the consumer of such difficulties. The inspection department should require early notice of such change, and should then notify the consumer of any changes needed in wiring or appliances.

The inspection department has been of great benefit to the electrical business in the past, and, if intelligently developed, can be of much greater benefit in the future.

1. A paper read before the Western Association of Electrical Inspectors at the annual meeting in St. Paul on October 23, 1907. Mr. Cutcheon is electrical superintendent of the St. Paul Gas Light Company.

Electric Hammer.

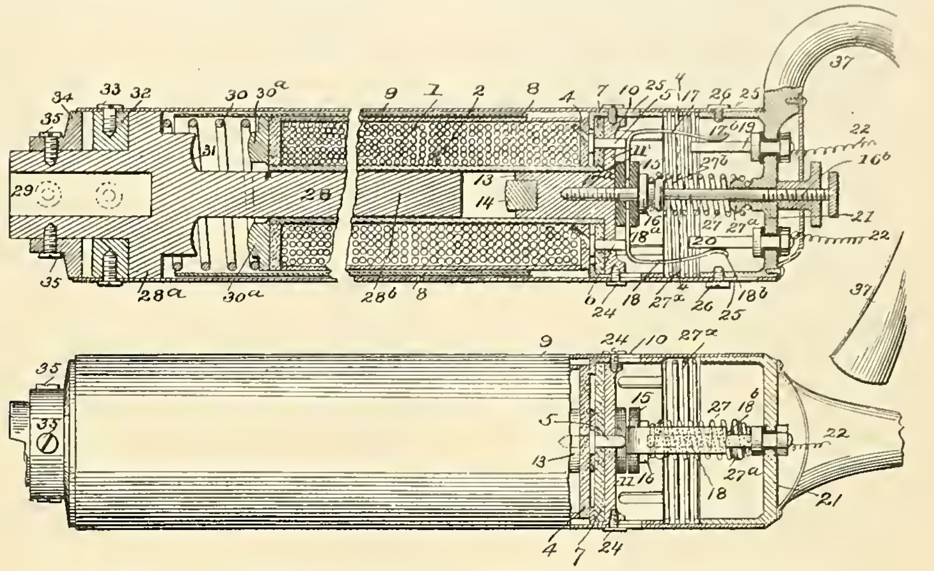
The increasing use of portable pneumatic tools, such as riveters and drills, has attracted the attention of inventors to this class of machinery, and particularly those of an electrical bent, for it was realized that electricity could be brought to the tool more conveniently and with greater economy than could compressed air. One of the chief objections to compressed air is the large leakage from the piping, especially in long flexible portions. In some cases this amounts to as high as 75 per cent. of the air supplied from the compressor. In electrical transmission the line loss is comparatively insignificant. The electric motor, being particularly adapted to rotative work, has enabled the electric drill and electric hoist practically to drive its pneumatic rivals from the field. For hammering and riveting especially, the electric hammer has made rather slow progress because it could not produce a sufficiently powerful blow and because of arcing and other troubles in the mechanism.

To overcome these difficulties Robert Smith of Middletown, Ohio, has invented a new form of electric hammer, which has been patented in this country. Of the accompanying drawings, the upper one represents a vertical longitudinal section of the device, while the lower one is a view (partly in section) at right angles to the section of the one above. Reference to the first drawing shows that there is provided a solenoid (1), comprising a section of brass tubing (2), threaded at each [illegible] (27) being arranged between the cap and the ring to retain them in proper relation with each other.

The extended end (16^a) of the set-screw (16) normally contacts with the set-screw (16^b), traversing a screw-threaded opening in the cap (21), which is encircled between the cap and the set-screw (16) by a spiral spring (27) having its ends reduced to engage bosses (27^a, 27^b) on the set-screw (16) and the inner face of the cap, respectively, a locking screw (27^c) engaging the outer end of the set-screw (16^b) and the cap for locking the set-screw in its adjusted position.

A relatively long core (28) is arranged in the lower end of the casing, and comprises a section (28^a) of large diameter engaging the inner face of the casing and the core proper (28^b), of relatively small diameter, normally extending within the solenoid. The outer end of the core is provided with an opening (29) for the reception of a tool. A spring (30) is arranged between the solenoid and the core and normally retains the solenoid in its upper position over the short core and with its contact points in engagement with the spring contacts.

A striking ring (30^a), of phosphor bronze, is arranged upon the lower end of the solenoid, a surface (31) being provided upon the portion of the core of relatively large diameter for co-acting therewith. The outer end of the core is reduced in diameter, and a collar (32) is secured to the inner face of the casing by set-screws (33) for



Upper view is a longitudinal section. Lower view is partly in a section at right angles to the first.
ELECTRIC HAMMER.

end and having screwed on either end thereof a fiber washer (3 4), the wire being wound upon the tube between the washers, and a fiber sleeve fitted over the wire between the washers for completing the insulating case. The terminals of the solenoid are extended through the washers (4) and connected to the contact points (5 6), oppositely disposed upon a second washer (7), also screwed upon the tube and provided with openings to permit the passage of the contact points.

The solenoid is mounted in a fiber sleeve (8) so as to permit it to slide therein, and surrounding this sleeve and extending beyond its ends is a metallic casing (9). A ring (10) is arranged within the casing above the solenoid and provided with a diaphragm (11), having integral therewith a relatively short core (13), provided on its free end with a boss or projection (14) of phosphor-bronze or other suitable diamagnetic material. A pair of insulating washers (15) are arranged in superposed relation centrally of the diaphragm and opposite to the core, being secured to the core by a set-screw (16) engaging perforations in the washers and a screw-threaded opening in the core. The set-screw is extended, as at (16^a), and between the washers are arranged oppositely disposed spring contacts (17 18), comprising the transverse portion (17^a), adapted normally to engage the contact points on the diaphragm, and the longitudinal portions (17^b, 18^b), adapted to remain in sliding contact with a pair of electrodes (19, 20), secured to a cap (21), fitting within the upper end of the tube, the electrodes being insulated from the cap in a suitable manner and connected at their outer ends to the terminal wires (22) of an electric circuit.

The casing (9) is provided with longitudinal slots (25), through which extend set-screws (24), engaging screw-threaded openings in the ring (10). A similar arrangement is provided for the cap (21), comprising longitudinal slots (25) and the set-screws (26). By the above-described means both the cap and the ring are permitted a slight longitudinal motion within the casing, but are retained from rotary motion therein, whereby the contact springs (17, 18) are always maintained in proper alignment with the electrodes (19, 20), a limiting the outward motion of the core, a second collar (34) being secured to the core by set-screws (35) for limiting the inward motion of the core. The collar (34) is set in such position that a slight amount of play is allowed to the core, and the spiral spring (30), arranged between the core and solenoid, normally maintains the solenoid in contact with the short core and normally retains the long core in its outward position. For convenience in manipulating the tool a handle (37) is secured to its upper end.

It will be evident from the description that the solenoid is maintained normally in its outward position and with the contact points (5, 6) in contact with the spring contacts (17, 18), whereby the circuit is completed. The completion of the circuit through the solenoid tends to draw the core (28) farther into the solenoid; but since the core is fixed the solenoid is drawn over the core. The core (13) is carried with the solenoid until the boss or projection (14) engages the end of the long core, which checks the movement of the short core and allows the solenoid to proceed alone until the striking ring (30) engages the surface (31). As soon as the solenoid leaves the short core, however, the circuit is interrupted, and the spiral spring (30) returns the solenoid to its original position. The diamagnetic boss (14) retains the two portions of the core out of direct contact with each other, thus permitting the adjacent ends to retain their opposite polarity. The operation of the hammer is entirely automatic, since the movement of the solenoid completes and interrupts the circuit.

If desired, the striking ring (30) may be replaced by a rubber ring, thus reducing the noise of operation, and, for a like purpose, the collar (32) might be faced with rubber. The provision of the slotted connection between the cap and the casing (9) allows the cap carrying the electrodes to slip out from the casing far enough to break the contact between the electrodes and the spring contact fingers, so that by releasing the handle the circuit is broken. When the hammer is in use, the act of pushing the tool against the work brings the electrodes and contact fingers into contact to complete the circuit.

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DEPARTMENTS.

COTTON AND WOOLEN mills have proved particularly favorable for the introduction of electric drive. With this system the electric motor and machinery may be placed in any relative position, each machine may be driven independently without reference to others; and when group driving is necessary greater simplicity is possible with less cost in regard to shafting. The steadiness of driving secured by means of the electric motor brings a consequently greater and more perfect output of each machine. The independence of machines gives greater freedom from breakdowns and less cost in running on light loads. The electric system enables a constant check to be made upon the power consumption of each department. It also simplifies matters, since it makes easy the lighting of the mill.

In commenting upon the present conditions of English cotton and woolen mills, in which about 8,000,000 new spindles and 77,000 new looms have been added this year, a London paper remarks upon the great advancement in favor which has been recently made by electric drive in competition with steam and shaft drive. It is no less apparent that American mill owners are as much alive to the advantages of electric drive as are the English manufacturers.

WHETHER PLATINUM is an element, as has been taken as a matter of course until lately, it still remains scarce and high-priced. But this was not always the case. In presenting statistics of the platinum industry in 1906 in an advance chapter from "Mineral Resources of the United States, Calendar Year 1906," Dr. David T. Day, of the United States Geological Survey, quotes an article by S. I. Gulishambarov, of the Russian ministry of finance, translated in the Mining Journal (London), summarizing reasons for the remarkable advance in prices. A paragraph from that article may be quoted:

"In the '20's of the last century, after the discovery of platinum in the Ural Mountains, the world's output of the metal, according to data collected by the Russian minister of finance, amounted to 40 poods [a pood equals a trifle over 36 pounds] per annum. The demand for it was, however, so small that the government had to take steps to find a sale for it and began buying it on its own account for coinage. In the '60's of the same century the development of the chemical industries in western Europe, and later the springing up of electrical engineering and of the dental manufacturing business, increased the uses of platinum, but in spite of this the supply was still in excess of the demand."

All this has been changed. Statistics show that the United States, France, Great Britain, Germany and Russia require annually quantities of the metal much larger than are produced, and the present high price—somewhere in the neighborhood of $25 an ounce—is the legitimate result of natural conditions of supply and demand.

IN COMMENTING on Mr. E. J. Young's paper on single-phase power transmission read at the annual convention of the American Institute of Electrical Engineers for 1907 and printed in the Western Electrician of August 10th last, Dr. C. P. Steinmetz made some interesting observations. The statement that the three-phase system has an economy in copper of 25 per cent. is not now correct, he said, for the high-potential line with grounded neutral; but at present, with grounded neutral, the three-phase system does not offer any advantage in copper economy over the single-phase or four-wire two-phase system. The advantage of the polyphase system over the single-phase system is only the greater usefulness of polyphase power, since the largest part of the power is always used for synchronous motors, induction motors, synchronous converters, etc. The advantage of the three-phase system over the two-phase system is the advantage of three wires over four wires. This is what upholds the three-phase system at present, declared Dr. Steinmetz, who continued:

"In comparing the three-phase or single-phase system with direct-current high-tension transmission it was pointed out in the early days that they cannot be compared as regards copper economy on the basis of maximum voltage or effective voltage, because one stress is alternating with the average equaling zero, the other stress is unidirectional, and so all those effects of the electrical stress which are unidirectional exist to a very small extent only in the alternating-current system, while prominent in the direct-current system, and all those effects which depend on instantaneous voltage are greater in the alternating-current system. So direct-current high-tension and alternating-current high-tension cannot directly be compared on the basis of some voltage, average, effective, maximum, or whatever it may be, but require a further investigation which the future will give; and the future will indicate whether the direct-current high-potential transmission should be reintroduced to any appreciable extent, which, by the way, I do not believe."

Those who have been impressed with the claims made in Europe for the Thury direct-current high-tension system of power transmission will find little support for their views in this country, for few American electrical engineers will dissent from Dr. Steinmetz's opinion on this subject.

WHAT IS the truth about transatlantic "wireless"? Is it proving a success or a failure? Some of the daily newspapers—in this country, notably the New York Times—say that the new service is doing what is claimed for it, and their testimony must be given weight, for so far the service seems to be confined to press dispatches, and the papers say that Marconi's system is "delivering the goods." Foreign news dispatches "by Marconi wireless telegraph" from Clifden, Ireland, to Glace Bay, N. S., filling more than a page, were printed in the New York Times on Sunday, December 1st. The Times thinks that Marconi has solved the most difficult of wireless-telegraph problems with brilliant success and adds editorially: "The time is not far distant when wireless communication will be as common as telegraphing by wire. Already the wireless transatlantic news service is swift and accurate and compares favorably with the cable service. Both are needed. We cannot have too many methods of rapid communication in this busy age.'

On the other hand, Reginald A. Fessenden, writing from Brant Rock, Mass., on November 4th, to the London Electrician, says that many inaccurate statements have appeared in the daily papers in relation to transatlantic radio-telegraphy, and he gives reasons why "wireless" has failed hitherto to come into extensive use. For one thing he says that the statement that on October 18th 14,000 words were transmitted across the Atlantic is incorrect, the correct number being approximately 1,400. Further, there were many mistakes, and the rate of speed was seven, not twenty, words a minute. Professor Fessenden observes that the messages from Clifden were received better, apparently, at Brant Rock than at Glace Bay. He believes that statements that commercial wireless telegraphy has been established across the Atlantic are premature, and that these premature statements have an injurious effect on the real development of the art. Professor Fessenden says that he has no intention of reflecting upon officers of the Marconi company, who have been doubtless unable to control the exaggerated statements which have appeared in the press. However, he believes that the system as at present installed is not capable of commercial operation, owing to slow speed, lack of secrecy, liability to interference and lack of facilities for distributing messages.

It is to be noted that Professor Fessenden's criticism was written about a month ago and that he has himself a wireless system which may be regarded, perhaps, as a rival to that of Marconi. But it is evident that there are two sides to the story; there are unquestionably formidable difficulties still remaining in the path of transatlantic "wireless" as a practicable commercial proposition. Nevertheless Marconi is entitled to the highest praise for the work which he has accomplished and for the resolute way in which he is endeavoring to remedy the defects in a practical way. Every great invention was crude at first in comparison to its later form, and it is likely that history is repeating itself in the matter of "wireless." But at the present time some of the newspaper stories must be received with reserve.

Domestic Electric Heating.[1]

By A. A. Pope.

During the last three years great progress has been made in the field of electric heating, due largely to the vigorous campaign of advertising carried on by the central stations throughout the country, and to the improvements made by the manufacturers in the apparatus and devices. Because of great convenience and cleanliness electric heat is always popular, and as a rule when once a device is connected it soon becomes a permanent feature of the installation.

The electrical iron has been developed to a very satisfactory state of perfection and is undoubtedly the most popular piece of electric heating apparatus today, with the water cup a close second. In many residential installations, or, more properly speaking, installations for small families, the electric iron for trouble in making the disconnection at that point, as the connecting cord remains alive, but is not so treated by the party using it. The cord switch increases the price of the iron, which is high enough as it is.

This work was done with a seven-pound iron, but a six-pound iron is the best suited for general household work where one iron only is used. Care should be taken to see that the iron is adapted to the voltage of the circuit to which it is connected. If an iron is made for 115 volts and is used on a 104-volt circuit it will not be hot enough for steady work, and vice versa. We do not believe the automatic cut-off in the handle of the iron is necessary for domestic use. Ninety per cent. of the industrial users of electric irons will tie down the handle, thereby nullifying the effect of the cut-off. A satisfactory automatic cut-off has not yet been devised; it is needed in commercial work.

Daily Cooking Record for Week of June 10 to June 17, 1907.

	Breakfast.	Persons Served.	Food.	Lunch.	Persons Served.	Food.	Dinner.	Persons Served.	Food.	Special Baking.	Ironing.
	Kw.h.			Kw.h.			Kw.h.				
Monday..	1.9	5	Cereal, Toast, Coffee, Boiled Eggs.	1.9	4	Warmed-over Dishes, Tea, Toast.	1.4	3	Broiled Steak, Tea, Boiled Potatoes.		
Tuesday.	2.8	5	Cereal, Coffee. Poached Eggs, Toast.	1.5	4	Omelette, Tea.	3.5	5	Roast Mutton, Asparagus, Potatoes, Beets.		2.9
Wed'day.	2.8	5	Coffee, Cereal, Griddle Cakes.	.6	4	Stew, Tea.	4.9	3	Chops, Peas, Tea, Potatoes, Custard.		
Thursday	1.5	5	Cereal, Coffee, Toast, Boiled Eggs.	1.6	3	Eggs, Tea, Toast.	6.1	5	Roast Veal, Corn, Spinach, Potatoes, Bread Pudding.		
Friday...	2.5	5	Cereal, Coffee, Griddle Cakes.	2.0	4	Stew, Tea, Poached Eggs.	3.7	5	Soup, Fried Fish, Tomatoes Spinach, Potatoes, Pudding.		
Saturday.	2.6	5	Cereal, Coffee, Stew, Toast.	.5	4	Warmed-over Soup, Tea.	3.5	4	Steak, Potatoes, Coro, Baked Apples.	4.2	
Sunday..	3.1	5	Cereal, Coffee, Toast, Eggs.	5.0	4	Roast Beef, Potatoes, String Beans, Soup, Ice C'm.	.5	5	Cake (Baked Saturday), Salad, Tea.		
	17.2	35		13.1	27		23.6	30		4.2	2.9

2 8-in. stoves	1,625	watts.
1 6-in. stove	440	"
1 9x12-in. broiler	1,300	"
1 oven	1,500	"
1 plate warmer (12x14x20)	300	"
	5,165	watts.

Total cooking consumption	58.1	Kw. H.
Watts per person per meal	631	Watts.
Ironing	2.9	Kw. H.
No. of meals served	92	
Lighting consumption	5.63	Kw. H.
Milk warmer	1.63	Kw. H.

has sufficed to do all the laundry work, making it possible to discard the usual coal stove. The cost of operation is surprisingly low, being actually less than the cost of coal used in the laundry stove for the heating of irons alone. It is needless to say that the discomforts of a hot coal stove on a summer day are overcome by the electric iron. A prominent feature of electric ironing is the quickness with which the work is done. Undoubtedly education on the part of the public in the use of electric heating devices will tend to their more general use.

As a rule the public require more work from electrical devices than they do from a similar class of apparatus operated by coal or gas. A five-gallon clothes boiler will be placed on an eight-inch disk stove, and the user will wonder why the water does not boil. A proper selection of apparatus is a most important feature of this work.

The amount of energy lost by the ordinary coal or gas range is not appreciated by the average customer until the same is brought to his attention. After the food has been cooked on the electric stove the switch can be turned to "low heat" to keep it warm; the "medium" or "high heat" are no longer necessary. Then again, the heating units of the oven will keep the food warm after the current is turned off.

The consumption of fuel continues after the dinner is prepared in the coal range, but no work is done, whereas in the electric range the consumption of fuel terminates with the opening of the switch when the food is ready. The emphasizing of such principles as these will do much toward making electrical cooking a feature in the modern house, particularly in the summer months.

A chart (not given here) shows the current consumed and the time of consumption for a seven-pound iron which was used to do the work of six persons, exclusive of collars and cuffs and starched shirts. The ironing extended over two days of the week because of an extra amount of work that week. In this case the current consumption was about 4.3 kilowatt-hours for the week's work. The ironing load does not conflict with a possible summer lighting load, as the ironing work is finished by 5:07 p. m. each day.

Although we have had calls for an iron which is disconnected at the iron terminal, we find that there is so much trouble arising from weakness at that point, that we advise an iron which does not disconnect at the iron terminal, but depends upon a pull type of plug for its disconnection. We suggest the replacing of a key socket by a keyless socket for this work. Bring the socket near the ironing board, and you will have the best results. If a switch is placed in the cord at the iron terminal, we believe there is too much opportunity

The accompanying table shows the amount of current required for the preparing of each meal of the week and the nature of the food prepared for that meal. A 300-watt plate warmer 12 by 12 by 20 inches was added to a standard equipment. The vessels used were one six-inch double boiler with a porcelain food vessel; one eight-inch tea-kettle, capacity four quarts; two eight-inch vegetable boilers, capacity four quarts; one eight-inch frying pan. These vessels are made of copper, nickel-plated on the outside and made to lock upon the heaters on which they are used. It was necessary to add a plate warmer to this range, as there was no warming closet. The kitchen was operated by a domestic, without constant supervision by any-one familiar with electric devices. Preliminary instructions were given, and a few suggestions made from time to time. The range, I believe, was operated under ordinary conditions which would be found in a three-story detached frame house. An independent three-wire circuit was run from the service to the kitchen, where it was terminated in a switch cut-out. The range has been in constant use since its connection, without requiring any repairs or changes whatsoever.

The figures given in this table might be shaded slightly in consumption, but I believe if the number of people served and the nature of the food supplied were taken into consideration, you would find that these figures would present a very fair average. Having used an outfit last year under practically the same conditions, which did not have special utensils for each separate operation, I am convinced that, for domestic work, where one is looking for the best results, specially designed vessels must be used. I might add that an instantaneous gas water heater was used to supply hot water for bathing and laundry purposes.

The monthly (30-day) consumption of this kitchen was 249 kilowatt-hours, which would require a 2½-cent rate to put it on an equal cost footing with gas at $1 per 1,000 cubic feet. We believe that you can sell electric heat at a 25 per cent. advance over gas heat, which would allow you to sell current at 3.1 cents per kilowatt-hour.

1. Extracts from a report to the Association of Edison Illuminating Companies, presented at the convention at Hot Springs, Va., September 10-12, 1907. The author is connected with the New York Edison Company.

Landslide Damages Power Plants.

An entire mountain side sliding hundreds of feet to the bed of the Santa Ana River, near San Bernardino, Cal., has put out of commission two of the power plants in the Santa Ana Canyon belonging to the Edison Electric Company of Los Angeles. A large section of tunnel was carried down the mountain, and flumes and water pipes were badly wrecked. Still more serious damage is threatened unless the company can blow loose a portion of the mountain before other sections are affected. Engineers declare that the slide was started by an earthquake late in the summer, which opened a seam in the cement lining of the tunnel, permitting the water to saturate the soil and loosen the mountain side.

International Electrotechnical Commission.

Although not a great deal has been heard of the International Electrotechnical Commission which was established as the result of a resolution at the St. Louis Congress of 1904, substantial progress is being made upon the lines of the deliberations at the preliminary meeting held in London in the summer of 1906 under the auspices of the Institution of Electrical Engineers. Official information from the Institution of Electrical Engineers shows that local committees have been appointed in the United States, England, Germany, France, Denmark, Belgium, Austria-Hungary, Mexico and Sweden and that the appointment of similar committees in a number of other important countries, including Australia, Russia, South Africa, Canada and Japan, is under consideration. Prof. F. B. Crocker of Columbia University, New York, is secretary of the American local committee. The members of the American committee are:

Elihu Thomson, Lynn, Mass., president.
Charles F. Scott, Pittsburg, Pa., first vice-president
Samuel Sheldon, Brooklyn, N. Y., second vice-president.
Bion J. Arnold, Chicago, Ill.
Arthur W. Berresford, Milwaukee, Wis.
John J. Carty, New York city.
W. C. L. Eglin, Philadelphia, Pa.
Carl Hering, Philadelphia, Pa.
John W. Howell, Harrison, N. J.
Dugald C. Jackson, Boston, Mass.
Francis W. Jones, New York city.
Arthur E. Kennelly, Cambridge, Mass.
Benjamin O. Lamme, Pittsburg, Pa.
W. A. Layman, St. Louis, Mo.
John W. Lieb, Jr., New York city.
Clayton H. Sharp, New York city.
Charles P. Steinmetz, Schenectady, N. Y.
Lewis B. Stillwell, New York city.
Henry G. Stott, New York city.
Samuel W. Stratton, Washington, D. C.

The British local committee has already appointed a sub-committee on electrical nomenclature, and Mr. A. P. Trotter, the electrical adviser to the Board of Trade, is the chairman. A list of terms in general use in the industry is now being drawn up, together with their explanations, and it is the intention of the council of the commission to publish a glossary of electrotechnical terms in French and English. The question of symbols is to be taken in hand at a future time, while later on a sub-committee is to be appointed upon electrical machinery and apparatus with a view to bringing certain matters before the commission as a basis for international agreement. The central office has now been established at 28 Victoria Street, London, and through this co-operation is maintained with all the foreign local committees.

The Decomposition of Platinum.

Dr. Theodore Grosse's announcement that he has brought about the decomposition of platinum was mentioned briefly in a previous issue of the Western Electrician. Dr. Grosse adds that when the decomposition of platinum was effected he obtained an unknown chemical element consisting of black crysals in no way responding to the usual tests for platinum. His method follows: Molten potassium carbonate was subjected to a great heat in a platinum vessel. This was for many hours subjected to an alternating electric current between platinum electrodes, with occasional additions of niter. The electrodes became attacked and were coated with needle-shaped crystals of the color of charcoal. At the same time the platinum vessel and electrodes lost weight, and upon extracting the metal a brown powder free from potash and carbon was obtained. Upon test no platinum was present. The crystals and brown powder thus revealed the presence of an unknown substance and possibly a new element.

The fact that at various times William H. Hodgkinson and other well-known chemists have announced the discovery of the presence of some other elements in association with the elements comprising what is termed the platinum group renders Dr. Grosse's discovery the more credible. The significance of the discovery, although of no practical value at the present stage, is that a substance formerly supposed to be a single element is now found to be a compound. It illustrates how much work is still left for chemists. Dr. Grosse already enjoys a wide reputation both in this country and abroad. In 1897 he announced that he had decomposed sulphur into a new element, which he termed bythium. This discovery, although not universally accepted, has never been disproved.

ELEMENTS OF ELECTRICAL ENGINEERING.

By Geo. R. Metcalfe.

XLV.—Electric Railways.

Catenary Line Construction.

Where high-tension alternating current is carried on the trolley line for the class of roads just described, the ordinary type of overhead construction used for 500-volt direct-current systems is not sufficiently substantial, and a modification of it known as catenary construction is used.

Catenary construction may be of either the bracket or span-wire type, and on straight track the poles are spaced 150 feet apart. On curves this spacing is reduced according to the degree of curvature, so that the trolley wire extending in a straight line between points of support will not vary more than 17 inches from a perpendicular to the center of the track at any point.

A galvanized stranded steel cable is stretched between the brackets or span wires, according to the style of construction, and is pulled up to the desired tension, which is measured by the sag between supports. From this steel cable, which is known as the messenger cable, the trolley wire is supported at intervals of 10 or 15 feet by means of vertical hangers, which are made of different lengths, so as to maintain a trolley wire approximately horizontal. This style of construction is known as the single catenary, and is used for voltages up to 6,600.

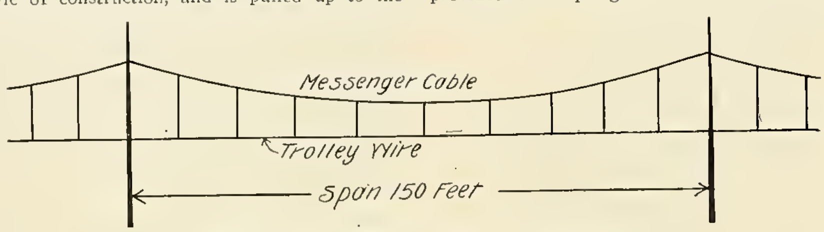
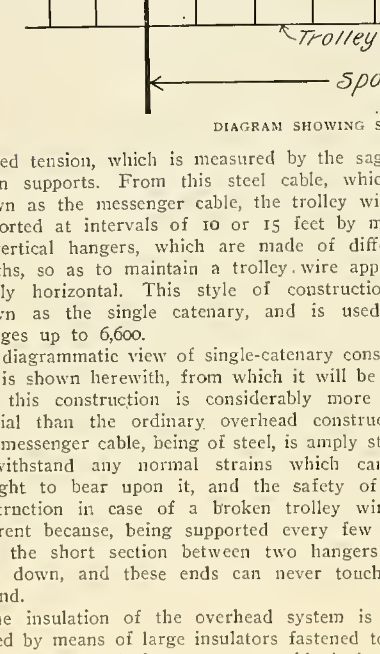


Diagram showing single catenary construction.

A diagrammatic view of single-catenary construction is shown herewith, from which it will be seen that this construction is considerably more substantial than the ordinary overhead construction. The messenger cable, being of steel, is amply strong to withstand any normal strains which can be brought to bear upon it, and the safety of this construction in case of a broken trolley wire is apparent because, being supported every few feet, only the short section between two hangers can hang down, and these ends can never touch the ground.

The insulation of the overhead system is furnished by means of large insulators fastened to the bracket arms, and the messenger cable is in turn fastened to these insulators. What are known as sleeve-type insulators are used for voltages up to 6,600, and for voltages up to 11,000 skirt-type insulators are used.



Perspective view showing suspension of trolley wire (C).

Arrangement for double catenary construction.

Where very heavy construction is required, what is known as a double-catenary-line construction is employed. In this case two messenger cables separated a short distance from each other are substituted for the single messenger cable described above, and the hangers, instead of being single rods, consist of triangular frames of different sizes proportioned so as to support the trolley wire approximately horizontal. In the second sketch (A) and (B) represent the two messenger cables, (C) is the trolley wire and (D) the triangular hanger. From this it will be seen that the trolley wire is located centrally beneath the two messenger cables. This type of construction is in use on trolley circuits operating at 11,000 volts, and it can undoubtedly be insulated for any voltage which may be found practicable to adopt.

Pantagraph Trolleys.

What is known as the pantagraph trolley is used for collecting the current on catenary lines. The current collector, instead of being a wheel, consists of a bar of galvanized steel several feet in length which is supported at either end by a framing jointed similarly to a pantagraph, so as to permit a wide range of vertical motion. When raised to its greatest height the collector stands about 9½ feet above the roof of the car, and when closed down it is less than two feet above the car roof.

The great advantages of this type of trolley consists of its wide range of motion, its uniform pressure at any height and its ability to be operated in either direction. The lower part of the frame is provided with springs which tend to maintain the frame at its highest position, and an arrangement of spring levers permits a uniform pressure against the conductor throughout the full working height of the conductor. The trolley is forced down to its lowest position and is latched or unlatched by means of compressed air.

The control of the trolley is in the hands of the motorman, who, by means of a three-way cock, can either lower the trolley and latch it in its lowered position, or unlatch it, after which the springs return it to its running position.

These trolleys are in use on 11,000-volt lines, and their current-collecting capacity may run up to 400 amperes or more, depending upon pressure of the sliding shoe.

[*To be continued.*]

QUESTIONS AND ANSWERS.

Hazard of Moving-picture Machines.

G. L. M., Chicago: Please enlighten one of your subscribers in relation to the hazard of moving-picture machines which are so common at the present time.

Answer.

In view of the large number of these equipments now being temporarily installed throughout the country there is naturally more or less hazard incident to carelessness or defective installation of apparatus. The main hazard is due to the films. These films vary in length from some 800 to 2,000 feet, are made of thin celluloid, the base of which is the unstable and dangerous compound, guncotton. They readily burst into flame at a comparatively low temperature and, under favorable conditions, such as are met with in these operating booths, will burn almost explosively. The arc lamps throwing this picture are so constructed as to minimize the probability of a broken film coming in contact with the arc, but, when broken, the loose lengths of these films coil themselves about the place very much like the loose spring of a Waterbury watch, and are likely to find their way to any part of the room.

In operation, light from the lamp is thrown on a small section of the moving film, through lenses, and the focusing effect tends to produce heat similar to that from the sun glass. It will be readily seen in view of this that should some defect in the mechanism or feed cause the film to stop for a few seconds, unless a shutter is promptly dropped to cut off the heat, the film would quickly burst into flame. It is for this reason that an automatic shutter is required. It should be borne in mind that the film burns quickly, and, if so enclosed that the sudden flash cannot communicate fire outside the operating booth, this hazard can be eliminated, and, owing to the short duration of the fire, this is not difficult of accomplishment. The other hazardous features are mere matters of construction, consisting of defective wiring and improperly located rheostats or resistances, both of which can be obviated by inspection.

The operating mechanism is usually contained in an elevated booth at the front of the building, ordinarily of dimensions of about five by eight or six by ten feet, and the picture is thrown on a white curtain at the opposite end of the building. As it is essential that the auditorium be kept dark, the operating booths are generally entirely closed, with a small opening toward the curtain through which the picture is thrown. With an experienced operator and the apparatus enclosed in a fireproof booth conforming to the requirements of the National Electrical Code, the probability of fire loss would be reduced to a minimum. The greatest hazard will be in small towns, due to inexperienced operators, defective and uninspected equipments and installation and inferior fire protection. A chemical extinguisher might well be required in these places.

A Remedy for Cross-talk.

Apropos of the answer to E. G. A. in the Western Electrician of November 2d, page 360, Mr. W. F. Hankins of Gordon, Neb., kindly adds the following:

"The questioner says, 'Lightning causes a lot of burnouts.' That being the case, it looks as if the apparatus (including repeating coils, if such are used) should be protected with good carbon arresters.

"In regard to cross-talk: It seems unlikely that any considerable amount of cross-talk, due to either static or magnetic induction, could be caused by the lines being parallel for so short a distance as one-half mile, unless the wires are very near together. If the wires are on the same poles, there may be leakage of current between them. It is also possible that there is apparatus connected to each line using the same ground. In that case a slight resistance in the ground connection would cause trouble. If the lines are connected to a switchboard, the fault may be in the board or its ground connection."

Engineering in Russia.

Engineering development in Russia is of a very unequal character. As regards the more modern engineering advances, such as the use of electrical energy for lighting and the telephone, the larger cities have a service which, though expensive, is satisfactory. As regards the more elementary necessities of a civilized community, water supply, drainage, transport facilities for passengers and goods, the country is very much more backward. Industrial enterprise has been undoubtedly retarded by the unsettled political situation.

The first development which is to be expected is the improvement of the means of transport. The two great cities of Moscow and St. Petersburg now have electric traction over a part of their tramway systems, but the length of street which is equipped in this way is very small compared with what must ultimately be required. In Moscow, also, only about one-half of the city has electric tramcars, all lines south of the Moskva and some of the circle routes being still operated by horses.

Another example of the same thing is the carrying out of the electrification of the St. Petersburg tramways at a cost of 10,000,000 rubles. It is not a little remarkable that, although this electrification has been proceeded with at a time of great political disturbance, the delay caused by labor difficulties has been almost negligible; the Russian workman when once he understands what is required of him does his work well, and, in the opinion of some engineers of great experience, is quite as effective as an Englishman.

Electric light is used in practically all the best houses and hotels in the larger towns; in the other quarters the poverty is so great that the supply of the small consumer is almost out of the question. There is, however, with the gradual improvement of the cities, always an increasing demand for electric light, a fact well illustrated by the large extension, by over 8,000 kilowatts, which is now being made in the central station at Moscow.

As regards electric power, very little has been done. There is not the same possibility as there is in America or the mountainous parts of Europe, for large schemes in which waterpower is used to generate electrical energy, since there is practically no waterpower in Western Russia. There is, however, a vast supply of oil available. In several electric-light stations oil is now used in preference to coal for firing the boilers. The attendance required is reduced to a minimum; one man can easily look after a battery of 20 boilers, and, as regards cleanliness, the oil-fired boiler is greatly to be preferred to that in which coal is the fuel.

In the Moscow station to which reference has already has been made the whole of the new part of the station is designed with oil-filled boilers, and nearer the oil fields, where the fuel is cheaper, it seems hardly likely that coal will be used at all. The possibilities of the oil engine on a large scale would appear to be worthy of very careful consideration, since the economy in fuel over oil-fired boilers and steam engines should be very great. The price at present charged for electrical energy is high; in some places there is a maximum charge of 50 kopecks [25 cents] per Board of Trade unit [kilowatt hour.] This, however, is seldom obtained, and the usual price is from 25 to 30 kopecks per Board of Trade Unit. For power the charge is much less, but the supply of power on a large scale is at present in its very early stages.—Part of an article by Prof. E. W. Marchant in London Times Engineering Supplement.

OBITUARY.

Charles P. Matthews.

Dr. Charles Philo Matthews, professor of electrical engineering at Purdue University, died on Saturday, November 23d, at Phœnix, Ariz., where he had gone in the hope of recovering his health. While his death is supposed to have been due to consumption, Professor Matthews at the time he left his university duties on a temporary leave of absence in the fall was suffering as well from heart trouble and from the injury to his eyesight

PROFESSOR MATTHEWS.

incurred at the time of the extensive photometric researches which he carried on several years ago.

Professor Matthews was born September 18, 1867, at Fort Covington, N. Y. He was graduated from St. John's Academy in 1887 and from Cornell University in 1892, receiving his degree of Ph. D. from the latter in 1901. After several years of service in the instructional corps of Cornell as an instructor in physics and electricity, he was called to Purdue as associate professor of electrical engineering, and upon the resignation of Prof. Winder E. Goldsborough in 1905 became the head of the department.

Professor Matthews was an authority upon the subject of electric lighting, and his invention of the integrating photometer served to bring his name before electrical men all over the world. The instrument was devised while Professor Matthews, as photometrist for the National Electric Light Association, was engaged in making tests of arc lights. Later he developed the integrating photometer for incandescent lamps upon a similar principle. Professor Matthews was a member of Sigma Xi, the honorary scientific fraternity, of the American Institute of Electrical Engineers and of the Society for the Promotion of Engineering Education.

Though his illness had been of long standing, he could not be prevailed upon to take a rest from his duties at Purdue until a few days after the present university term opened in September, when he set out for the Pacific Coast, hoping the change would bring about an improvement in his health. His letters to friends at the university in Lafayette, Ind., were very cheering as to his condition, and the news of his death came as a great shock. Indeed, cheerfulness and patience were the keynotes of his life, and though in latter years he scarcely enjoyed a day of health, he gave no outward evidence of his illness and impressed all by his cheerful ways. Blessed with a keen sense of humor and a faculty for telling delightful stories in the French-Canadian dialect, his own pleasure was in imparting happiness to others. In the classroom his students tell with real affection of the endearing traits of "Candle Power" (a Campus nickname based upon his initials)—of his dizzying demonstrations in polyphase currents, his grasp of essentials in "exams" and his ability to "tell more than is in the book."

Possessed of the true scientific spirit, a manly, modest man of lovable character, the death of Professor Matthews at the early age of forty is greatly regretted. The funeral took place at Fort Covington.

S. F. B. Morse.

The Telegraph Age says that "Samuel F. B. Morse, a grandson of the late Prof. S. F. B. Morse, died at Buffalo, N. Y., November 15th, aged 54 years." This is undoubtedly the S. F. B. Morse who was prominent in the wire business and in electrical circles generally in Chicago 10 or 12 years ago, and if so, the news will be sincerely regretted, for, although by no means faultless, Mr. Morse was generally liked for his generosity, kindliness and cheerfulness.

S. F. B. MORSE.

Mr. Morse bore the same name as his illustrious grandfather and he was proud of his descent. He had when in Chicago a large collection of objects, like pictures, books and newspaper clippings, relating to Professor Morse and his far-famed telegraphic inventions. But he was an entirely different man from his grandfather, as he was himself the first to admit. He enjoyed the creature comforts of life, and was generous to a fault. He was born in Brooklyn in 1852 and held a number of positions with telegraph companies in earlier life and with electrical and other manufacturing concerns in his later years. He was with the Atlantic and Pacific Telegraph Company at the Centennial Exhibition in Philadelphia. In Chicago he was western agent for Day's Kerite wires and cables for several years, but later he engaged in non-electrical pursuits, and finally he drifted from Chicago and out of the ken of his electrical friends, who, however, continued to hold him in kindly memory.

Professor Michelson Gets the Nobel Prize for Physics.

The Nobel prize for physics has this year been awarded to Prof. Albert A. Michelson, head of the department of physics at the University of Chicago. The Swedish Academy of Sciences, which is given the duty of annually selecting the scientists whose work has been of greatest value to the human race, has voted him the honor and the gift of $40,000 that go with each prize, for his work on the measurements of the velocity of light propagation and of the wave lengths of different light rays. On November 29th Professor Michelson received in London the Copley medal from the Royal Society of England for his experiments on light. On December 10th the Nobel prize will be formally conferred on him in Stockholm, Sweden.

The most important of Professor Michelson's scientific achievements are in his researches on light. In his measurements of the velocity of light, which yielded the most accurate results ever attained, he used the revolving-mirror method devised by him. Subsequently he invented the interferometer for measuring minute wave lengths. Another instrument of great value that he invented is the echelon spectroscope. By means of these instruments of precision he analyzed spectrum rays and found many of them that were regarded as simple rays to be actually complex in nature.

Indian Service Wants Engineers.

The United States Civil Service Commission announces an examination on January 8, 1908, at over 200 places in the country, to secure eligibles from which to make certification to fill four vacanices as stationary engineer and other similar vacancies as they may occur in the Indian Service. All applicants should be able to operate boilers, steam engines and pumps; some of the positions also require the running of steam-heating plants, dynamos and electric-light apparatus. All applicants must be over 20 years old and must make early application by writing or in person to the secretary of the board of examiners at any office of the United States Civil Service Commission in the country. Salaries offered range from $480 to $1,000 per annum. Further particulars may be obtained from any of the secretaries mentioned above or from the United States Civil Service Commission, Washington, D. C.

Lewis Institute Branch of American Institute of Electrical Engineers.

Another student branch of the American Institute of Electrical Engineers has been organized in Chicago. Through the active assistance of Prof. P. B. Woodworth this branch has just been started at Lewis Institute with 29 charter members, of whom W. H. Hayes is chairman and M. G. Kopf secretary. The first regular meeting was held on the evening of November 27th, this being the occasion for an interesting illustrated lecture on "Automatic Telephony," by Edward A. Mellinger, assistant engineer of the Automatic Electric Company.

Parts of a 100-subscriber switch unit were used in demonstrating the construction and operation of the line, selector and connector switches. Lantern slides showed circuit diagrams, details of the switches and views of exchanges in operation. Some of the most striking points brought out were that the automatic system has been so far developed that branch exchanges and party lines with selective ringing are now in successful operation without the assistance of any manual help and that the "girlless" system can be extended to have a million or more subscribers automatically interconnected in one system of central and branch exchanges.

Public Utilities Merger in Baltimore.

The deal has been closed by which the Consolidated Gas, Electric Light and Power Company of Baltimore leases for 999 years the Baltimore Electric Company, with its power plants and sub-stations, and the Maryland Telephone Company, which it also controls. The Consolidated company owns and operates large electric-light and power plants and sub-stations, together with the full control of all current to be supplied within a radius of 25 miles of Baltimore by the McCall's Ferry Power Company, now building a plant on the Susquehanna River.

By this merger practically all of the electric power generated for public sale in the city is controlled by the Consolidated company, which also has full control of generation of all illuminating gas. It is the intention of the company to arrange the distribution of the power so that all manufacturing companies in Baltimore County and around the city will receive power from McCall's Ferry Power Company, while commercial electric-light and power users within the city will be supplied by the several consolidated steam plants. It is probable that the Maryland Telephone Company will be merged with the Chesapeake and Potomac Telephone Company, thereby giving the latter company full control of the city's telephone system. Alten S. Miller is general manager of the Consolidated company.

BOOK TABLE.

Lamp Lighting Schedule for 1908 (Western Electrician's Moonlight System). Chicago: Electrician Publishing Company. 1907. Pp. (3½ by 5⅝ inches), 32. Price, 10 cents.

The "Moonlight Schedule" for 1908 is a handy little booklet of much value to men in charge of street-lighting plants. This system is based on "The Philadelphia Moonlight Schedule," which gives standard rules for lighting and extinguishing lamps in relation to sunset and moonset and sunrise and moonrise. The interpretation of these rules has caused considerable confusion, however, so to avoid disputes a schedule stating definitely when to light and extinguish the lamps is absolutely necessary for every day in the year. The booklet also explains the departures from the table that must be made for changes in latitude from that selected (41 degrees) which approximates New York city, Cleveland, Chicago and Omaha. The details of the system are explained and every feature made clear so that all questions may be avoided.

Traffic Results of the Simplon Tunnel.

The first year's (1906-1907) operation of the Simplon Tunnel did not meet expectations. During the year only 27,400 tons of goods entered and 29,400 tons left Italy over this line, while 430,000 passengers were carried through the tunnel. The authorities expect that at least 100,000 tons of goods will annually pass through the tunnel. The line earned $5,170 a mile; the estimate was $6,000 a mile. The company calculated that the line would have to produce $6,000 in order that the second tunnel could be built, construction of which has been postponed.

Fittings for Superheated Steam.[1]

By August H. Kruesi.

General Conditions.

While there is some question as to the exact economy effected by the use of superheated steam, due to lack of accurate data as to the extra amount of coal required to obtain a given amount of superheat, there is little doubt that superheating in moderate amounts, say, up to 200°, pays in connection with steam turbines; and it is quite practicable to work to this degree of superheat by the use of suitable materials and properly designed apparatus. Experience with turbines especially designed for such service indicates that they require no additional attention or maintenance due to the use of highly superheated steam, and in this respect they are superior to other apparatus and material forming the steam plant. Superheaters themselves have been a source of considerable trouble in many plants, largely on account of leaky joints, occasioned by variation of temperature through wide limits. It is an essential requirement in a successful superheater that it shall be readily drained of water. It is desirable also that the flow of steam shall be continuously downward through it and from it, that is, that it shall neither contain water pockets within its structure nor constitute a water pocket as a whole.

The feature of the plant which requires most attention in design on account of superheat is the steam piping. Experience in plants at Schenectady and Lynn and elsewhere with superheat up to 300° F. indicates that the piping must be radically different for satisfactory operation, as compared with that which has been considered good practice in connection with saturated steam, piping of the latter kind having failed under superheat in a considerable number of cases. This is partially due to the high temperatures involved, but probably in the largest degree to variation of temperature. Observations by thermometer and by recording pyrometer on the outlets of individual boilers and in headers carrying steam from a number of boilers show that the temperature in the header receiving steam from a number of boilers may remain fairly constant while the temperature of steam from individual boilers, even under steady load on the plant, varies incessantly in a large degree. In a particular plant equipped with boilers and combined superheaters designed for 125° superheat over 180 pounds pressure it was found in test with a perfectly steady load that the superheaters actually gave averages of 89° at one-half load, 130° at full load and 142° at 50 per cent. overload. In actual service, with hand firing under variable load, the superheat varies 50° in almost any 20-minute period which may be selected. The superheat frequently reaches a value of 225°, and from this to zero at the time of cleaning fires.

Cast-iron in Superheated Steam Lines.

Experience convinces the writer that under such variable conditions (which apply in greater or less degree to every plant, depending upon the type of boiler and superheater used and the nature of the load) cast-iron and so-called semi-steel are totally unfit for use for flanges, fittings, valve bodies or other essential parts required to withstand the steam pressure and temperature in all pipe lines of four-inch size and larger. Parts made of these materials have had to be replaced in a large number of instances on account of excessive warping and cracking or other dangerous developments, in some cases after four days' operation, and in other cases not until three years had elapsed. Many cast-iron fittings have had to be replaced on account of cracks like spider webs over the entire surface, and more particularly on account of radial cracks in the flanges.

It appears that cast-iron fails more on account of lack of elasticity than because of insufficient strength, and this failure is due to incessant and rapid variation in temperature rather than to high temperature. The fact that grate bars and stove plates warp and crack is a matter of common observation, and is due to the wide range in temperatures to which they are subjected. Cast-iron has been known to enlarge in volume as much as 40 per cent. and in linear dimensions as much as 8 to 10 per cent. when heated through wide ranges in temperature, such as occur in annealing ovens. The writer has removed cast-iron fittings which had taken a permanent set, increasing the length from one to two per cent. inside of a week's time. Numbers of valves of the globe type made of semi-steel have increased in dimensions to such an extent that the seat ring of a six-inch valve, for example, originally threaded tight into the body, could be lifted clear of the threads when cold, representing an enlargement of the diameter of the body at the seat ring of over three per cent.

It is generally believed that water may exist in the presence of superheated steam under certain conditions, and it is probable that such difficulties with cast-iron parts are chiefly due to the occasional spraying of highly heated interior surfaces with water carried by the steam, resulting in extremely rapid local cooling of considerable extent, which would fully account for radial cracks in the flanges, generally the first evidence of distress. This belief is confirmed by the observation that in a certain header receiving steam from individual boilers through side openings in cast-iron header manifolds, so that steam and entrained water impigned on the sides of the manifold opposite the openings, replacement of the manifolds has been necessary. Semi-steel angle valves in which water, when present, can impinge on the inside surfaces of the bonnets, have failed similarly. On the other hand, straight cast-iron fittings carrying the same steam have proved satisfactory, the only difference being that they are arranged vertically; and the flow of steam through them being parallel to the sides of the fittings, there is no impingement or local cooling.

It is undoubtedly true that cast-iron has given satisfactory service in superheated-steam lines in a number of plants, and this will not appear contradictory to the experience in other plants where it has been unsatisfactory, if the explanation offered above is correct. The writer believes it wrong to regard cast-iron as safe because it has in many instances given no trouble. The rapidity with which it will go to pieces will depend largely on the nature of the service as regards fluctuations in load and consequent fluctuation in temperature and priming of boilers. That it will ultimately become unsafe for use seems inevitable, but the danger may not be discovered until serious results ensue, for the reason that such fittings are usually completely covered with heat-insulating materials. It cannot be assumed that cast-iron is safe for use up to the time that large cracks occur and are detected. The writer has found fittings in which the most careful examination would disclose only minute cracks, but the fittings could, however, be readily broken up with a light hammer.

As stated above, it seems probable that smaller piping, say, 3½-inch and less, can safely be made with cast-iron flanges and fittings and other parts as well as with valves of brass of good composition. The reasons for the more satisfactory behavior of these materials in such small sizes are probably as follows: Such lines are generally remote from the boilers; and, on account of radiation, the superheat of the steam they carry is generally less, consequently the temperature variation which they undergo is materially reduced. These small lines usually contain many bends and fittings; and, being more removed from the boilers, sufficient time probably elapses for water carried over with the steam to be more or less completely evaporated into steam. The bends and fittings undoubtedly contribute to the evaporation of such water. The effect would be to lower the superheat, and such fittings having smaller flanges and thinner walls, will be of more nearly the same temperature inside and out when water happens to strike them.

Attempts have been made to find a clue to the reason for cast-iron being unsatisfactory, in the chemical analysis of parts which have cracked or warped badly; but the reason will probably be found in the lack of elasticity inherent to all cast-iron. The following table shows the analysis of three valve bodies which cracked badly. These came from the same foundry.

	Valve 4.	Valve 8.	Valve 12.	Manifold 1.	Manifold 2.
Silicon	2.56	2.54	2.59	2.61	1.81
Sulphur	.06	.08	.058	.132	.11
Phosphorus	.69	.77	.905	.40	.58
Manganese	.50	.64	.64	.275	.33
Combined Carbon	.25	.24	.24	....	.64
Total Carbon	3.44	3.50	3.48	3.26	4.64

Figures are also given for two manifolds, size 8 by 6 by 6 by 8. The manifolds were probably both made in the same foundry and at about the same time, but have no relation to the three valves. The two manifolds were put in service at the same time and were subject to conditions believed to have been identical when they were replaced, manifold No. 1 being in practically perfect condition, whereas manifold No. 2 (typical of many others) was covered with cracks, more particularly in the flanges, many of the latter cracks being one-eighth inch wide and extending from the outside edge of the flange through the body of the casting. These castings would be called good for all ordinary purposes, and the figures indicate nothing to which the unsatisfactory behavior can be ascribed.

Cast-steel in Superheated Lines.

Cast-steel has been in use for fittings and valve bodies for a considerable number of years, and has, in some cases, caused trouble on account of cracks, splits, blow holes, sand holes and other foundry defects which were not at first apparent but which manifested themselves in service with superheated steam after the lapse of considerable time. The trouble in some instances was due in part to making steel castings from patterns designed for cast-iron. The art of making steel castings has developed very rapidly, and such difficulties are now infrequent and can be minimized by correct design in the way of maintaining the thickness as nearly uniform as possible, and, where changes in thickness or contour occur, by providing fillets of large radius. Blow holes and other defects in flanges can be minimized also by pouring the castings through more than one gate, and it is desirable in the case of pipe fittings that they be poured at each flange. Annealing helps to show up defects, and is desirable in order to avoid the expense of machining defective castings, as well as to relieve shrinkage stresses. Such steel castings cost about twice as much per pound as similar iron castings, but can usually be successfully made with a thickness of wall not exceeding three-fourths inch, so that the saving in weight largely offsets the increased cost per pound. Open-hearth castings are preferable to converter castings, on account of their higher elastic limit.

Valves.

Gate valves of various makes have proven in many instances practically worthless after short periods of operation under superheated steam. This is often due to their being used incorrectly. A gate valve with solid plug will seldom seat truly unless placed in a horizontal pipe line with the spindle vertical and the hand-wheel on top. Any other arrangement of the valve is practically certain to cause the plug to rotate about its center line so that its faces will not be parallel to the seats, hence it cannot close tightly. Any warping of the valve body on account of its very unsymmetrical shape will have the same effect, and gate valves are open to objection on this account even when made of steel. It therefore becomes an object to return to the use of globe and angle valves wherever possible, it being generally practicable to regrind or reface the seat of such valves in place without breaking joints. The disks can, of course, be readily removed and refaced in a lathe. Stems, seats, disks and other internal parts are frequently made of bronze or nickel bronze. These materials become very "short" at the temperatures under consideration and have a coefficient of expansion approximately 50 per cent. greater than that of steel or iron, and hence quickly become loose and lose their fit. The operating valves of Curtis turbines have for some years been made of mild steel, seating on seats of the same material, and have after extensive experience proved most satisfactory. These seats have the same coefficient of expansion as the steel bodies in which they are mounted, and have never become loose. It is well known that steel retains its elasticity practically unimpaired at the temperatures commonly employed in superheated-steam work. Experience may prove that nickel-steel alloy containing a high percentage of nickel is preferable for seats and disks, on account of less corrosion, but nothing in the writer's experience indicates that this will be the case.

Flanges and Gaskets.

The foregoing considerations concerning cast-iron and steel apply to pipe flanges as well as to fittings. Gaskets of corrugated copper are in common use, but in the writer's experience copper gaskets of any kind have proven worthless in superheated-steam work, chiefly because copper anneals at a temperature as low as 600° F., or about 220° superheat above 180 pounds pressure. Corrugated gaskets of any kind are open to the objection that careless pipefitters in making up a joint can readily overstrain the bolts and flanges. Gaskets of asbestos and rubber compounds or other organic material, while often temporarily successful, can seldom be regarded as permanently satisfactory. The writer believes the most satisfactory gasket to be one of thin sheet steel not more than five-eighths inch in radial width, so that heavy pressure can be brought on it with bolts and flanges of ordinary weight, the steel being soft annealed so that it can be pressed into the rough surface of the abutting flanges with a reasonable tension on the bolts.

1. A paper read at the annual meeting of the Association of Edison Illuminating Companies at Hot Springs, Va., September 10, 11 and 12, 1907. The author is designing engineer for the General Electric Company.

Angle Between Trolley Pole and Wire.

[From the Question Box of the American Street and Interurban Railway Engineering Association.]

What should be the angle between trolley pole and wire?

Answers.

R. A. Dyer, Jr., Auburn and Syracuse Electric Railway Company, Auburn, N. Y.: Do not know the angle, but a short pole is preferable to a long one.

D. Thomson, De Kalb-Sycamore and Interurban Traction Company, De Kalb, Ill.: About 45°.

H. H. Adams, United Railways and Electric Company, Baltimore: About 45°.

W. J. Jones, Austin Electric Railway Company, Austin, Tex.: Forty-five degrees, as at this angle the trolley wheel will follow the wire better and a more nearly even pressure is maintained.

George W. Knox, Green Bay Traction Company, Green Bay, Wis.: Thirty degrees.

H. R. Fothergill, Greenville (S. C.) Traction Company: Forty degrees, with 35-pound pull at end of pole.

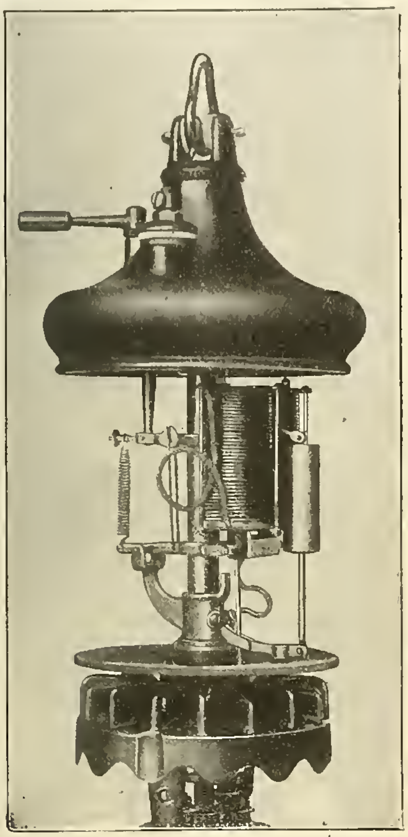
The Magnolia (Ark.) Ice and Light Company will rebuild its electric-light plant, which was recently damaged by fire

Arc-light System for Small Towns and Isolated Localities.

Frequent demands are made for a simple and inexpensive method of arc street lighting for small towns and isolated sections of larger cities, and any developments in this line are of interest to central-station men. A multiple system of alternating-current enclosed arc lighting intended for the needs of the smaller towns is described in a recent bulletin of the Fort Wayne Electric Works. It was developed by the engineers of that company.

The general plan of this system is shown in the accompanying diagram. It is a three-wire single-phase high-tension transmission system with a two or three-wire secondary distribution for incandescent lighting and a two-wire multiple arc-lighting circuit for each lamp. The incandescent lighting circuits are supplied from ordinary transformers having a ratio of 10 to 1 or 20 to 1, giving standard secondary voltages for the operation of the house circuit.

The arc-lighting circuit consists of one of the incandescent mains and an additional third wire connected at the switchboard to the other side of the incandescent-lighting circuit through a single-pole single-throw switch. This switch controls the arc-lighting circuit. Each lamp is connected to the secondary terminals of a small type MA transformer having primary coil connected between the



MECHANISM OF TRANSFORMER-TYPE ARC LAMP.

third wire and a common wire of the incandescent circuit.

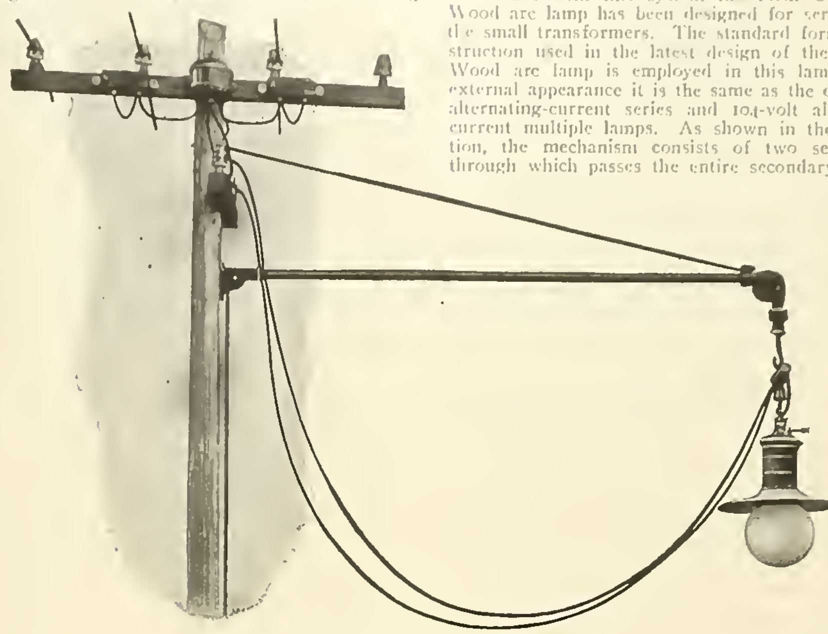
A standard switchboard panel has been designed for use with this system and is equipped with expansion fuse holders, ammeter, voltmeter, ground detector, receptacles and plugs, rheostat hand-wheel, card receivers, double-pole station switch and a single-pole station switch.

The primary terminals of each transformer are connected to the line through fused cut-outs or switches. These cut-outs are mounted on a cross-arm of the pole on which the transformer is installed. They are made of porcelain and are of such shape that they may be used as leading-off insulators for the line wire running to the transformer. The insulator type fused cut-outs recommended are shown in the general plan.

Since the power factor of the system depends directly upon the power factor of the individual transformers and lamps which are in multiple with each other on the line, the power factor of the system is therefore kept at approximately constant value whether there are two transformers or forty in operation; hence the system does not, when operating at light load, consume unproductive generator capacity. The efficiency is high and is the same for all loads, because the system efficiency is not affected by changing the number of lamps in circuit.

A feature of this multiple alternating-current system is that lamps of different candlepower or current can be used by simply using a type MA transformer specially designed to give the desired current. In this way low-energy arc lamps for interior lighting may be used on the same circuit with lamps consuming higher current and giving stronger light for outdoor service.

In many instances it is desirable to locate arc lamps in places where arc circuits are not installed. In such cases the transformer and arc lamp can be installed directly on the incandescent wiring network without any additional expenditure for installing the extra wiring or extending an existing



A MULTIPLE ARC-LIGHTING UNIT.

arc-light circuit. In installing the system it is only necessary to run one additional wire along with the two incandescent lighting mains wherever these mains are installed, or extend one of the incandescent lines and add the third wire for the arc-circuit return wherever it is desired to install arc lamps outside the territory covered by the incandescent mains.

Store lighting by arc lamps can be supplied from the same mains as the street lighting by installing the type MA transformer on the outside of the building or on a nearby pole and running the secondary wire to the interior the same as is done for the incandescent lighting.

No additional equipment to an existing plant is required except the arc lamps, their individual transformers and the third wire. There are no regulating devices in the station to get out of order, the arc-lamp transformers furnishing all regulation and safeguards. The line voltage of the system is not excessive and it is not possible for anyone handling the lamp to receive line voltage, since the lamp is connected only to the secondary of the special transformer and the secondary is wound separately

ARC-LAMP TRANSFORMER.

from the primary coil and is not ordinarily in contact with the same. This feature of the system renders it adaptable to interior as well as exterior lighting service.

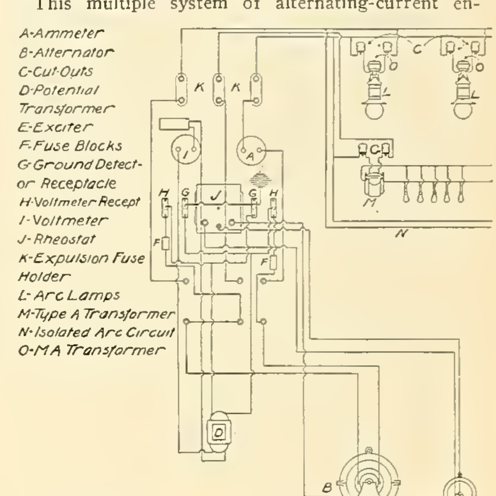
The air-cooled type MA transformers, shown in the illustration, are designed with a single primary coil wound for 1,050 or 2,100 volts and a separate secondary coil. They furnish a ratio of transformation from constant primary voltage to a constant secondary current for the arc lamp. The 1,050-volt transformer will operate satisfactorily on circuits from 1,000 to 1,100 volts and the 2,100-volt transformer on circuits from 2,000 to 2,200 volts, without any further adjustment. The transformer can also be furnished for circuits of 2,300 volts.

When adjusted for operating conditions with the lamp in circuit and six amperes in the secondary, the transformer supplies about 77 volts at the lamp terminals. The regulation is an inherent quality and is such that a practically constant current is maintained in the secondary throughout the range of primary voltage variation from 800 to 1,250 volts. It will regulate from open to short-circuit with a rise in secondary current not exceeding 10 or 11 amperes. This makes the transformer especially valuable as a protection to the regulation of the incandescent-lighting circuit.

For use with this system the form C enclosed Wood arc lamp has been designed for service with the small transformers. The standard form C construction used in the latest design of the enclosed Wood arc lamp is employed in this lamp and in external appearance it is the same as the direct and alternating-current series and 104-volt alternating-current multiple lamps. As shown in the illustration, the mechanism consists of two series coils through which passes the entire secondary current The series magnets furnish the actuating energy for maintaining and regulating the arc. The clutch is suspended from the dash-pot lever, the motion of which is steadied by the dash-pot.

This company's suspension pulley, known as the "Sure Grip," is recommended for all street arc lamps. It is an automatic locking pulley and is a great time-saver for the trimmer as well as a protection for the lamp. The pulley is locked when the lamp is raised into the proper position and is unlocked only by raising the lamp three or four inches higher before lowering. These pulleys are made for use with outriggers, as shown in the illustration. When it is necessary to trim a lamp, without lowering it to the ground it can be drawn in to the pole by means of a traveling Sure Grip pulley. This pulley is used in connection with a twin-pole pulley and a fixed pulley at the point of suspension.

This multiple system of alternating-current en-



WIRING PLAN OF MULTIPLE ALTERNATING-CURRENT STREET ARC-LIGHTING SYSTEM (BACK OF BOARD).

closed arc lighting has been installed in a number of localities and is said to be giving entire satisfaction.

A member of the firm of Arthur Young & Co., chartered accountants, has been appointed to prepare a system of bookkeeping in connection with the business of the Chicago Telephone Company by which the city will be able to determine, at the end of 30 months, what will be a reasonable rate to charge for telephone service in Chicago. Under the terms of the franchise granted the Chicago Telephone Company, the city comptroller has the power to prescribe in detail what information the books of the company shall show and exactly how the bookkeeping shall be done. This provision of the ordinance was said by advocates to be one of its most important sections.

Interurban Railways.[1]

By Hugh J. McGowan.

This notable gathering may well be called a congress of representative business men, national in its scope and purposes. You have assembled here this evening from many states of the Union to exchange views and discuss topics of vital importance to the country. Men of national distinction in their different spheres have come here to address you. I therefore feel that it is no slight honor for me also to be selected to speak to you and upon a subject which has within the past few years awakened so great an interest among investors and the traveling public. Permit me to thank you most heartily for this distinction, and without further preface I will proceed to the subject in hand.

The social and economic progress of all peoples has been indicated to a great degree by their advancement in improved facilities for travel. The evolution of transportation is contemporaneous with the march of civilization. Development has gone steadily on. Centuries passed before the wheel was employed; then followed the cart, wagon and other vehicles drawn by beasts of burden. The problem of mechanical propulsion occupied the thoughts of men of genius for centuries, until steam was finally mastered and made successfully to serve commercial purposes, resulting in that great masterpiece of mechanical ingenuity, the locomotive of today.

Ninety-three years have elapsed since George Stephenson gave to the world the first practical locomotive. During all that time inventive minds in Europe and America have been perfecting the "iron horse." But while some were experimenting with steam, others were following a more subtle power—electricity—culminating in the invention of that marvel of the age, the electric motor, which has worked such wonders in our times and has revolutionized business and social conditions.

The successful operation of electric street railways in general dates back 20 years. First confined to the streets of cities, they gradually extended in the suburbs, thence to nearby towns, or as far as direct current would take them. It was not until the introduction of the alternating current some ten years ago, which made possible the transmission of electric energy over great distances, that interurban railways became a well-established factor in transportation. Our purpose tonight is to refer briefly and in a general way to the interurban railway, its present development and its future possibilities, without entering into the details of its history or burdening you with elaborate statistics. It should be mentioned, however, in passing, that some of the earliest and most successful experiments in traction development were made in this great city of Chicago.

An interurban railway may be defined as a high-speed electric railroad having nearly all its mileage outside the limits of municipalities and running, as the name implies, between cities, serving at the same time intermediate towns and villages. Transmission of power is generally by overhead trolley, although the third rail is used in some sections of the country to a limited extent. Heavily ballasted roadbeds with from 70 to 90-pound rails constitute typical construction. The up-to-date equipment consists of large and elegantly appointed double-truck cars, approximately 62 feet in length, weighing from 40 to 50 tons, provided with smoking and baggage compartments, and with a seating capacity for 66 passengers. These cars are usually propelled by four 85-horsepower motors, or four 100-horsepower motors.

To accommodate those desiring quick service between cities and towns and those living in the rural districts, two distinct services are maintained. One is known as limited cars, competing with the first-class trains on steam railroads, running every hour or two and stopping only at the principal towns along the line. The other is called local or regular cars; these are dispatched at frequent intervals and make stops every half or three-quarters of a mile, enabling dwellers in the country and on the farm to reach their very door, or board a car at their gate for tbe next village or city. The local cars might be called country omnibuses, for they convey the children to and from school and carry their parents and friends between towns and villages, at the same time maintaining a speed of 20 to 30 miles an hour.

Most of the interurban lines do an extensive freight and express business, principally in the lighter class of package freight. For this purpose large and commodious freight and express cars are provided. The interurban freight and express service has opened up new markets for the produce and poultry of the farmer and bas done much to develop and stimulate gardening along the lines, the raising of vegetables, fruits and flowers and the establishment of first-class dairies. The slow and cumbersome produce wagon trudging into town is superseded by the interurban freight express.

The growth and success of interurban railways is not confined to any particular section of the country. They flourish in New England and the Middle Atlantic States as they do in the Western and Pacific States. They were early known in the South and were welcomed in the North. But I may be pardoned in stating that it is believed by many that they have reached their highest efficiency in the states of Illinois, Indiana and Ohio, which may be characterized as "The Big Three."

The total interurban railway mileage in this trio of states approximates 5,000 miles, representing an investment of many millions of dollars. As an indication of the possibilities of through travel it may be mentioned that upon the completion of a gap of 50 miles one may journey in interurban cars from East St. Louis to Chicago, and upon the building of a short connecting link between Danville, Ill., and Crawfordsville, Ind., it will be possible to go from St. Louis to Buffalo by electric traction. At present the interests which I represent own a through line in full operation between Paris, Ill., and Zanesville, Ohio, a distance of over 300 miles, and will in the near future install a through service between Indianapolis and Toledo as well as between Cincinnati and Toledo, thence to Cleveland and Buffalo.

A glance at a map of the combined interurban lines in the three states named will quickly remind one of the familiar comparison to the spider's web. Few cities, towns, villages or hamlets may now be found that are not touched by the ramifications of interurban railways.

Indianapolis is located in the center of this great network of electric lines and occupies a unique position in the traction world. From the middle of a large block owned by the traction company, situated in the heart of the city, on one side of which is the State House and on the other the most beautiful and lofty soldiers' and sailors' monument in the United States, rises the now famous Traction Building, erected three years ago at a cost exceeding $1,000,000, with its spacious and handsome terminal station adjoining, conceded to be the finest in the world. Nine tracks enter this station, accommodating 12 interurban lines and divisions which run in all directions. Four hundred cars on an average arrive and depart daily, which on a steam railroad would be equal to 100 trains of four cars each. In 1906 more than 5,000,000 passengers were carried to and from this terminal station, and it is estimated that in 1907 the number will reach 6,000,000. These figures do not include passengers carried between points outside the city limits.

This terminal station stands as a justification of the faith of my associates and myself in interurban railways. When first projected there was naturally some doubt as to whether the volume of prospective business would warrant the erection of such a building, which would be the first of its kind in existence, but our confidence was never shaken, and it has since transpired that we have found it necessary to purchase more ground to provide for additional facilities for the constantly increasing traffic. Since its completion, buildings of a similar character have been erected in other cities both in this country and in Europe.

The benefits resulting to the people of Indiana with its 1,500 miles of interurban roads, controlled by various companies, are duplicated in every other state of the Union enjoying a like means of transportation. Employment has been created for thousands. Social conditions have wonderfully improved. We read no longer of the man of 80 in the rural districts who never rode in a passenger car, for these interurban cars pass his door every few minutes, ready to convey him to the next village or into some great metropolis.

The recluse who sighs for a lodge in some vast wilderness will find none since the advent of the interurban railway. Crowded cities, thriving towns and villages, hamlets and rural districts are all happily united and share alike the advantages of interurban lines.

There is an awakening and thrill of life in every town and village through which an interurban line runs never felt before. Commercial opportunities which laid dormant are made possible and become profitable realities. New markets are opened. The reciprocal relations which develop between the city and town and between the village and farm are beneficial to all. The dweller in the small town, while escaping the expense of living in a big city, may still enjoy all its advantages. He receives by means of the interurban cars his morning paper every day before breakfast and his afternoon paper before his evening meal, and is in touch with the news of the world. The weekly newspaper is getting to be a thing of the past. His sons and daughters may attend the institutions of higher education in the city and return to the parental fireside every evening. The theaters and grand concerts are likewise available. No longer is the narrow view entertained that interurban roads benefit the large cities at the expense of the towns.

Summing up interurban development throughout the United States we find that this new means of transportation has won favor with rich and poor alike. Hundreds of thousands of dollars have been saved to the people in reduced fares, while the enhancement in the value of lands contiguous to interurban lines has reached millions of dollars. It is difficult to obtain correct statistics regarding electric roads which may be strictly classified as interurban railways, but in general terms it may be stated that the present and projected interurban railway mileage is equal to nearly one-tenth of the total mileage of the steam roads of this country. The capitalization reaches hundreds of millions of dollars, and the roads give employment to an army of tens of thousands of men.

Investments in interurban lines which have been properly located, financed, constructed and operated have yielded substantial profits, and their securities are sought by conservative investors. The freight and express business, though confined principally to the handling of the lighter classes of merchandise, has increased materially and is a large source of revenue. The carrying of mails is being steadily developed.

The question is often asked: Is the interurban railway injurious to the steam railroad? Sufficient time has elapsed since the establishment of interurban roads to warrant our answering this in the negative. Each has its sphere. One benefits the other. There is ample business for both. We are a growing race, following the biblical injunction to "increase and multiply," so wisely promulgated by our chief executive. To show how inadequate are the present means of transportation for our 90,000,000 of population, we need only cite the statement of Mr. James J. Hill, that it would require $5,000,000,000 properly to equip the steam roads of this country to handle the increasing traffic. It should also be remembered that the steam roads derive the greater part of their revenue from the carriage of heavy freight, in which they have practically no competition.

In this brief and imperfect presentation of the subject allotted me I have endeavored to show something of the present development of interurban railways. What of their future? Their future is as limitless as the bounds of electricity. They are harnessed to a power infinite in its possibilities. Interurban railways have come to stay. Each succeeding year will mark their further extension, improvement and efficiency. We who are now interested in them are but witnessing their beginning. Who will predict to what a standard of perfection they will reach when in operation as many years as the steam railroads are at present? To us is not given the gift of prophecy, and yet, Mr. Chairman, I may be permitted to say in conclusion that in the upbuilding of this nation and in all that makes for a happy and prosperous people no greater element to that end will be found than the interurban railways of the United States.

[1] An address delivered at the banquet of the National Business League of America, in Chicago, November 23, 1907. Mr. McGowan, whose home is in Indianapolis, is prominent in interurban-railway operation, being president of the Indianapolis and Eastern Railway Company, Indianapolis and Northwestern Traction Company and other companies.

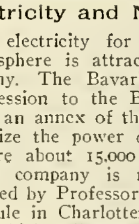
Electricity and Nitrogen.

The use of electricity for extracting nitrogen from the atmosphere is attracting renewed attention in Germany. The Bavarian government has granted a concession to the Berlin Cyanid-Gesellschaft, which is an annex of the Siemens-Schuckert concern, to utilize the power of the Alz River at Trostberg, where about 15,000 horsepower can be produced. This company is making use of the process discovered by Professor Frank of the Technische Hochschule in Charlottenburg for producing calcium salts, which will be used as agricultural fertilizers. The same company is already engaged in building a similar establishment near Bromberg, in the province of Posen, where 2,000 horsepower is being developed.

A still more important project on the Alz is that of the Badische Anilin und Soda-Fabrik of Mannheim, by which it is proposed to extract nitrogen from the atmosphere by the electrical process used in Norway. The features of this undertaking are the damming of the Alz at a point lower than the project already mentioned, and diverting the water into tbe Salzach. This would give a heavy fall and make the power station the largest in Germany. The Mannheim company has been acquiring the land necessary for carrying out the scheme, but has met with some difficulties with the peasant proprietors, who are said to demand excessive prices for their meadows. The Bavarian government is hesitating about granting a charter, too, in view of its own plans.

Bracket for Heavy Wire.

The Peirce Specialty Company of Chicago and Elkhart, Ind., has recently placed on the market a specially designed one-point bracket for heavy power wires. This bracket is supported to brick,



BRACKET FOR HEAVY WIRE.

stone or concrete walls by the well-known Peirce expansion bolt. It is equipped with a spiral spring steel thread, which has become popular with electric-light companies because of the elimination of breakage due to the expansion and contraction of the supporting member.

Alternating-current Generators for Direct-connection to Corliss Engines.

Modern power-station generating apparatus is steadily tending toward larger units, higher voltages and more stringent requirements as to regulation, heating, efficiency, etc. A satisfactory alternator must be able to furnish current to motors as well as lights, and when supplying current to an inductive circuit its voltage must not fluctuate unduly with variations in load. Modern alternators, therefore, have to meet much more exacting conditions than older machines.

Alternators of the revolving-field type have proved desirable both for mechanical features and electrical performance. The armature coils are stationary and hence are not subjected to mechanical vibrations or centrifugal force. They can, therefore, be readily insulated for high voltage.

Allis-Chalmers alternators for direct connection to steam engines are made in two types. The standard engine-type alternator is designed to attain the best possible results without special reference to the flywheel effect of the rotor. The engine flywheel is mounted on the shaft alongside the generator.

The flywheel alternator is constructed with the field poles mounted on the face of the engine flywheel, which thus serves the double purpose of flywheel and field spider. This type can be built to advantage only in the larger sizes, because the rotor must necessarily be of large diameter to give the required flywheel effect.

The construction of the stator, or armature, is practically the same in both types of generators.

The armature or stator yoke is of iron, cast in one piece for the smaller alternators and in two or more for the larger machines. The sections are held together by bolts on the inside of the yoke, thus avoiding projecting lugs and giving the machines a graceful and pleasing appearance. The yoke is designed to secure maximum stiffness with minimum weight and is well provided with cored openings to allow free circulation of air.

The core is built up of steel laminations securely clamped between end plates and carefully annealed and varnished beforehand to reduce the core losses. At intervals throughout the core, ventilating segments are placed to provide ducts through which air is forced by the rotating field and efficient ventilation is thereby secured.

In engine-type machines the field structure consists in most cases of laminated pole-pieces mounted on the rim of the spider; in flywheel machines the poles are mounted directly on the flywheel face. The field spiders are liberally designed to withstand all stresses to which they are liable, even under abnormal conditions of load or speed. In some of the large machines the rim of the revolving field is built up of steel laminations in order to secure exceptional strength. In most machines, pole-pieces are provided with dovetail projections that fit into corresponding slots milled in the spider rim and are securely held in place by tapered steel keys. The poles are usually built up of steel punchings clamped together between malleable-iron end plates securely held by rivets. Each pole-piece carries a magnetizing coil held firmly in place between the spider or flywheel rim and projecting parts of the pole and end plates.

The form-wound armature coils are interchangeable and can be easily replaced in case of damage. The insulating materials are the best obtainable and are applied by a special process whereby all moisture is excluded and the insulation molded firmly around the armature conductors. The coils are pressed in steam-heated molds and formed to exact size to fit the slots. The insulation offers a high resistance to puncture and is permanent in character. No insulating material is placed in the slots, as it has been found more satisfactory to have the insulation integral with the coil.

The field coils are made of copper strip wound on edge. This method of winding affords excellent ventilation because the heat is rapidly conducted from the inner parts to the exposed edges of the strip and there dissipated from the rapidly moving coil surface. Moreover, the strip winding is almost essential for revolving fields where the insulation between turns is subjected to heavy pressure on account of centrifugal force. With an edgewise strip winding the pressure is distributed over a flat surface and the insulation is not damaged. The field coils are carefully insulated from the poles and are securely joined to each other by copper strap connections.

Alternators are rated according to their output on non-inductive load. Thus a machine rated at 750 kilowatts will deliver 750 kilowatts to a load of power factor 1 and will deliver 750-kilovolt-amperes to loads of lower power factor; but if an alternator were required to deliver 750 true kilowatts to a load of power factor 0.8, a machine of

$$\frac{750}{0.8} = 937$$ kilowatts rated output on non-inductive load would be needed.

Allis-Chalmers alternators have been successfully built for pressure as high as 13,200 volts, but the usual standard pressures are 1,100, 2,200, 4,400 and 6,600. In cases where the current is used for local distribution as, for example, in factories, lower pressures of 220, 440 or 550 volts are frequently used. The standard frequencies are 60 and 25 cycles per second, but the company is prepared to construct machines for special speeds and frequencies.

Alternators are wound for one, two or three phases. Allis-Chalmers Company prefers to supply three-phase machines, and in many cases it will pay to install them in preference to single-phase, even if they are operated single-phase temporarily. For a given output three-phase machines are smaller than single-phase, and the single-phase load can usually be balanced between the three phases. Moreover, if a three-phase machine is installed, polyphase current will be available in case it may be necessary to operate polyphase motors at some future date.

Great care has been exercised in the design of Allis-Chalmers alternators to secure close regulation, i. e., to make the percentage of variation in voltage from full load to no load, with constant speed and field excitation, as small as practicable. The machines are constructed on liberal diameters, thus avoiding crowded field-poles and reducing magnetic leakage.

Practically all Allis-Chalmers alternators are wound for excitation at 120 volts. By using this low voltage the danger due to an inductive discharge caused by a sudden opening of the field circuit is minimized, and very often excitation can be supplied from an existing 120-volt circuit. Alternators are provided with a main field-circuit rheostat of sufficient range and capacity to adjust the excitation.

Druggists' Public Telephones.

In the course of a recent address Joseph F. MacDonald of the Chicago Telephone Company made the following observations on druggists' public telephones:

"Of few public utilities can it be said that it has grown from a luxury to a necessity to a greater extent than the public telephone. In all large cities not only must the very great number of people who have no telephones in their own premises be furnished with this accommodation, but the great number of telephone patrons desiring to reach their own stations must also be served.

"From the first, the drug store has been the natural location of these instruments. Probably no other class of stores frequented by the public is as attractive as the drug store. It is warm, light, attended by courteous and painstaking employes, and invites one to its general accommodation whether to consult the city directory, wait for the street car, or use the telephone, and it is well known that in a large percentage of cases the enjoyment of these facilities leads to some purchase from the stock displayed.

"Some years ago it was generally the practice in Chicago and other large cities that druggists would pay for a telephone and furnish the service free to all who might call for it, just as he bought a city directory or furnished a convenient bench for people waiting. With the larger growth of exchanges this practice in big cities acted as a boomerang. So many people demanded the free telephone service that not all could be accommodated, and the druggist was blamed by the public for this so-called lack of accommodation.

"What has been aptly called 'the free-lunch telephone germ' was brought forth in some places with disastrous effect. The druggist was blamed because people who wanted to use the telephone were kept waiting while some long and apparently useless conversations were carried on. Patrons who wished to reach the druggist by telephone could not get him at all. His line was busy from morning until night. The telephone companies, in defense of their own service, were obliged to demonstrate that the fault did not lie with them, but with the druggists who were choosing to give away their service. Thus at both ends of the line there was dissatisfaction. No one was benefited, not even the public, willing to pay if service was rendered.

"At this time in Chicago the proposal was made by Mr. William Bodemann, that for the salvation of the druggists in the matter of telephone service, the telephone company should provide for them some form of slot machine by means of which service could be paid for at the time it was rendered. This proposal was taken up in conferences with the Retail Druggists' Association, and plans were made by which it was carried out. Mr. Bodemann's plan solved the problem. The public is accommodated with a service which it gets by paying for it, the 'free-lunch' fiends have died off, the druggist can be reached by telephone when he is assisted, and, last, but not least, he receives by way of commissions a considerable sum for service he renders in giving up certain space for telephones, booths, etc."

Organization for the Small Electric Railway.[1]

By H. S. Cooper.

The importance of organization is not fully appreciated by the "small" or "near small" road. To many owners and managers organization into departments seems a useless and non productive process, entailing no revenue and much unnecessary expense, time and labor. To the very small road where the manager is everything, from engineer to bookkeeper, where the difference between bond interest and deficit is but a hairbreadth, in such a road departmental organization seems—and probably may be—somewhat of a farce. But it must be a very small road where this really applies. Simple organization is capable of beginning much lower down in the scale of roads than is commonly practiced among owners and managers, and even a pretty full and complete organization can be started, and will prove remunerative, a great deal sooner than is generally believed.

The simplest organization will have not less than four departments—counting the manager as one of them. These would be:

1. Accounting.	Bookkeeping, Car accounting, Purchasing, Correspondence,	Manager and clerk.	
Claim department.	Accidents, etc.	Manager and local counsel.	
2. Generating.	Power station.	Chief engineer.	Assistants.
3. Transportation.—Operating of cars.		Inspector, or starter and trainmen.	
4. Maintenance	Rolling stock, Buildings, Track, Line.	Superintendent	Barnmen, Barnmen, Trackmen, Linemen.

This simplest plan of organization is possible to any road; of course in a very small road the manager may have to be the chief engineer and the superintendent of maintenance and of transportation in addition to his other duties, but in any road having full business for six to ten regular cars on an urban line or three or four regular cars on an interurban line, the above plan of organization is none too complex.

As we go up in the scale of the smaller roads, or as a road grows in size, these departments can easily and profitably be amplified until it is—for a small road—fully organized into departments, which means into about eight, as follows:

1. Accounting and auditing.
2. Claims and legal.
3. Purchasing and stockroom.
4. Power station.
5. Shops.
6. Track.
7. Line.
8. Transportation.

And, if there is a "pleasure-park" attachment,

9. Advertising and attractions.

That organization—those departments—will answer for a wide scope of sizes of roads. It may be that in the smaller roads the manager will again have to be the virtual head of each department; that the departments will overlap and interfere to some extent, but these are drawbacks only to be amended by increase in size, in earnings or in profits, and, if properly carried out, that very organization will aid to that end.

It may seem foolish when your trackman and lineman are one and the same person, when your winder also repairs trucks, when your carpenter repairs cars and buildings and does pipefitting, to ask them to bisect themselves into heads of departments, while you show them how you want the work done, and, perhaps, how to do it; but, unless you expect your road to be forever stationary as to size, you can afford the foolishness. In the first place, it is good training for both men and manager; it leads to and teaches the proper forms and the proper use of them; it tends to exactitude in work, in authority, in responsibility, and in these ways makes far better discipline and more efficient and economical operation. That is the first problem of the small road—so to organize itself that, without waste of time or energy, or the unnecessary unreeling of red tape, it will have the advantage of known authority and responsibility from the track greaser up to the manager. If the road thinks it is too small for any real departmental organization, let it "play at it" with a few simple departments and forms, and in a short time that play will develop into earnest. It is good policy in all such matters to "go through the motions" for a little while before any change is really and actually started. It familiarizes those interested; it brings out faults, deficiencies and objections, and puts the matter into immediate and perfect working order when it is made a fixed actuality.

1. A portion of a paper read before the American Street and Interurban Railway Association at Atlantic City on October 17, 1907. Colonel Cooper is manager of the Galveston (Texas) Electric Company.

CORRESPONDENCE.

Continental Europe.

Paris, November 19.—The automobile show, which was begun at Paris last week, has already proved to be a great success, and the number of exhibits is much increased over last year. The interior of the Grand Palais is brilliantly illuminated at night, and most of the stands have decorative designs of lamps which add greatly to the general appearance of the show. Among the electric cars I noted the "electromotion," which carries a motor mounted directly inside the rear wheel and forming part of it, having about half the diameter of the wheel. These motors give about five horsepower each. Another point is the absence of a controller drum, and this is replaced by a simple speed-changer contained in an aluminum box and worked by a lever. Six speeds are obtained in this way, from five to 30 miles an hour, and two reverse speeds. There are no sparks in passing from one contact to another, this being carried out by a special device. Another make is the electric car constructed by the Compagnie Française, mainly for city use. It is built for two or four places, and has a central electric motor which runs the rear axle by a universal-joint transmission. The same company also makes a large delivery van or omnibus, which takes two tons load, with batteries which give it a 40-mile run.

Turning to the combination gasoline-electric system, there are several different cars of this type to be seen at the show. One of these is the new Krieger car. It is somewhat the same in principle as the one illustrated in the Western Electrician last year. This time the system is also applied to city cabs and to delivery vans. A gasoline motor mounted in the front, as usual, is coupled direct to a small dynamo. The circuits of the latter are passed through the controller, and then into the two motors of the car. Each of the front wheels has a separate motor placed near it upon the inner side, and the motor drives the wheel by means of a small pinion working on a large gear fixed to the inner side of the wheel. In the combination system there is no mechanical speed-changing nor friction clutch, and the car has the easy running of the electric method, combined with the unlimited range given by the gasoline machine.

The well-known Mercedes automobile firm has now taken up the manufacture of such cars, and there are a number of them to be seen at the show. They are characterized by a motor built directly into the rear wheel. On the front of the chassis is a four-cylinder gasoline engine. Mounted on the motor shaft in the rear is the armature of a six-pole dynamo of small size. By means of the controller, six speeds are secured with an easy progression. I also noticed a new stationary motor built by the Cazes firm which uses ordinary kerosene. It is of the four-cylinder upright pattern, and is coupled on the same base with a multipolar generator. The present group is rated at 70 horsepower, and this type of motor can be built as high as 200 horsepower.

A mining plant which is now using a well-equipped cable system for working the cars in the shaft is located at the Hermannschacht mine near Eisleben. Current is generated in a plant which is erected four miles from the shaft, and here are installed two gas-engine dynamo sets of 900 kilowatts each, using three-phase alternators of 3,000 volts. The shaft is 330 meters deep and the standard load is 2½ tons of material at the rate of 10 meters a second. The motor apparatus for working the cable drum is designed on the Ilgner system, using a 12-pole motor of 600 kilowatts. The present plant is one of the best designed in Germany.

A. de C.

Great Britain.

London, November 22.—An ambitious and comprehensive scheme has been formulated for the amalgamation of all the electric-lighting companies in London, with the object of devising a power scheme which shall have none of the disadvantages of previous proposals by single companies, and all the virtues of modified municipal control. This latter is to be brought about by the nomination of representatives of the London County Council upon the joint board of control which it is proposed to form of the directors of the existing companies. The area of supply comprises all the administrative county of London and substantial portions of the four surrounding counties. The scheme, if matured, would result in the transfer to the jurisdiction of the new joint committee all the generating stations of the existing companies, which would also have the power to purchase lands for the erection of additional power houses.

News has just reached London that the contract for electrifying the street railways in Moscow has been granted to the Edinburgh firm of Bruce Peebles & Co., in competition with German firms.

The question of grading the dielectrics of cables, which has never been very enthusiastically taken up by British cable makers, was, after an interval of six years, again the subject of discussion at the first meeting of the session of the Institution of Electrical Engineers last week. Mr. Alexander Russell read a paper on the subject, which, though largely theoretical in its character, was a strong indictment in favor of grading. One of the leading cable makers here, however, in the discussion stated that a cable costing £130 per mile for insulation against £700 per mile for a graded cable of the same class was now being made by British cable makers, and concluded, somewhat satirically, that he hoped Mr. Russell's paper would not induce engineers to spend unnecessarily large sums of money with the cable makers in the hopes of securing a small theoretical advantage, for there was material upon the market at the present time commercially as good as any graded cable. This may be taken generally as the view of the cable makers of this country, for, although Mr. O'Gorman took out patents here seven years ago, he himself has stated that no maker has yet tackled the question seriously. Mr. Patchell mentioned the fact that some years ago he brought home from the United States a sample of cable in which the copper was covered with a varnished cambric with paper outside, and which he was told has got rid of all the troubles on the 20,000-volt cables at Niagara, but he said he had not yet heard of anyone having made such a cable here.

The Aluminum Corporation, the second company of its kind to commence operations in Great Britain, is now erecting works in North Wales which will be supplied by the hydro-electric power company in that district. A number of interesting machines for aluminum production are to be driven by 1,000-kilowatt induction motors, each unit consisting of induction motor and two direct-current generators. The interesting feature of these machines is that the full output is given at 75 volts.

G.

Dominion of Canada.

Ottawa, November 28.—At the opening of the Dominion Parliament this week the speech from the throne contained the following significant announcement: "The time has arrived when public interest requires that telegraph and telephone companies holding federal charters should be placed under government control. A bill will be introduced for that purpose." The policy of the opposition party, as recently declared by the Conservative leader, is the nationalization of all telephones and telegraphs in Canada.

The City Council of Hamilton, Ont., has decided to submit a by-law to the ratepayers of the city, at the civic elections next January, asking the citizens to vote $225,000 for a municipal lighting and power plant. The by-law will expressly provide that the power is to be taken from the Hydro-electric Power Commission.

Advices from the Pacific coast province state that Mr. F. J. Cross, electrical expert in the employ of the Fiji government, and at the same time sent as special representative of the Colonial Office in London to report on the proposal to connect British Columbia with Australia by a wireless-telegraph service, has arrived at Vancouver. He declares that the proposition is easily workable, and stations are now being erected at Fiji. The biggest jump will be from Vancouver Island to Fanning Island, then to Samoa, Fiji, Ellis, New Zealand, and, finally, Australia. This will be an important link in the round-the-world wireless connection planned by the British government. He thinks that by using the different islands as connecting stations, the system may be established at a cost not exceeding $500,000. The only station on foreign soil will be at Hawaii. Mr. Cross installed the wireless system at Honolulu for the United States government.

W.

New York.

New York City, December 2.—Some attention has been attracted by the large and complete signaling and track-switching plant at the new Hoboken terminal of the Delaware, Lackawanna and Western Railroad. It is said to be the first plant of the track-circuit interlocking type to be installed in this country. There are 131 levers that electrically control the switches on every track that runs into the main terminal. The old way of switching required at least 30 men to do the work. Under the new arrangement four men can do the work in less time, and so perfectly constructed is the plant that, according to the engineers, it is almost impossible to make a mistake. In the interlocking cabin, where the system is operated, there is a model of the yard, showing every track controlled by the apparatus and which indicates at all times to the men in charge exactly how the system is working. As soon as the automatic signals are installed the locomotive engineer before he starts his train will get his signals, his routing will be absolutely fixed, and the signal will indicate to him when and where to move. As soon as the engineer gets his train on the fixed route the operator in the tower cannot change that route, or change the switches under that train until the train is clear of the route. It will be impossible for another train to foul that train while it is on the route fixed for it. Seventy-five miles of insulated wire was used in connecting the track circuits with the interlocking layout. The system is electro-pneumatic, the power used being compressed air, the movement of the switches being controlled by a piston operating in an air cylinder. The operation of the air cylinders is effected by electromagnets. When the train is made up in the terminal and is ready to go out the station master touches an electric button, which indicates to the director in the operating tower that the train is ready to go. The director then fixes the routing for that train, gives it the signal, and the train is off on its journey.

It is said that at least $1,000 a day, or $365,000 a year, is the amount that conductors' carelessness costs the Brooklyn Rapid Transit Company. This was the testimony given by T. S. Williams, vice-president of the company, at the general investigation today. He said that this loss was due to the failure to ring up fares. He took occasion during the testimony to praise the honesty of the men.

Andrew Carnegie entertained the members of the board of trustees of the Carnegie Foundation for the Advancement of Teachers at his home in Fifth Avenue recently. Henry S. Pritchett, president of the foundation, said that professors of state universities should not receive pensions from the foundation and that the state should make provision for them. Presidents of state universities took the opposite view. They asserted that they had no control over the action of state legislatures, and that if they were unable to obtain aid from the Legislature their professors should not be made to suffer.

About 200 men made the trip from Manhattan to Brooklyn on November 27th under the East River, making the journey on the first train to run from Bowling Green to Brooklyn Borough Hall through the Battery Tunnel. The journey over took 15 minutes, and the return about a third of that time. The officials of the Interborough company predict that the tunnel will be in full operation early in the new year. The journey was made in an ordinary three-car subway train, which the guests boarded at the Wall Street Station. August Belmont and Theodore P. Shonts were the hosts, and among the guests were many public officials, engineers, officials of the company, Public Service Commissioners and reporters. The tunnel proved to be dry for the greater part of its length, though here and there were puddles, and occasionally a tiny rivulet. All the way across the tunnel was brilliantly lighted, and every detail of the construction could be plainly seen. The line consists of two tubes running parallel. Each is 15 feet 8 inches in diameter. The upper half presents a semicircular appearance, but the lower half of the circle is broken by the bench wall, which is built out so that the sides of the cars are quite close to it. This wall contains the conduits through which the cables run, and it is wide enough to form a footpath. Each tube is provided with one set of tracks. The lighting circuits will be entirely independent of the third rail, so that if the power is shut off there will still be plenty of light. The block-signal system is the same as that used in the subway. At the little office in the Bowling Green Station there will sit a man who will control the tunnel absolutely. Before him will be a transparency representing both tubes. Colored lights will show where the trains are at the time. There are telephones in the tubes every 300 feet.

The New York Times says that a plan has been advanced by those interested in seeing the Belmont Tunnel opened to the public, and is now being seriously considered, which contemplates the acquisition of the property by the city and what would amount to a partnership in its operation between the city and the interests now owning the tunnel. It is possible that the plan will come before the Public Service Commission within a short time. Briefly stated the plan is that the city shall buy the tunnel, as it stands, for what it cost to construct it, with interest to date; shall pay for it with city bonds instead of cash, and shall enter into a contract with the Belmont interests whereby those interests shall operate the line in connection with the Queens County surface lines, the net earnings to be equally divided between the city and the Belmont people, and the city to apply its share of the proceeds to the payment of the interest on the bonds.

W.

Ohio.

Toledo, November 30.—The city of Asheville, Ohio, will erect a system of electric street lighting, to be operated in connection with the sub-station of the Sciota Valley Traction Company.

A new system of fire-alarm telegraph will be installed soon at Springfield, Ohio.

The new municipal electric-light plant at Bryan, Ohio, has announced that it will supply its patrons at the rate of six cents a kilowatt-hour.

A free electrical show was recently conducted at Marion, Ohio. A feature of the display was an auxetophone in the booth of the Marlin Electric Supply Company. This is a great phonograph, extremely loud and distinct, and is operated by compressed air, an electric motor being used to make the compression. Thousands of people attended the exposition.

The stockholders of the Bryan Insulating Fiber Company have decided to close the plant and abandon the business. The company was organized about a year ago for the purpose of developing what was thought to be an important discovery of a sort of fiber by Howard J. Meyers, who declared it to be a substitute for rubber in such work as telephone parts and other uses to which hard rubber is put for insulating purposes and to take the place of ivory in billiard balls and various other things. After nine months of experimenting the composition is still affected by water, which makes it pulpy. This, with the fact that the inventor has been unable to produce the fiber in commercial form, has led to the closing down of the plant. S.

Michigan.

Detroit, November 30.—There has been a reorganization in Flint by the Michigan State Telephone Company. G. W. Johnson, assistant manager at Ann Arbor, has been promoted to district manager at Flint. The office of superintendent of telegraph has been abolished. The plant department will have charge of construction work which was formerly handled by the superintendent of telegraph, and the contract department will attend to making of all contracts.

The Detroit City Council has transferred to other purposes the $10,000 appropriated several years ago for the building of municipal street-car tracks, as the Supreme Court decided that the city did not have the constitutional right to build tracks.

The Detroit City Council has passed Mayor Thompson's ordinance requiring a 24-second street-railway service at rush hours.

The Bellevue Council has rejected the offer of the lighting company for a renewal of its contract.

The Michigan Power Company will build a transmission line from Diamondale to Charlotte in the spring. A separate distributing company will be formed to distribute the current in Charlotte, buying it from the Michigan Power Company. As soon as the company is in a position to build the transmission line, estimated to cost $75,000, a franchise will be asked for.

The residents of Grosse Isle are contemplating lighting the main driveway of the island by electricity. D.

Indiana.

Indianapolis, November 30.—The Shelbyville Gas Company has incorporated to take over the property of the Shelbyville Gas and Light Company in Shelbyville. The promoters of the new company say they will enlarge and re-equip the gas and light plants so as to make them modern plants and furnish the people with light, heat and power.

Mayor Boehne of Evansville has started a movement for the erection and installation of a municipal lighting plant in Evansville. Mayor Boehne has secured the assistance of the Merchants' Association in his advocacy of municipal lighting, and the association passed resolutions declaring its faith in municipal lighting when properly managed.

The Standard Electric Headlight Company of Indianapolis has been incorporated with a capital stock of $50,000. The company proposes to establish, equip and operate a plant to manufacture electric headlights. C. H. Lewis, J. A. Overman and W. S. Van Buskirk are directors.

By a decision of the Indiana Supreme Court an ordinance of a town or city requiring a railroad company to maintain at street crossings an electric light is a valid ordinance and enforceable. The same ruling will apply to interurban roads, and hereafter the cost of maintaining such lights at street crossings must be borne by the steam and interurban lines.

Eugene Rush, a capitalist of Chicago, who, with associates, is promoting the White River power-dam project at Decker, Ind., visited the site last week and said that arrangements were being perfected to begin work soon. S. S.

Illinois.

Peoria, November 30.—The City Council has passed an ordinance providing for the placing of all street-railway feeder wires underground and the erection of iron poles in the fire limits. Manager Nelson of the Peoria Railway Company says that while the company is willing to make the improvement, he believes that the money could better be spent in improving the service by the purchase of new cars.

A number of changes among the Illinois Traction officials will be made next month. The office of assistant superintendent will be abolished. This was held by A. C. Murray. He will have his office in Springfield and continue in charge of the line between Springfield and East St. Louis, as also the Hillsboro and Staunton divisions. W. W. Street will continue in charge of the southern terminals, and Charles Cain will be superintendent of the Tri-City lines. The different departments of the auditing department will be abolished and the department concentrated at Champaign. Work on the Mackinaw Lincoln line is progressing rapidly and steel is laid within three miles of Mackinaw, and with good weather it will only take a few days to complete the line.

The Danville Car Company has completed six electric locomotives for the Illinois Traction Company, which will be delivered at once. They are equipped with General Electric motors and equipment.

The five-year contract for lighting the city of Virginia will expire on December 1st, and the Council is debating the renewal of the contract The service has been very satisfactory.

Mr. Henkle of the interurban road that has been built between Canton and St. David has resigned as president and general manager. It is expected that George W. Chandler will be elected to succeed him. The contract for the power to operate the line has been let to the Canton Electric Light Company, and the work of bonding the tracks has been commenced. The company will run a set of feed wires to the town of St. David and light the city, using the trolley poles to carry the lines. The line has been operating with a gasoline car, and the service has been far from satisfactory. V. N.

Northwestern States.

Minneapolis, November 30.—It is reported that the Twin City Rapid Transit Company is planning the construction of an electric-railway line to Anoka, Minn., via Robbinsdale and Osseo. The line, as now proposed, would cross the Mississippi River at Thirty-second Avenue north, and thence to New Brighton, where the new Armour packing plant is to be located.

Bids are being taken at Sleepy Eye, Minn., for new machinery for the municipal electric-light plant, it being planned to add sufficient equipment to make a 24-hour service possible.

By a settlement out of court, the control of the Minnesota Power and Trolley Company has passed to Archibald S. White of New York, and it is expected that the new dam at Monticello, Minn., will be rushed to completion. This will be the means of furnishing considerable additional power to Minneapolis.

The machinery is being installed in the new electric-light plant at Gary, S. D.

The Minneapolis City Council and the Minneapolis General Electric Company are negotiating for an adjustment of the question of new light and power rates, over which there has been trouble since June. It seems likely that an amicable understanding will be reached. R.

Pacific Slope.

San Francisco, November 27.—The financial situation is clearing up a bit in this city. Part payments in gold on check accounts were made today at many of the larger banks. Considerably more coin and less clearing-house currency is in circulation than during the last few weeks. The city is paying off employes, and about half a million dollars in hard cash will be paid out in this way within the next few days.

The illuminated steel arches which have been erected on Fillmore Street, spanning that business thoroughfare at each intersection for a distance of 12 blocks, will be lighted up tonight for the first time. Several thousand incandescent lamps were used in the installation. These arches are of artistic design and spring from all four corners of the street intersections. The Fillmore Street Improve- Association had the work done by the Butte Electrical Engineering and Construction Company and then turned the arches over to the city, which will light them nightly.

An auxiliary electric-light plant, including a steam-turbine generating set, will be installed in the 17-story Humboldt Bank Building, which has just been completed on Market Street, San Francisco. Isolated electric lighting and power plants are to be installed in the new six-story steel-frame building of the Oakland Bank of Savings on the corner of Twelfth and Broadway and in the new St. Mark's Hotel, which has been built of reinforced concrete, one block further east on Twelfth Street.

The preparations of the Southern Pacific Company to change its Alameda County local lines from steam to electric power are going rapidly forward. General Manager E. E. Calvin says that the franchise arrangements are nearly adjusted by which the Southern Pacific will have a loop system of electric lines in Alameda, aside from the extensions that are contemplated in Oakland.

The United Railroads is moving the large frequency-changer, which has been in service at the Martin power station, to that at North Beach. The change will increase the capacity of the North Beach station by 4,000 kilowatts, permitting the company to add 100 cars to the service. It will be a week or more before the machinery can be set up and placed in operation. The City Electric Company, which generates at 60 cycles, will supply this current, to be changed to 25 cycles.

The Ocean Shore Railroad is now regularly running two trains a day from San Francisco to Pedro Valley, 20 miles down the coast, with five trains on Sundays and holidays.

Henry E. Adams, manager of the Stockton Gas and Electric Company, states that the corporation of which that company is a part will build an electric-light and power line from Sacramento to Stockton, Cal., through Lodi and other towns in the vicinity, to compete with the American River Electric Company.

The Bismarck Mill Company of Bismarck, Wash., will start work shortly on a steam power plant for the generation of electricity to supply the suburbs of Tacoma. A.

PERSONAL.

Mr. John C. McMynn has resigned his connection with Robert W. Hunt & Co., this action taking effect on December 1st.

Mr. S. T. Lee, formerly manager of the Department of Electricity in Santo Domingo, is now in Chicago. He reports a prospect of a considerably increased electrical activity in that country.

Mr. E. B. Smith has resigned as president and general manager of the Iowa Telephone Company, with headquarters at Des Moines, and Mr. G. E. McFarland has been elected as his successor.

Mr. R. H. Stirling of San Francisco, formerly in the employment of the Martin and De Sabla electric companies, has been appointed general manager of the American River Electric Company, with headquarters in Stockton, Cal.

Mr. F. G. Stewart, general foreman at the shops of the Memphis (Tenn.) street railway, has accepted the position of general superintendent railway department of the Texarkana Gas and Electric Company, Texarkana, Ark.

Mr. C. G. Waggoner, engineer for the Automatic Electric Company, Chicago, who has been in South America looking after the business interests of his company, is now on a visit to Chicago. Mr. Waggoner has been absent in South America for about a year.

Mr. J. H. Van Dyke, manager of the Rocky Mountain Bell Telephone system in the Cœur d'Alene district, has resigned and will engage in other business. He is succeeded by Fred C. Lewis, acting assistant superintendent under R. E. Hart of the Cœur d'Alene branch.

Mr. J. B. Crawford, superintendent of transportation for the Fort Wayne and Wabash Valley Traction line, has resigned to become general manager of the traction system in Lexington, Ky. General Manager R. T. Gunn of the Lexington system will come to Fort Wayne to succeed Mr. Crawford as superintendent of transportation for the Fort Wayne and Wabash Valley Company.

Word was received some time ago that Mr. John M. Robb is in Peoria, Ill., where he will rest in order to regain his former health. It will be remembered that Mr. Robb wandered from Chattanooga, Tenn., about a month ago while his mind was temporarily affected from overwork. He had wandered to Osage, Okla., from which point he telegraphed to his wife. Mr. Robb was brought to Peoria by his brother-in-law, no harm having befallen him. It is thought that he will soon recover.

Mr. H. J. Pettingill has resigned as president of the Northwestern Telephone Company, and will be succeeded by Mr. Charles E. Yost, president of the Nebraska Telephone Company, with headquarters at Omaha. Mr. Pettingill will continue as a director in the Northwestern company, but will devote most of his time to the Southwestern Telegraph and Telephone Company in Texas and Arkansas. Mr. Yost will continue to reside at Omaha, and Vice-president C. P. Wainman will be in charge of the company's headquarters' office at Minneapolis.

Sir Clifton Robinson, managing director and engineer of the London United Tramways, director of the Underground Electric Railways of London, and prominent in several other electric-railway enterprises in England, is visiting the United States on his way to Japan. In Chicago he was not greatly impressed with what he saw of street railways. "In the matter of tramways," he is reported to have said, "America is in the position of the old chess player, who, having taught the game to a child, awoke one day to find that the child was his master."

Many friends of Mr. W. A. Blonck, consulting electrical engineer of Chicago, will be glad to hear that he is now on the way to recovery after a siege of six weeks in the hospital. Mr. Blonck was taken to the hospital on October 16th, where it was found that an operation for appendicitis would be necessary. The operation was successful, but the case was so severe that it was not thought possible that the patient could recover. Mr. Blonck's exceptional vigor, however, finally prevailed, but it was not until November 24th that he was strong enough to be removed to his home. Mr. Blonck is now gradually regaining his strength and hopes to be back among his friends and business associates within two weeks.

Mr. Edward Schildhauer, formerly with the Washington office of the Isthmian Canal Commission as electrical and mechanical engineer, has been transferred to Culebra, Canal Zone, Panama, where he will have charge of the design of power plants and operating machinery for the locks, movable dams and regulating works. He will also study the water supply for the power plants and the feasibility of electrifying the relocated Panama Railroad. Mr. Schildhauer was an engineer of the Chicago Edison Company before going to Washington.

The following, relating to a prominent electrical engineer of Chicago, is from Collier's Weekly of last week: "Congratulations are due to the city of New York upon the employment of Mr. Bion J. Arnold as expert adviser to the Public Utilities Commission with regard to subways. The public generally might be congratulated, also, as there is needed a start on the idea that men of the highest qualifications are available for employment on the people's side of public-utility questions. As a rule, the public-utility corporations and the great financial interests retain in their interest the professional talent of the country. Mr. Arnold has been able to command the respect of all interests, including the public."

ELECTRIC LIGHTING.

W. N. Mitchell intends to install an electric-light plant in Limestone, Tenn.

H. C. Hodge has been granted an electric-light franchise in Stevensville, Mont.

Lecompte, La., contemplates installing an electric-light plant to cost about $10,000.

The Hennessey (Okla.) Light, Power and Ice Company will install its plant this winter.

The Clinton Gas and Electric Company of Clinton, Ill., has increased its capital from $100,000 to $175,000.

The Sioux Falls Light and Power Company of Sioux Falls, S. D., is about to begin remodeling its plant.

The Farmers and Merchants' Gin, Light and Ice Company of Baird, Tex., has been incorporated by V. F. Jones and others.

The Fort Smith Light and Traction Company has applied for an extension of its electric-light franchise in Van Buren, Ark.

The Kihlberg Company will install an electric-light and power plant in Sulphur Springs, Ark. E. B. Guthrey is interested in the company.

The Home Water, Light and Ice Company of Blooming Grove, Tex., has been organized with a capital of $15,000 by M. G. Young and others.

The city of Barnesville, Ga., will submit to a vote on December 31st the proposition to issue $4,000 of bonds to enlarge the electric-light plant.

Sealed proposals will be received by the Town Council of Chinook, Mont., up to December 21st for the construction of a system of electric-light works for the town. The bid is to cover everything appertaining to the installation in any way.

Sealed proposals for furnishing materials for the construction of a power house and electric-lighting system at the Tulalip School, in Washington, will be received by the commissioner of Indian affairs at Washington, D. C., up to December 27th.

The Massachusetts Board of Gas and Electric Light Commissioners has authorized the Gardner Electric Light Company to issue $100,000 additional bonds and stock. Of the proceeds $40,000 will be applied to the payment of necessary additions to the plant.

"One of the American consuls in Europe writes that the erection of a large central electric generating plant of something like 100,000 horsepower is contemplated. He states that as the project is not a government undertaking, it would be open to competition from electrical supply manufacturers of any country, and it might be worth while for some of our firms to look into the matter in case the erection of the proposed plant should be definitely decided upon." For further information refer to No. 1675, Bureau of Manufactures, Washington, D. C.

Complying with the request of the committee on gas, oil and electric lights, Assistant Corporation Counsel Miller of Chicago will, it is said, confer with officials of the Commonwealth Edison Company relative to drafting an amended franchise for the company. The ordinance will provide for compensation of three per cent. on all the gross receipts and also regulate the price of electricity. Soon after the Legislature passed an act enabling Chicago to regulate the rates of electricity the Council passed one, but Mayor Dunne vetoed it. Since then the company has twice voluntarily reduced the rates. Under their old franchises the companies combined, and Mr. Miller recently gave an opinion that the combination was legal.

The Americus Railway and Light Company of Americus, Ga., which has the contract for lighting Americus, proposes to construct a lighting system and electric pumps in the city. Plans for the power plant and electrical machinery are being prepared, and the specifications will call for January delivery of equipment. The company was organized by W. A. Dodson and associates.

ELECTRIC RAILWAYS.

The Pekin, Peoria and Bloomington Interurban Railway Company of Pekin, Ill., has been dissolved.

The fast interurban electric service which is to be established between Hartford and Rocksville, Conn., will be put into operation early in December. The line will be operated partly over regular trolley tracks and partly over the tracks of the Highland division of the New York, New Haven and Hartford Railroad.

The electric railway being constructed between York and Hanover, Pa., may be in use by January 1st. Four passenger coaches built by the Brill company will be operated daily and cars for transporting freight will also be placed in service. John Dobbling of York is constructing the line from York to Bear's Station. The section from Bear's Station is in charge of Dodge & Day of Philadelphia. The line is being built for the York Railways Company. Cost of construction averages $11,000 per mile.

The South Side and the Northwestern elevated railways of Chicago report large traffic increases for November over the figures for the corresponding month last year, due principally to an increased mileage within the last year. The Metropolitan reports a small decrease, attributed to decreased working forces in some of the factories along the route. The daily average of passengers carried on the Metropolitan in November was 151,518; on the South Side, 120,594, and on the Northwestern, 106,847. Corresponding figures for November, 1906, were 152,471, 94,281 and 93,238, respectively.

The electrification of the West Shore Railroad between Utica and Syracuse has been closely watched. Special attention has been attracted to it on account of its 60,000-volt transmission line, the adoption of an inverted, protected third rail, and the hydro-electric development from which power is supplied. In Bulletin No. 4546 the General Electric Company, Schenectady, N. Y., has issued a handsomely bound pamphlet of 24 pages, in which the installation is very completely described. The bulletin is profusely illustrated with views of the trains, interior of the cars, transmission lines, exterior and interior of sub-stations, plans of the buildings and wiring diagrams, and details of the track construction. Not the least interesting feature of the pamphlet is a comparison of two train sheets, one showing the operation before electrification, and the other after, where the increase in traffic with the same track capacity is strikingly shown. The bulletin cannot fail to be of interest to all steam-railroad engineers as well as those actively engaged in electric traction.

PUBLICATIONS.

Pass & Seymour of Solvay, N. Y., have just issued catalogue No. 17, in which the company sets forth its large line of electrical specialties. Aside from its value to those having need of electrical specialties, the catalogue presents over 60 new and originally designed plates illustrating porcelain ignition tubes, porcelain transformer cut-outs or junction boxes, high-tension fuses, conduit clamps, push buttons, switches of great variety, all kinds of sockets, socket fittings, receptacles, attachment plugs, rosettes, ceiling buttons, switch bases, strain insulators, knobs, cleats, porcelain tubes, cabinet bushings, etc. This catalogue tells of the quality of P. & S. material and gives descriptions, prices, etc., of the various P. & S. products. A copy of the catalogue will be sent to anyone in the electrical business on receipt of his business card.

"Electrical Instruments of Precision" is the title of a handsomely covered and well-prepared booklet of 34 pages, which is No. 79 of the recent publications of the Wagner Electric Manufacturing Company of St. Louis, Mo. It shows and explains the different types of direct and alternating-current switchboard instruments made by the company. The direct-current instruments are all of the D'Arsonval galvanometer type. The alternating-current instruments are built on either the dynamometer or magnetic-vane principles. The different mountings are on the large fan shape, round and vertical or horizontal edgewise patterns. All instruments are dead-beat and have individually calibrated scales. Besides standard voltmeters, ammeters and wattmeters, special types, such as the compensated voltmeter and the polyphase ammeter, are built. A large variety of series and potential transformers for use with instruments of various ranges and types are shown. Full data, dimensional diagrams and full-size duplicates of scales are also to be found. The Wagner company was one of the first to develop a line of alternating-current instruments, and to its efforts is due to a considerable extent the advancement which this class of apparatus has now reached. Switchboard builders and consulting engineers will appreciate this new Wagner publication.

The December number of Graphite, issued by the Joseph Dixon Crucible Company of Jersey City, N. J., has 10 well-illustrated pages devoted to the recent Atlantic City convention of the American Street and Interurban Railway Association. The Dixon exhibit is well shown, as also a large number of views about the convention headquarters and along the famous Board Walk and Steel Pier. These special features make this issue an interesting souvenir of the Atlantic City meeting.

Bulletin No. 1501, entitled "Belted Corliss Engines," issued by Allis-Chalmers Company, Milwaukee, Wis., contains much of interest. It is said that sales of this engine have not decreased since the more general introduction of such other prime movers as gas engines and steam and hydraulic turbines, indicating a popularity due to reliability, durability and simplicity of construction. The Reliance pattern of the Reynolds-Corliss engine was designed to meet the demand for a strong and serviceable machine which would occupy less floor space and run at somewhat higher speeds than is usual in Corliss-engine practice, thus, in many cases, better adapting it to be used as a prime mover for electric generators and other fast-running machinery. In its design, most careful consideration was given to every detail. The bulletin contains some excellent illustrations of these engines, displaying their harmonious design and rigid construction. A copy will be sent to anyone who may be interested, upon receipt of a request.

SOCIETIES AND SCHOOLS.

The eleventh annual national convention of Tau Beta Pi, the honorary engineering fraternity, was held at Purdue University, Lafayette, Ind., on November 29th and 30th. Delegates were sent by chapters of 18 leading technical schools of the country, from Columbia University at New York to the University of California at Berkeley.

David Ranken, Jr., has deeded to the David Ranken, Jr., School of Mechanical Trades titles to real estate in St. Louis and railroad stock valued at more than $2,000,000. This property is to form the first endowment of Mr. Ranken to his trades school to be established in St. Louis, where poor boys will be given instruction in the manual trades.

On the afternoon of November 27th Dr. Charles P. Steinmetz delivered a lecture on "Alternating-current Series Motors" before the Urbana (University of Illinois) Section of the American Institute of Electrical Engineers. Dr. Steinmetz was given a most cordial welcome by both the professors and students of the University of Illinois, who thronged the university chapel to listen to one of his most interesting talks.

Incorporation papers have been taken out by the Chicago Aeronautique Club, organized by a number of business men. A large balloon is to be built at once and plans are under way for a series of races next spring. To promote aerial navigation a $1,000 cup has been pledged as a trophy. Mr. Charles E. Gregory, well known to electrical men, is first vice-president of the club; C. E. Coey is president, A. B. Ferrigo, secretary, and H. C. Foster, treasurer.

Electrical engineers of Hazleton, Pa., held a meeting recently and laid plans for the organizing of an engineering society in Hazleton. The object will be for advancement in electrical engineering and scientific matters by the reading and discussing of papers. Frank Watts was made temporary chairman, and V. H. Hurdell, secretary. Others present at the preliminary meeting were O. T. Eberhardt, H. G. Knoderer, G. W. Thompson, A. F. Harger, T. F. Irvin and Foster Morgan.

MISCELLANEOUS.

C. H. Alexander of Velasco, Tex., is building a large dam and will install an electric power plant near Velasco.

The Marconi wireless station of Siasconet, Mass., recently destroyed by fire, has been repaired and business is being done. The damage was about $6,000.

It is predicted by a very modern architect that the house of one large room, a small electric kitchen attached and an enormous enclosed porch with facilities for outdoor sleeping has come to stay.

A British writer reports that notwithstanding the great and rapid increase in the demand for india rubber, chiefly for motor vehicles, the price has fluctuated but little in Great Britain, indicating that the sources of supply are equal to the calls made upon them. It is stated that cultivation of rubber trees is being carried on in various parts of the world under expert surveillance.

A report of accidents on steam railroads and street railways in Greater New York made to the Public Service Commission on November 22d shows that during the month of October 47 persons were killed and 4,860 injured. The report states that 593 persons were injured while alighting and 510 in boarding cars. Car collisions with vehicles caused injuries to 791 persons, while 603 employes were hurt in the performance of their duties.

An examination for cadet engineers in the government revenue service has been announced by the secretary of the treasury to continue five days from December 16th. Any young man between the ages of 21 and 25½ years who is of satisfactory character and has sufficient technical or actual training is eligible for the examination. Successful candidates will be assigned to the school ship Itasca at $75 a month, and after at least six months' training they may be made second assistant engineers at $1,400 a year.

J. G. G. Kerry and Professor Galbraith, two of the commissioners appointed by the Canadian government to inquire into the collapse of the Quebec bridge last September, have been taking evidence in several cities, and will soon report to the authorities in Ottawa. Until the result of their investigation is known no definite decision can be arrived at as to the reconstruction of the bridge. The pledge of the Canadian government to the Grand Trunk Pacific Railroad insures the continuance of the project, but a delay of several years seems to be inevitable.

A cable dispatch from Berlin says that the necessity of finding new sources of revenue to meet the expected heavy increase in imperial expenditures is giving occasion for the discussion of the novel proposition that Germany establish a government monopoly of electrical power plants. The advocates of the plan, who include Professor Gustav Schmoller and other distinguished university authorities in the science of government, declare that electricity, like the mails, telegraph and railways, now belongs to the category of utilities which may appropriately be placed under government control.

The decision of the commissioner of patents affirming the decision of the examiner of interferences in the petition filed by the Crouse-Hinds Company against the Appleton Electric Company is to the effect that the words "Wirelets" and "Condulets," used as trade-marks for electric-wiring purposes, are not so similar in appearance as to deceive a purchaser using reasonable care and diligence in the selection of his wares. It was urged that the two words have the same suggestive meanings, "wire-outlets" and "conduit-outlets," each signifying an outlet for electrical conductors, and that the manner in which the words are applied to articles of the same construction will cause confusion in the minds of the public.

The Automobile Show in Chicago this week is spoken of as the greatest in the history of the business. There were many buyers. The electric vehicle seemed to receive more favorable consideration than ever before. A recent writer says: "Though we accept the automobiles on the streets as a matter of course, and are no more surprised by them than we are by horse-drawn vehicles, the exhibition compels us to think on a rapidity of development so far which seems almost incredible. But a short time ago, within the memory of children, there were only a few crude machines which represented doubtful experiments. Today we have in this magnificent show the proof of a brilliant success that has come from those experiments. A new business has sprung up which requires an enormous investment of capital; the cars show the perfection of workmanship, and their practical value is no longer questioned."

TRADE NEWS.

Harry Chambers has purchased the electrical contracting business of the Woodruff-Lesh Company in Lincoln, Neb.

The Edwards & Merrill Company of Boston (electricians, with capital of $25,000) has been organized. William G. Merrill, John E. Edwards and Samuel W. Culver are directors.

The superintending engineer, Patiala State, India, is calling for tenders, up to January 6, 1908, for the electric and pumping plant required for the Patiala water supply, particulars of which may be had by addressing him.

The Pyro One-light Electric Sign Company of Chicago, capitalized at $100,000, has been incorporated to enter into the sign and advertising business. The incorporators are S. E. Loveless, S. Samson and M. S. Emirch.

The Chicago Electrical Equipment Company, capital $2,500, has been incorporated for the purpose of entering the manufacturing and contracting business. The incorporators are William Ku Yath, Hiram Keck and J. W. Clark.

The quartermaster, Fort Revere, Hull, Mass., will receive sealed proposals for furnishing and instaling electric-lighting fixtures in hospital at Fort Revere, until 10 a. m. on December 10th. Information furnished on application. Preference will be given to articles of domestic production and manufacture. Envelopes containing proposals should be indorsed "Proposals for electric-lighting fixtures," and addressed, C. O. Zollars, Captain, C. A. C.

The Power Equipment Company of Chicago has been incorporated, capitalized at $10,000, and proposes to manufacture and install electric and heating equipment. The incorporators are O. C. Foster, A. C. Field and Frank Crozier.

The Columbia Incandescent Lamp Company of St. Louis, of which Mr. A. C. Garrison is president, announces the opening of a New England branch office at No. 280 Devonshire Street, Boston. Here the company will carry in stock a full assortment of lamps for the benefit of its increasing New England trade.

BUSINESS.

Among the recent orders received by Dossert & Co. of 242 West Forty-first Street, New York city, was one from the Chicago City Railway Company for 150 two-way solderless connectors for 1,000,000-circular-mil cable.

McDowell, Stocker & Co., Chicago, have just completed the moving of their machinery stock to their new store at 16 to 20 S. Jefferson Street. The new quarters were designed to afford advantages in the display, storing and shipment of machinery which few similar buildings possess. The building is of mill constructon, absolutely fireproof in every requirement, even to the outward swinging doors, and has three floors and a basement, the floor space of each being 66 by 151 feet.

Legnard Bros. of Waukegan, Ill., report good results with their auto-marine spark plug. This device is said to be practically soot and oil proof and to give perfect ignition with a hot spark between points extended well into the firing chamber. By a quarter turn of the insulated handle the points may be readily removed for inspection without danger of shocks while the engine is running. A non-corrosive wire is used, which, with the porcelain, withstands the intense heat.

A recent circular from the National Battery Company, Buffalo, N. Y., tells of reliability, durability and simplicity of National storage batteries. National sparkers are said to be the standard equipment for more cars than any other make. They are constructed to withstand the hard service of high-power cars; are proof against acid sloppage, and the terminals are non-corrodible. They have no complicated connections to confuse the user, and can be easily operated and cared for. National batteries for electric vehicles are constructed to give long life without reducing the capacity or increasing the weight. The different types of plates are of standard size.

ILLUSTRATED ELECTRICAL PATENT RECORD.

Issued (United States Patent Office) November 26, 1907.

871,772. Sealing for Electric Apparatus. James R. Baker, Arlington, N. J., assignor to the Cooper Hewitt Electric Company, New York, N. Y. Application filed March 31, 1905.

The seal-off cavity of a mercury vapor tube has a shock-resisting body located within it and a wire passing through the wall of the tube and holding the same in position.

871,804. Apparatus for Electrically Operating Water-tight Bulkhead Doors. Robert H. Kirk, Cleveland, Ohio, assignor to the "Long Arm" System Company, Cleveland, Ohio. Application filed April 22, 1905.

Electric motors operate the bulkhead doors and hatches aboard ship. The motors are controlled either from a distance or near by and have overload protecting devices. When the door reaches the closed position a signal is automatically shown at the distant point.

871,826. Electric Train-lighting System. Walter Scribner, Columbus, Ohio. Application filed January 12, 1907.

A compound dynamo is provided for lighting the lamps and a shunt dynamo for charging the storage batteries, of which each car has a set. Automatic regulating devices control the connection and charge of the batteries.

871,851. Fuse. Frederick W. Young, East Orange, N. J. Application filed March 14, 1907.

An air-tight retaining tube is partly filled with oil and has a vacuum at one end. A fuse member is arranged in the tube and immersed in the oil.

871,875. Stop Motion for Looms. Charles D. Lanning, Dorchester, Mass. Application filed February 23, 1907.

Electrical detecting devices are arranged which move a knock-off device and stop the loom upon the occurrence of either weft or warp failure.

871,904. Shaft Oscillator. Edwin C. Wright, Newport, Ky., assignor to Allis-Chalmers Company and the Bullock Electric Manufacturing Company. Application filed April 20, 1907.

This is a magnetic oscillator. A coil is placed near the end of the shaft. A rotary switch for the coil is operated by a disk coming in contact with the end of the shaft as it moves longitudinally.

871,913. Trolley-wheel Bearing. William M. Caswell, Warren, Pa. Application filed June 6, 1907.

A trolley fork is screwed into the outer end of the pole. The fork has Babbitt metal bearing blocks set in recesses and cap plates mounted over these, which supply oil or grease to the rollers for the axle only when the pole is raised.

871,915. Reflector. Augustus D. Curtis, Chicago, Ill. Application filed January 18, 1906.

This reflector is of the hood type, fitting over two or more incandescent lamps. The reflecting surface has corrugations radiating from flat spots adjacent the center of each filament.

871,937. Surface-cleaning Machine. Robert B. Hutchison, Pittsburg, Pa. Application filed December 9, 1905.

The motor is mounted on a U-shaped frame and is connected by gearing to the rotating brush.

871,943. Belt Tightener. Emil Mattman, Norwood, Ohio, assignor to the Bullock Electric Manufacturing Company. Application filed January 2, 1906.

An electric motor has mounted on it a plate with a stud, to which is pivoted an arm carrying an idler pulley. A tension spring is adjustably attached to the arm.

871,947. Process for the Manufacture of White Lead. Frank W. Morris, Victoria, British Columbia, Canada. Application filed December 28, 1906.

Spongy lead and formic acid are produced electrolytically in separate compartments. The two are then combined and an alkaline carbonate added, thus precipitating lead carbonate.

871,948. Process for the Manufacture of Cyanide of Potassium or Sodium. Frank W. Morris, Victoria, British Columbia, Canada. Application filed December 28, 1906.

Formic acid and caustic soda or potash are electrolytically formed. The formic acid is then changed to ammonium formate and this distilled to hydrocyanic acid, which is added to a hydrate to form the cyanide desired.

871,960. Signaling System. Wilmer W. Salmon, Buffalo, N. Y. Application filed August 29, 1905.

A block-signal system has a battery in each section which operates a relay actuating a rotating armature that moves the signals.

871,970. System of Motor Control. Emmett W. Stull, Norwood, Ohio, assignor to Allis-Chalmers Company and the Bullock Electric Manufacturing Company. Application filed March 31, 1906.

A series-parallel controller controls two pairs of motors and has a single cut-out switch whereby either pair of motors may be disconnected without changing the effect of the controller on the other pair.

871,971. Electric Furnace. Edward R. Taylor, Penn Yan, N. Y. Application filed September 5, 1906. Renewed April 15, 1907.

This is a resistance furnace which has a vertical chamber. Metallic stems carry carbon electrodes extending through an outer feed space into the working chamber.

871,984. Cable Terminal and Junction Box. Frank B. Cook, Chicago, Ill. Application filed July 9, 1906.

A sheet metal air and water-tight box has fanning strips secured in the back and a series of spring members supporting protective devices.

871,994. Method of Cleaning Metal. Jean Hawthorne, New York, N. Y. Application filed March 26, 1907.

This is an electrolytic process for cleaning tarnished silver and consists in placing the articles to be cleaned in a tin vessel containing a solution of sodium carbonate. The silver being electrically connected with the tin walls, an electromotive force is developed between them whereby hydrogen is set free on the silver plate, thus decomposing the silver sulphide tarnish.

871,998. Bottle-capping Machine. Georg Kirkegaard, New York, N. Y. Application filed June 13, 1906.

The cap is forced on by two electromagnets operating a plunger and forming ring.

872,002. Railroad Signaling Device. Burns S. Miller, Everett, Wash. Application filed May 4, 1907.

A crossing gate is operated in conjunction with a distant visual signal, an electric circuit controlling the same.

872,022. Door Fastener and Opener. Charles Smith, Boston, Mass. Application filed April 24, 1907.

A hinged catch is controlled by the armature of an electromagnet.

872,029. Molding Receptacle. James S. Stewart, New York, N. Y., assignor to Annie Stewart, New York, N. Y. Application filed June 29, 1906.

A porcelain block with shell and central stud terminals is mounted directly over the molding, the two wires in which are connected to these terminals.

872,039. Automatic Alarm and Stopping Device for Engines. Daniel B. Adams, Summitville, N. Y. Application filed September 30, 1903.

The ignition circuit is automatically broken when the supply of water for cooling the cylinder fails.

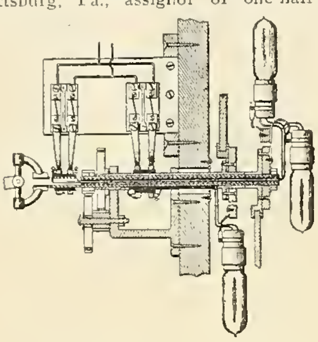
872,065. Incandescent-lamp Cluster. Harvey Hubbell, Bridgeport, Conn. Application filed October 13, 1905.

This cluster is made of two parts, each having half-sockets which form the sockets for the lamps when the two parts are joined together.

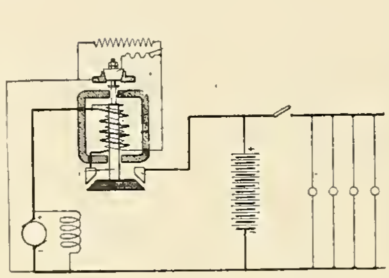
872,075. Sparking Device. Harry A. Miller, Pasadena, Cal., and Benjamin G. Gilbough, Chicago, Ill. Application filed February 14, 1906.

This spark plug consists of a tubular stationary electrode and vibratory electrode extending to near the other.

872,094. Trolley-securing Device. John Szekeres, Pittsburg, Pa., assignor of one-half to John

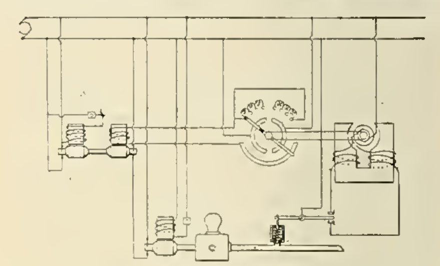


NO. 872,200.—TOWER CLOCK.



NO. 872,215.—AUTOMATIC ELECTRIC SWITCH.

NO. 872,216.—INSULATOR.



NO. 872,298 —AUTOMATIC MOTOR CONTROL.

Poluba, Allegheny, Pa. Application filed August 23, 1907.

The support for the trolley wheel carries a number of vertical arms with laterally hinged portions on each side of the trolley wire.

872,102. Electric Stop for Engines. James K. Wright, New York, N. Y.. Application filed February 4, 1907.

An electromagnet restrains a weight from closing the steam supply valve. A speed responsive device opens the magnet circuit when the speed becomes either too low or too high.

872,104. Sand Box for Cars. Abbott L. Bacon, Franklin, Mass. Application filed March 22, 1907.

The box has a number of electrically heated bars or plates near its bottom, which prevent moisture in the sand from freezing.

872,126. Massage Implement. Henry G. Hart, Mount Vernon, N. Y. Application filed May 15, 1905.

Two disks rigidly connected by a central tube over a spindle have a number of rollers between their peripheries. Connecting wires pass through the handle and conduct current to the disks and rollers.

872,141. Automatic Stop for Railway Trains. Vaughn Morrison, Wessington Springs, S. D. Application filed June 26, 1907.

A railroad crossing is provided with a series of switch boxes containing electromagnets that bring levers into position for operating trip mechanisms on the locomotives that apply the brakes.

872,142. Rail Bond. Asa H. Mosher, Westfield, N. J. Application filed January 17, 1907.

This bond for signaling circuits has a split eccentric plug driven into the hole so as to wedge about the bond wire.

872,143. Controlling Mechanism for Electric Motors. Martin B. McLauthlin, Malden, Mass. Application filed September 22, 1902.

A controller for an elevator motor has electromagnetic devices operated from the car for closing and opening the operating motor circuit, and then short-circuiting the armature and applying the brake to stop the motor.

872,145. Protective Shield for Skeleton-frame Bells, and 872,146, Adjustment for Contacts. George L. Patterson, New York, N. Y., assignor to Alice C. Patterson, New York, N. Y. Applications filed July 11, 1907.

These are electric bell improvements. The shield is detachably secured at the back of the frame by clips. The contact adjustment is secured by having a screw pass through a split post with an adjusting nut secured between the two split parts.

872,148. Electrotherapeutic Apparatus. Nelson H. Raymond, Brooklyn, and Joseph C. Vetter, Coney Island, N. Y., assignors to Alice C. Patterson, New York, N. Y. Application filed August 24, 1905.

A casing contains a battery with one terminal connected to a body electrode and the other to a similar casing, the two cells being in series.

872,154. Combined Controller and Circuit-breaker. William M. Scott, Philadelphia, Pa. Application filed April 9, 1907.

This is a starting switch for a three-phase induction motor. In starting, circuit-breakers are cut in that have a higher current capacity than the normal ones, which are automatically substituted when the motor comes up to speed.

872,171. Means for Protecting Operators' Ringing Leads. William W. Dean, Elyria, Ohio, assignor to the Dean Electric Company, Elyria, Ohio. Application filed April 7, 1906.

A relay in the leads has a high impedance, making it normally inoperative. A low-impedance shunt is connected around the relay under its control.

872,193. Electrocapillary Apparatus. Axel Orling, Upper Tooting, England. Application filed June 1, 1907.

This indicator of successive electric impulses has a horizontal capillary passage containing two plugs of distinct conducting liquids in contact with each other and with the two terminals of a circuit. A pivoted oscillating member carrying one element of a recording device is also connected to one of the liquids.

872,197. Electric Switching Device. James A. Posey, Midlothian, Tex., assignor to the Posey Automatic Switching Company, Dallas, Tex. Application filed March 3, 1906.

An electromagnetic track switch is operated by the motorman on the car.

872,200. Tower Clock. Edward Rowe, Indiana, Pa. Application filed May 9, 1901.

An otherwise unilluminated dial has extension arms secured to its hands that carry incandescent lamps with long filaments. (See cut.)

872,204. Apparatus for Fumigating Telephone Instruments. Louis I. Shrader, New Albany, Ind. Application filed May 29, 1907.

A casing containing a fumigating agent has holes in its sides for inserting the transmitter mouthpiece and the receiver.

872,208 and 872,209. Enclosed Resistance. Henry J. Wiegand, Milwaukee, Wis., assignor to the Cutler-Hammer Manufacturing Company, Milwaukee, Wis. Applications filed October 30, 1905.

The resistance is mounted on a base or supporting member. The whole is surrounded by a casing which is filled with an insulating cement in a plastic condition that later hardens.

872,213. Battery Support for Automobiles. Samuel R. Bailey, Amesbury, Mass. Application filed January 4, 1907.

The battery is supported at points below its center of gravity. Three suspension rods are provided which are mounted so as to permit universal swinging of the support with relation to the vehicle frame.

872,215. Automatic Electric Switch. William L. Bliss, Brooklyn, N. Y. Application filed January 6, 1905.

This switch connects a storage battery to a generator and has one winding in shunt with the latter and another in series with generator and battery. As soon as the shunt winding has closed the switch the current in this winding is reduced to merely a retaining current. (See cut.)

872,216. Insulator. Homer D. Bodley, Stanley, N. Y. Application filed February 27, 1907.

The insulator has a groove arranged to receive a wire, a slide adjacent to the groove and movable against a wire therein, and a cam co-operable to clamp the slide against the wire. (See cut.)

872,224. Electric Guest-calling Clock. Ralph C. Dick, St. Louis, Mo. Application filed June 4, 1906.

A clock mechanism drives a number of shafts in unison by gearing. In a ring around each shaft is arranged a number of push buttons which come, when forced back, into the path of an arm on the shaft, thus completing an alarm circuit to a particular room.

872,228. Quadruplex-telegraph System. John J. Ghegan, Newark, N. J. Application filed July 25, 1907.

This system has a neutral and a polarized relay and their local sounder circuits in combination with an induction coil controlled by the armature of the neutral relay to act on the local sounder circuit of the neutral relay to prevent false signals.

872,251. Electromagnetic Power Generator. Joseph L. Potter, Indianapolis, Ind., assignor to Harry G. Hawekotte, Indianapolis, Ind. Application filed July 16, 1906.

A number of electromagnet coils are set side by side. One common armature for them is pivoted at one end and connected to a crank on a power shaft on the other.

872,283. Incandescent-lamp Socket. Gilbert W. Goodridge, Bridgeport, Conn., assignor to the Bryant Electric Company, Bridgeport, Conn. Application filed July 20, 1907.

The end of the shell and the flange of the cap are corrugated to fit together and provided with a latching means.

872,284. Transmitter. Rasmus Hansen, Chicago, Ill., assignor of one-half to A. Miller Belfield, Chicago, Ill. Application filed December 3, 1902.

A chamber for granular material is carried by the casing. A main and a supplemental diaphragm are situated behind the chamber in which is an electrode carried by the second diaphragm.

872,289. Controlling Mechanism for Electric Motors. Edward D. Lewis, Elmira, N. Y., assignor to the Lewis Motor and Crane Company. Application filed June 18, 1907.

Resistance coils are wound around and in series with the field coils. In starting the motor these are gradually cut out and in stopping the motor they are gradually cut in.

872,293. Ringing Device for Telephone Exchanges. William W. Dean, Elyria, Ohio, assignor to the Dean Electric Company, Elyria, Ohio. Original application filed January 16, 1906. Divided and this application filed August 8, 1906.

In the cord circuit is a ringing relay connecting generator and locking circuits to the line. When the called subscriber answers the locking circuit is broken.

872,298. Means for Automatically Controlling Electric Motors. Harry W. Leonard, Bronxville, N. Y. Original application filed February 6, 1897. Divided and this application filed January 28, 1902. Renewed July 10, 1905.

A source of electromotive force is connected in series with the armature of the motor and a regulator is controlled by the work for automatically controlling the electromotive force of the source to automatically increase or decrease the speed of the motor to meet the requirements of a variable duty. (See cut.)

872,300. Electrical Measuring Instrument. Paul MacGahan, Pittsburg, Pa., assignor to the Westinghouse Electric and Manufacturing Company, Pittsburg, Pa. Application filed October 18, 1905.

This instrument has two stationary windings respectively of high and low resistance and a movable winding. Connections are arranged whereby the instrument may be used as a voltmeter or as a wattmeter.

PATENTS THAT HAVE EXPIRED.

Following is a list of electrical patents (issued by the United States Patent Office) that expired December 2, 1907:

441,665. Regulator for Electric Motors. W. E. Hyer, Newburg, N. Y.
441,695. Brush Holder for Electric Motors or Dynamos. W. S. Patterson, Allegheny, Pa.
441,703. Electric Signaling System. J. W. Riggs, Minneapolis, Minn.
441,764. Trolley Covering for Electric Railways. H. Jones, Detroit, Mich.
441,773. Automatic Electric-railway Signal. R. O. Owen, Lynchburg, Va.
441,793. Dynamo-electric Machine. W. K. Freeman, Brooklyn, N. Y.
441,794. Regulator for Dynamo-electric Machines. W. K. Freeman, Brooklyn, N. Y.
441,807. Motor Regulator. D. Pepper, Jr., Philadelphia, Pa.
441,817. Electro-thermostatic Valve. L. Bell and F. H. Root, Chicago, Ill.
441,818. Electrode for Secondary Batteries. J. Y. Bradbury and F. J. Stone, Lowell, Mass.
441,828. Electromagnetic Traction-increasing System. M. W. Dewey, Syracuse, N. Y.
441,837. Conduit for Electric Conductors. E. T. Greenfield, New York, N. Y.
441,838. Attaching Device for Electric Conductors. E. T. Greenfield, New York, N. Y.
441,839. Process of Impregnating Porous Bodies. E. T. Greenfield and J. Nagel, New York, N. Y.
441,840. Underground Conduit for Electric Wires. E. T. Greenfield, New York, N. Y.
441,843. Galvanic Battery. A. H. Hoy, Racine, Wis.
441,847. Telegraph Circuit. F. W. Jones, New York, N. Y.
441,855. Thermostat. A. G. Sargent, East Tilton, N. H.
441,908. Electric Clock Alarm. M. W. Tiedemann, Brooklyn, N. Y.
441,953. Electric Motor. H. Groswith, Philadelphia, Pa.
441,954. Method of Operating Electric Motors. H. Groswith, Philadelphia, Pa.
441,958. Secondary Battery. C. W. Kennedy and H. Groswith, Philadelphia, Pa.
441,959. Electrode for Secondary Batteries. C. W. Kennedy, Philadelphia, Pa.
441,967. Galvanic Battery. C. G. DePeralta, Havana, Cuba.
441,972. Electrical Indicating Apparatus for Linear Measure. J. Rapieff, New York, N. Y.
441,973. Electrical Location and Range-finding Instrument. J. Rapieff, New York, N. Y.
442,018. Electric Arc Lamp. T. P. C. Crampton, London, England.
442,030. Electric Switch. F. E. Fisher, Detroit, Mich

WESTERN ELECTRICIAN

EVERY SATURDAY

Vol. XLI. CHICAGO, DECEMBER 14, 1907. No. 24

Chicago Automobile Show.

The Chicago Automobile Show which was opened on November 30th and continued to December 7th was the largest ever held anywhere in this country. Three of the largest show buildings in the city were required to display the exhibits, these being the Coliseum and the First and Seventh Regiment armories. There were about 150 distinct exhibits of automobiles, besides a large display of motor cycles and hundreds of exhibits by companies dealing in automobile accessories.

Of course the gasoline cars predominated, but the electric vehicle exhibits showed large gains over former years, and manufacturers of electrics say that this type of car is gaining in popularity and general usefulness even more rapidly, in proportion, than the gasoline and steam machines. Although prospective purchasers are not inclined to buy at this season of the year, many sales were made, and the various exhibitors are confident of large spring sales as a result of the show.

Detail of the gasoline cars cannot be considered here. There are of course many improvements tending to simplicity and efficiency of operation. The exhibits gave evidence of energetic efforts toward the production of moderate-priced, serviceable cars, and on the other hand there has been much advance in the more elaborate, high-priced machines, some of the cars exhibited being valued at $7,000 and $8,000. One notable feature was the attention given to the six-cylinder engines exhibited, but it seems probable that the four-cylinder will prevail for some time to come.

In electric vehicles there has been little change as to design, the display in pleasure vehicles being very handsome. The accompanying group shows a few of the vehicles exhibited. While electric pleasure cars have the disadvantage of being limited as to distance of travel on a charge to from forty to eighty miles, they are gaining in popularity because of the simplicity of operation, cleanliness and ease and economy of maintenance.

A more hearty co-operation on the part of electric-light companies will do much to increase the use of electric vehicles. On this subject many of the exhibitors at the show were especially enthusiastic. In some cities the central-station men are beginning to see the possibilities for a desirable load in automobile battery charging and are co-operating with the vehicle manufacturers to the interest of both and the public as well. Some of the manufacturers have a plan of arranging with the central-station companies whereby the services of skilled electricians are available for the benefit of purchasers of their machines without cost to the purchaser.

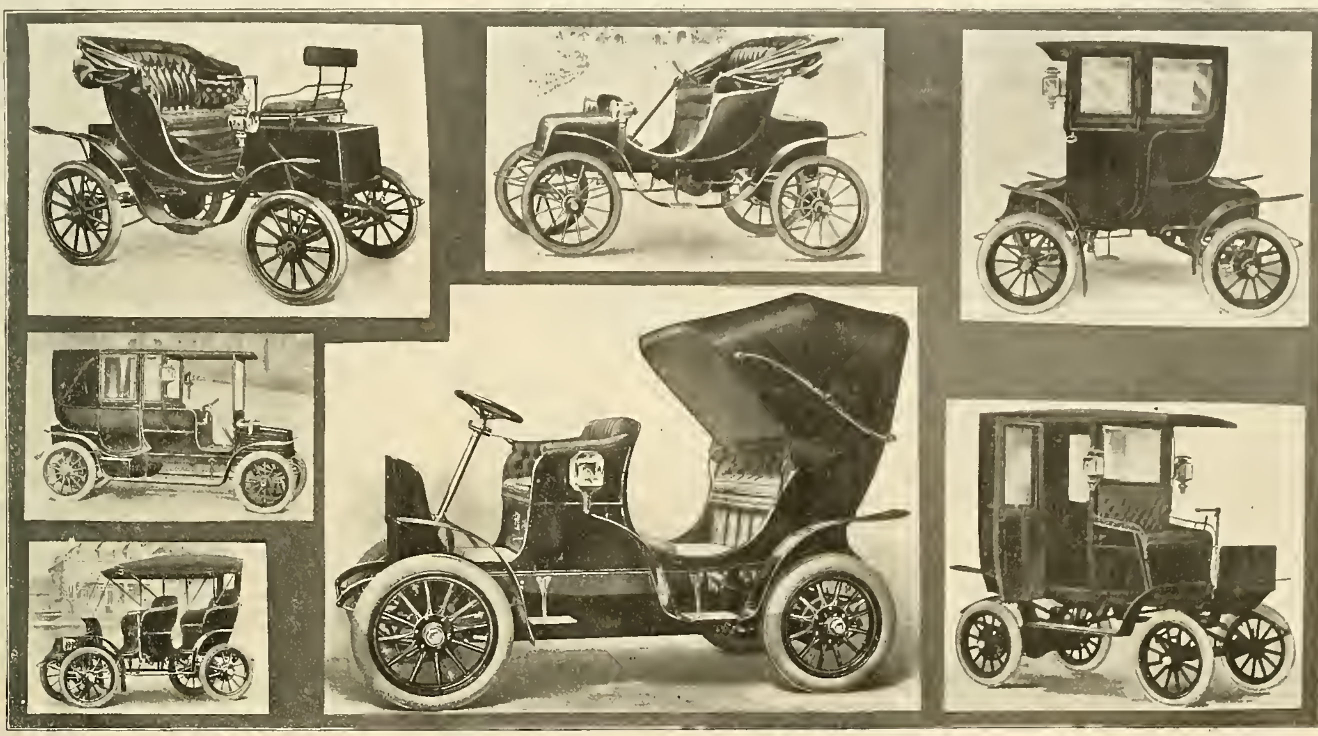
In districts where direct current is available the battery-charging problem is simple, and in small towns and outlying districts, where alternating current usually prevails, users of electrics can now avail themselves of any one of several forms of current rectifiers, thus bringing charging facilities within reach in almost any locality. These rectifiers can be installed at no great cost on the automobile owner's private premises.

There is some complaint that central-station companies do not make a sufficiently low rate to encourage the sale of electrics. However, in most cities the central-station managers have seen the possibilities of the electric-vehicle business and by low rates for charging are materially increasing their revenue. This load is a desirable one, as it can be taken on when the demand is low.

There is an increasing output of commercial electric vehicles of all kinds. A large variety of such vehicles was shown in the Seventh Regiment Armory, the exhibit including delivery wagons, heavy trucks, etc. One truck which attracted attention was that of the Couple-gear Freight-wheel Company. It has four motors, the transmission employing the principle of couple action whereby the single force of the motor is divided into two equal forces which act in opposite directions, pulling up one side of the wheel and down the other. The power is applied to the rim of the wheel.

Automobile accessories in great variety were exhibited by hundreds of companies, who showed all the latest electrical and mechanical devices of use to automobile owners. Much valuable automobile literature, handsomely illustrated, was freely distributed.

Among the companies which had large exhibits of electric vehicles were the following: Babcock Electric Carriage Company, Buffalo, N. Y.; Baker Motor Vehicle Company, Cleveland, Ohio; Byride Electric Auto Company, Cleveland; Columbus Buggy Company, Columbus, Ohio; Couple-gear Freight-wheel Company, Grand Rapids, Mich.; Electric Vehicle Company, Hartford, Conn.; Pittsburgh Motor Vehicle Company, New York and Pittsburg, Pa.; Pope Motor Car Company, Indianapolis, Ind.; Rauch & Lang Carriage Company, Cleveland, Ohio; Studebaker Automobile Company, South Bend, Ind.; Woods Motor Vehicle Company, Chicago.



Woods Queen Victoria with Detachable Child's Seat. Rauch & Lang Landaulette. Baker Surrey. — Babcock Victoria Phaeton. Columbia Open Victoria. — Columbus Coupe. Pope-Waverley Station Wagon.

SOME ELECTRIC CARRIAGES SHOWN AT THE CHICAGO AUTOMOBILE SHOW OF LAST WEEK.

Electrical Exports for October.

Electrical exports from the United States for the month of October, 1907, reached a total value of $1,457,914. This is an increase of $210,546 over September, 1907, and a decrease of $149,122 from the figures for October, 1906. Exports of electrical machinery during October show an increase in comparison with the corresponding month last year, but in electrical appliances there was a decline, the figures being as follows: Electrical machinery—October, 1907, $767,016; October, 1906, $743,749. Electrical appliances—October, 1907, $690,898; October, 1906, $863,287.

The following-named countries were the principal destinations of electrical exports from the United States in October, 1907, the figures given representing the value of the respective purchases, arranged in the order of size.

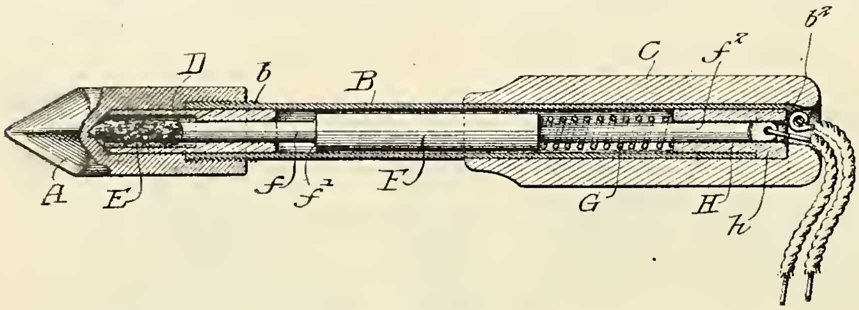
Electrical Machinery.—Mexico, $183,681; Brazil, $100,647; Japan, $100,550; United Kingdom, $96,370; British North America, $81,353; France, $28,870; Argentina, $22,668; British East Indies, $21,977; British Australasia, $14,770; Cuba, $13,022; Central American States and British Honduras, $12,021; British Africa, $8,467; Germany, $5,717; Philippine Islands, $5,409; other Africa, $39,003; other South America, $20,008; other Europe, $8,705; other countries, $3,778.

Electrical Appliances.—Brazil, $174,057; British North America, $143,966; Mexico, $55,629; United Kingdom, $54,161; Japan, $46,288; Cuba, $41,479; Argentina, $20,127; Central American States and British Honduras, $19,816; Germany, $19,211; Belgium, $8,731; British Australasia, $4,740; British Africa, $2,983; France, $2,685; Philippine Islands, $2,355; other South Africa, $70,671; other West Indies and Bermuda, $12,002; other Europe, $4,928; other countries, $6,979.

Electric Soldering Iron with a Simple Heating Device.

An electric soldering iron of quite novel and simple construction has been invented by William G. Hartwig of Chicago, and he was recently granted a United States patent on the device. The object was to provide an iron in which the heat generated within the head should be applied at the most effective point. The invention is illustrated in the accompanying sectional drawing.

The copper head (A) of the soldering iron is bored out as shown. The outer-end portion of the chamber of the head (A) is interiorly screw-threaded to receive the exterior screw thread (b) that is formed upon one end of the hollow stem (B). The opposite end of this stem has fitted thereto a tubular handle (C) of suitable material. Within the chamber of the head is set an insulating sleeve (D) of porcelain or other suitable insulating material, and within this insulating sleeve is placed a solid body of carborundum crystal (E) that will be pressed against the head (A) by



ELECTRIC SOLDERING IRON.

means of a plunger (F) that is carried within the sleeve (B).

The plunger (F) has a reduced stem (f) passing through the insulating sleeve (D), and a shoulder or offset (f') on the plunger (F) serves to limit the extent of the movement of the sleeve (B) toward the head (A), and thus guards against any danger of short-circuiting by reason of the contact of the end of the plunger with the head. The outer end of the plunger is formed with a stem (f²) that is encircled by a coil spring (G) that serves to force the plunger toward the head. The stem (f²) of the plunger passes through an insulating sleeve (H) that is held within the outer end of the tubular handle (C), this insulating sleeve being preferably formed with a flange (h) that is cut away at one side to receive the terminal extension (b²) at the outer end of the sleeve (B). To this terminal extension (b²) is connected one of the conductor wires, and the other conductor wire of the circuit is connected to the outer end of the plunger stem (f²).

The insulating sleeve (D), serving as it does to hold the high-resistance material (E) out of contact with the head of the soldering iron except at the end of the sleeve, insures the application of the heat due to the passage of current through the high-resistance material to that part of the soldering iron to which the heat may be most effectively used. The insulating sleeves (D) and (H) serve also to hold the plunger out of contact with the sleeve (B) and thus prevent the short-circuiting of the current between such parts. The plunger effectively serves to insure a constant contact between the high-resistance material and the head of the soldering iron.

The operation of this soldering iron is readily understood. Current passes by one of the conductor wires to the sleeve (B) and through the head (A) and high-resistance material (E) to the plunger (F) and thence to the other conductor wire.

Brushes and Brush-holders.

[From the Question Box of the American Street and Interurban Railway Engineering Association.]

What is done to prevent brush and brush-holder troubles by operators of fast and heavy electric-railway equipments?

ANSWERS.

R. A. Dyer, Jr., Auburn and Syracuse Electric Railway Company, Auburn, N. Y.: Get a well-designed motor and keep brush-holders and commutators clean.

Anonymous: Brush-holders and brushes should be inspected daily. Brush-holder springs should be kept at the right tension and the holders should be properly adjusted and well cleaned. Brushes must not be too soft or too hard, but of sufficient hardness to cut the mica, and commutators should be inspected frequently for flat or rough surfaces.

George W. Knox, Green Bay Traction Company, Green Bay, Wis.: Watchfulness.

H. R. Fothergill, Greenville (S. C.) Traction Company: Grind brushes for a neat fit and use heavy springs.

E. W. Olds, the Milwaukee Electric Railway and Light Company: Use good carbon brushes and see that the brush-holders and yokes are in first-class condition and properly adjusted.

C. C. Collins, Columbus (Ohio) Railway and Light Company: Frequent inspection and cleaning.

Dr. Steinmetz Invents a Steam Turbine.

One of the latest demonstrations of the versatility of Dr. Charles P. Steinmetz is his invention of a steam turbine which has just been patented in this country and assigned to the General Electric Company. The machine is a vertical one and the casing is divided by diaphragms into main-wheel chambers containing the bucket-wheels. Plates are mounted in the chambers on both sides of the wheels that conform approximately to the shape of the wheels and form small auxiliary chambers independent of the main wheel chambers. Passages in the wheels connect the auxiliary chambers on opposite sides. Packing sleeves are mounted between the diaphragms and the rotor of the turbine which are so arranged that the leakage passes to the auxiliary chambers so as to reduce rotation losses and thence passes to the main chambers.

A Curious Hydro-electric Scheme.

What are known as the "curiosities of invention" may be interesting if not apparently practicable. To this class, perhaps, belongs a recent proposal of Robert McLaughlin of Baltimore, illustrated herewith, recently patented as a "Means for Obtaining Power from Flowing Water." Modern hydro-electric plants have used almost exclusively hydraulic turbines or impulse wheels actuated by the head of water. The velocity of flow of running streams, where the head is not great, has been

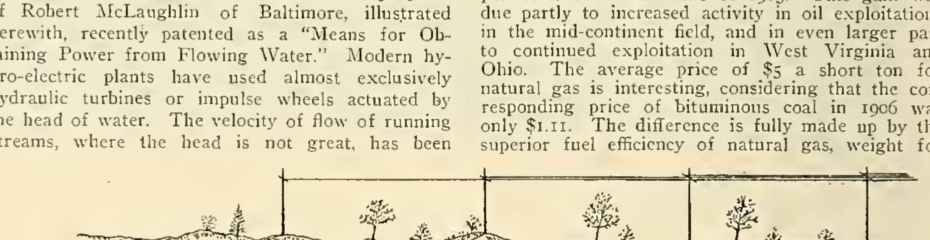


FIG. 1. A CURIOUS HYDRO-ELECTRIC SCHEME.

neglected since the abandonment of the old-style undershot waterwheels formerly popular for driving mills. Mr. McLaughlin seems to think that here is a wasted opportunity that may be utilized by his invention. It is to be feared, however, that not many mechanical or electrical engineers will agree with him as to the usefulness of the means he proposes.

The scheme is illustrated by the accompanying drawings, taken from the patent specifications. Fig. 1 is a general elevation of the application of the method and Fig. 2 a sectional elevation of one form of the apparatus. The latter consists of the supporting vessel (1), which is in the form of a water-tight case (a number of such vessels being shown in Fig. 1). This is moored or held in desired operative position by a cable or hawser (15). A driving shaft (4) extends longitudinally through the vessel and is journaled in end bearings (6) therein. The driving shaft passes through a stuffing box (5) at one end of the vessel, and a screw propeller (8) is fixed upon its outwardly projecting portion. If preferred, the opposite end of the driving shaft may also project outwardly and carry a screw propeller. The driven mechanism is a dynamo (9), which has its revolving element mounted directly on the driving shaft (4), and the

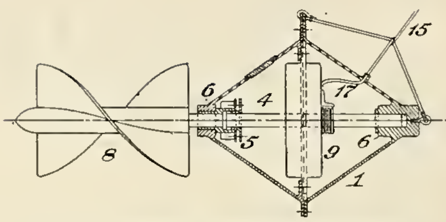


FIG 2. A CURIOUS HYDRO-ELECTRIC SCHEME.

current is conducted to a desired point, as to a connection with line wires (15), by properly insulated conductors (17), which pass through water-tight fittings in the vessel, and are supported by the hawser which moors the vessel. In lieu of actuating a dynamo, the driving shaft may impart rotation, through gearing in the ordinary manner, to a flexible shaft constituting the driven member, this shaft being led, similarly to the conductors (17), to a desired point of utilization on shore.

The vessel may be longitudinally extended and provided with tapering or conical ends, in the general form of a torpedo, in order to afford sufficient space for the reception of a number of dynamos, from which current is transmitted as in the preceding instance. This construction enables the diameter of the vessel to be reduced so that it may divide the water easily and so that a better waterway to the propeller may be afforded.

The inventor thinks that the apparatus shown may also be employed for the purpose of generating electric current for use on board sailing vessels or vessels in tow which are not provided with motive power, by being towed by such vessel, the screw propeller being rotated by the movement of the vessel through the water, in the same manner as a ship's log.

In his specifications the inventor does not describe any regulating devices for these dynamos nor make any claims as to the feasibility or efficiency of the system proposed.

Natural Gas in the United States.

Statistics collected by the United States Geological Survey and published in an advance chapter from "Mineral Resources of the United States, Calendar Year 1906," show that the natural-gas product of the United States for 1906 amounted to 388,842,562,000 cubic feet measured at the atmospheric pressure, or 9,396,963.8 short tons. Particular interest attaches to these quantitative figures, as they represent the first successful effort to obtain information in regard to the quantity of gas produced, for many small operators have been able to report only the total value of the gas sold.

The value of the gas product for 1906 amounted to $46,873,932, an increase of $5,311,077, or 12.8 per cent. over the value of 1905. This gain was due partly to increased activity in oil exploitations in the mid-continent field, and in even larger part to continued exploitation in West Virginia and Ohio. The average price of $5 a short ton for natural gas is interesting, considering that the corresponding price of bituminous coal in 1906 was only $1.11. The difference is fully made up by the superior fuel efficiency of natural gas, weight for weight, and by the great economy of labor in its use and in the cost of removing ashes.

The principal natural-gas-producing states in the Union are, in order of value of product, Pennsylvania, West Virginia, Ohio, Kansas and Indiana. The statistics of natural-gas production in 1906 were prepared for the Survey by Mr. B. Hill under the supervision of Dr. David T. Day.

St. Lawrence River Improvements.

The St. Lawrence Power Company of Canada has a proposition before the International Waterways Commission to develop, in connection with an American company, the waterpower at Mille Roches in the Cornwall district at a cost of $20,000,000. This power company, with the American company, is also investing on the American side of the St. Lawrence and has purchased Barnhart's Island, 2,200 acres, and tracts on Longue Sault Island and other properties. It is now erecting a dam at the head of the island, has already expended large sums and is to expend about $12,000,000. The St. Lawrence company has a development of 1,200 horsepower and has applications for more power. The project will cut out Lock No. 21, and will mean a saving to steamers of four hours. They will be able to run at full speed up the river and the traffic would necessarily go through American waters.

Recent Improvements in Inductor Alternators.

Inductor alternators are in many respects particularly adapted for use with prime movers operating at a very high speed, such as steam turbines, since no sliding contact and no moving wire whatever is required, and consequently the structure of the rotating inductor may readily be designed for great mechanical strength adapted to resist high centrifugal strain. As inductor alternators have been constructed usually it has been necessary to employ at least two poles on the inductor in order to secure a mechanical balance

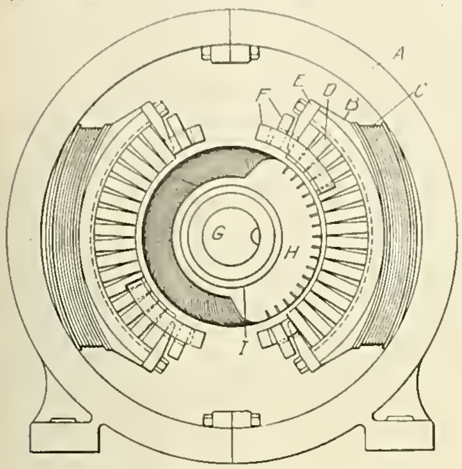


FIG. I. KELSEY'S INDUCTOR ALTERNATOR (END ELEVATION).

and, as inductor alternators are ordinarily arranged, one revolution of the inductor produces as many complete cycles as there are poles—that is, a two-pole inductor produces two complete cycles per revolution. Thus an alternator designed for 25 cycles would have a speed of 750 revolutions per minute, which, particularly with small machines, is too low for most efficient operation of a steam turbine, while for still lower frequencies a still more inefficient speed is required.

To overcome this difficulty improvements in inductor-alternator design have been brought about by Charles A. Kelsey of Pittsfield, Mass., and David B. Rushmore of Schenectady, N. Y., which have been patented and assigned to the Stanley and General Electric companies, respectively.

The first invention consists in arranging the inductor with a single helical polar projection. Since only one polar projection is employed, the machine gives only one cycle for each revolution, and since the projection is arranged in a helix, the inductor may be mechanically balanced.

In Fig. 1 is shown an end elevation of this alternator and in Fig. 2 a side elevation with one-

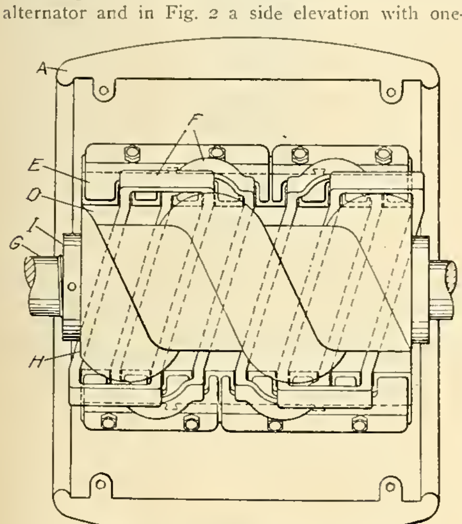


FIG. 2. KELSEY'S INDUCTOR ALTERNATOR (SIDE ELEVATION WITH ONE-HALF OF FRAME REMOVED).

half of the stationary frame removed. The frame (A) of the machine has two projecting poles (B) like an ordinary bipolar field structure. On the poles are mounted the field coils (C), which furnish the magnetization for the machine. On the faces of the poles are supported laminated cores (D), which are held in place by suitable clamping plates (E). The laminated cores are arranged with helical slots, as is clearly shown in Fig. 2, and in these slots are placed the armature coils (F).

In this arrangement the armature coils are disposed to produce a two-phase current, each phase comprising two coils, and the coils of the two phases being displaced from each other 90 electrical degrees. Counting from left to right in Fig. 2, coils (1) and (3) are at the point of maximum induced voltage, since one side of these coils is directly opposite the center of the polar projection on the inductor. Coils (2) and (4) are at the point of zero-induced voltage, since the polar projection is directly opposite the centers of these coils.

The inductor shaft (G), is mounted in suitable bearings (not shown) between the field poles. Surrounding the shaft and supported thereby are a number of punchings or laminations (H), arranged in planes perpendicular to the axis of the shaft. These laminations are shaped like rings or disks of unequal depth on opposite sides. Each lamination thus has one part projecting beyond the rest of the punching, and the several punchings are so arranged on the inductor shaft that each is displaced circumferentially a small amount from the next one. In this manner a laminated mass is produced having a single helical polar projection. As shown in Fig. 2, this polar projection makes two complete turns around the inductor.

In order to secure the helical arrangement of the punchings, the shaft (G) is provided with a spiral groove, and the punchings provided with similarly positioned tongues, adapted to engage the helical groove in the shaft. The punchings are held in place on the shaft by suitable clamping rings (I) at each end.

Since the relative movement of the helical inductor pole and of the armature slots is neither circumferential nor axial, but in a direction midway between these two, it may be desirable to laminate the periphery of the inductor punchings

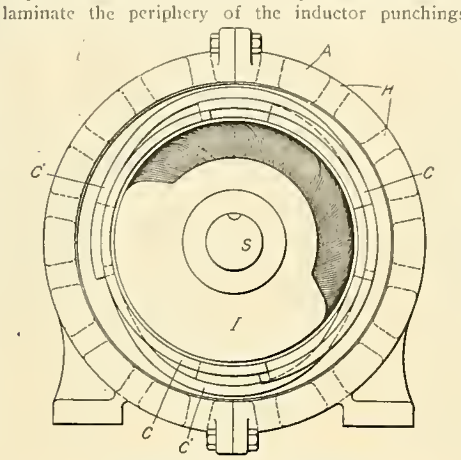


FIG. 3. RUSHMORE'S INDUCTOR ALTERNATOR (END ELEVATION).

axially. This may be done in a simple manner by slotting the periphery of the projection of each punching, as shown in Fig. 1.

The machine as above described evidently gives one cycle per revolution, so that by this construction it is possible to operate an inductor alternator for 25 cycles at 1,500 revolutions per minute or for 60 cycles at 3,600 revolutions.

Mr. Rushmore's design is quite a decided modification of the construction described above. Fig. 3 is an end elevation of this modified alternator and Fig. 4 is a side elevation of the same with one-half of the frame or armature body removed. In the drawings (I) represents the inductor mounted on the revolving shaft (S). The inductor is provided at each end with a helical projection, as is clearly shown in Fig. 4, and these projections are preferably oppositely arranged—that is, if one helix is considered as right-handed, the other is left-handed. The armature body (A) is provided at each end with laminations (a), so as to form a laminated ring surrounding each polar projection of the inductor, the two rings being joined by a bridge of magnetic material. The field coil or coils (F) are supported by the armature body beneath the magnetic bridge joining the two laminated rings. The armature coils (C) (C') are arranged in helical slots in the laminated rings of the armature body. The magnetic bridge joining the laminated rings is provided with ventilating holes (H).

With this construction it is evident that the field coils will magnetize the inductor, so that one helical projection will be of north polarity and the other of south polarity. A flux passes outwardly from one polar projection through the laminated ring surrounding it across the magnetic bridge to the other laminated ring, and back to the other helical pole of the inductor. If the armature coils are arranged in inductive relation to the polar projections, it is evident that as the inductor revolves alternating electromotive forces will be induced in the armature coils, and since the projections are in the form of a helix the induced electromotive force in the armature coils will pass through one cycle for each revolution of the inductor.

As has been pointed out heretofore, the helical polar projections are preferably oppositely arranged. The purpose of this is to allow them to act more efficiently as blowers, drawing air in from both ends of the machine. This air passes between the field and armature coils, cooling both of them, and escapes outwardly through the holes (H) in the central portion of the armature body. Furthermore

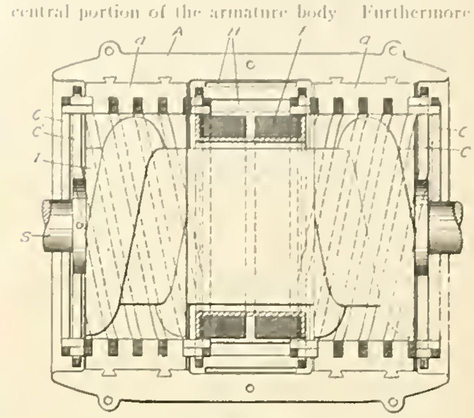


FIG. 4. RUSHMORE'S INDUCTOR ALTERNATOR (SIDE ELEVATION WITH ONE-HALF OF FRAME REMOVED)

since air is drawn in from both ends toward the center, the inductor is balanced with respect to the axial wind pressure, so that there is no end thrust due to the blower action. The machine is also balanced magnetically.

In Figs. 3 and 4 the armature coils are shown arranged for producing two-phase currents. The coils of one phase are indicated by (C) and those of the other phase, displaced 90 electrical degrees, by (C'). Each of the helical slots contains two coils. The end connections of each coil extend substantially 180 degrees around the armature. This is shown in Fig. 3. The machine may readily be designed for three-phase or single-phase instead of for two-phase, as shown.

Greasing Trolley Wire.

[From the Question Box of the American Street and Interurban Railway Engineering Association.]

Can sleet be prevented from forming on the trolley by greasing the wires? Has such an idea ever been tried?

ANSWERS.

D. Thomson, De Kalb-Sycamore and Interurban Traction Company, De Kalb, Ill.: Yes—with success—using petroleum jelly sold as trolley wire grease.

Fort Wayne and Wabash Valley Traction Company, Fort Wayne, Ind.: No. Yes.

H. M. Sloan, the Calumet Electric Street Railway Company, Chicago, Ill.: The greasing of the trolley wire to prevent sleet I found to be ineffectual after repeated trials.

George W. Knox, Green Bay Traction Company, Green Bay, Wis.: Yes; the writer tried this with good results. The trouble is that greasing the wire is rather expensive, but is very effective.

H. R. Fothergill, Greenville Traction Company, Greenville, S. C.: Not by me. I think it is a good one.

John K. Pischke, John Stephenson Company, Elizabeth, N. J.: In the fall of 1892 on the Mountain Route of the Suburban Traction Company, Orange, N. J., we had a lot of trouble with sleet. I heard a remark passed, "Why don't they grease the trolley wire?" I tried it and found it to be all right. We have not used a sleet cutter or wheel for this route in four winters.

C. C. Collins, the Columbus Railway and Light Company, Columbus, Ohio: Been tried. Not successful.

Massachusetts Electric Companies.

The Massachusetts Electric Companies, a voluntary association composed of a large number of electric-light and street-railway companies in Massachusetts, has issued its report for the year ended September 30th. The report contains the following figures:

	1907.	1906.
Gross earnings	$7,758,511	$7,518,240
Expenses	5,000,652	4,883,552
Net earnings	2,757,859	2,634,688
Charges	1,702,623	1,594,502
Balance	1,055,236	1,040,186
Dividends	880,773	710,406
Surplus	174,463	329,780

Comparative Performance of Steam and Electric Locomotives.

The Pittsburg branch of the American Institute of Electrical Engineers held a meeting on December 4th in the lecture hall of the Carnegie Institute. Mr. J. H. Schoeff of the Westinghouse Electric and Manufacturing Company abstracted Mr. Armstrong's New York paper, "Comparative Performance of Steam and Electric Locomotives," emphasizing important points in the paper. Among them was the fact that at higher speeds the electric locomotive develops comparatively more tractive effort than the steam locomotive; also that the electric locomotive works out better on mountain grades for hauling freight. Mr. Armstrong estimated the time a steam locomotive is idle during the day on account of standing in stations, at blocks, etc., and said that on account of having to keep up steam all the time the locomotive lost on an average 400 pounds of coal per hour.

Mr. A. W. Gibbs, general superintendent of motive power of the Pennsylvania Railroad Company, had been invited to take part in the discussion, but was unable to be present. However, he wrote a letter touching on some of the points along which the steam locomotive designer was working. Following is his letter:

"You should bear in mind that the present capacity of the steam locomotive is largely a question of the capacity of the fireman to stoke it adequately, and this is the principal reason why there is a prevailing feeling that the older, smaller locomotives were proportionately better than the modern large ones. The introduction of a mechanical stoker, which is probably a question of but a short time, will materially change this condition.

"Furthermore, considering an increase in the capacity of the road by whatever power is found most advantageous, will still leave the choke at the usual places, viz., the terminals. Moreover, the capacity of existing lines, especially double-track ones, is governed very largely by the presence on the line of trains having several rates of speed. While the use of a locomotive which will make high speeds with heavy trains will enable movements to be made which might not be made with a locomotive of slow speed, nevertheless what would most largely tend to economy of the movement is unification of the speeds. Finally, in considering the use of locomotives having sufficient power to maintain high speeds with heavy loads, it should not be overlooked that the construction of the electric locomotive as a vehicle which will maintain such high speeds without damage to track still requires attention."

Mr. Malcolm MacLaren, formerly of the British Westinghouse Company, discussed the subject of steam versus electric locomotives as to capacity limitations. He considered the 1,200-volt direct-current system and compared it with the alternating-current system. He showed that for some speeds and work the direct-current was more economical, but on a whole discouraged the use of the high-voltage direct-current system.

Mr. William Cooper of the Westinghouse Electric and Manufacturing Company discussed the subject of steam versus electric locomotives from the viewpoint of control. He made some good points regarding the braking of long trains on steep grades, calling attention to the fact that the electric trains can be braked by means of electrical control, while on some steam roads great trouble is experienced from hot brake shoes and wheels, the heat becoming so intense in some instances as to crack off the wheel flanges. He also pointed out how it was possible to run trains of practically any length by an arrangement of electric locomotives distributed through the train and controlled by one man, which is impossible with the steam locomotive.

Mr. N. W. Storer said that it was not practical for steam roads to change over all their equipment at once from steam to electric, but that it would pay to electrify a great many terminals and mountain divisions with steep grades. Upon one occasion he was snowed up in a Northern Pacific train for several days, with very little to keep him warm. The principal trouble seemed to be the inability of the locomotive to keep up steam on account of the severe cold. He pointed out that if the train had been propelled by an electric locomotive no delay would have been experienced, as the colder the motors the more efficiently they work.

Mr. Edwin Reid of the National Cable Company of London made a few remarks. He mentioned one thing which was hard for the Englishman to understand, and that was why the American people would "stand for" so many delayed trains. He declared that in England, as a rule, trains are on time.

Mr. Paul Lincoln answered a question as to the comparative coal consumption of a steam-locomotive system and an electric system.

Mr. C. F. Scott called attention to the greater cleanliness of the electric locomotive and also gave reasons why the steam-locomotive builder was not present, several of whom had been invited to take part in the discussion. He also pointed out that all the limitations of the steam engine had been exceeded by the electric locomotive. He had just received word from Indianapolis that an electric locomotive was making a 586-mile run per day.

Cleveland Electric Submits to Mayor Johnson.

According to dispatches from Cleveland, Ohio, the Cleveland Electric Railway, which for seven years has been in controversy with Mayor Johnson, declaring that its long hauls and model system could not be maintained at a three-cent fare, has agreed to the mayor's holding-plan proposal.

The surrender was made, the report says, on December 4th at a public meeting of councilmen, councilmen-elect, mayor, city officers, officers of the traction company and Fred H. Goff, an outsider named by the Cleveland Electric to conduct negotiations. Mr. Goff is empowered to accept terms from Mayor Johnson, with no report to the Cleveland Electric, and in his address to the meeting agreed to the merger of three-cent and five-cent roads under a holding company, and declared all that remained was the fixing of the figure at which the Cleveland Electric stock shall be taken over. As appraisers, President Andrews of the corporation and President Dupont of the three-cent line, were named, with lawyers and real-estate experts to assist, to determine a valuation on the old company's property.

The Cleveland company's system would have been cut to pieces, with practically nothing of value left, in six or seven years, had Mayor Johnson clung to his announced programme of giving the three-cent-fare companies franchises as rapidly as the old company's expired, with franchises to joint use of the old company's tracks, where possible, at once.

It is expected the fare to points outside the limits will be five cents, with transfers at no extra charge. Mayor Johnson has incorporated in his traction proposals and franchises granted to his self-inspired companies a clause providing that if a three-cent fare does not pay six per cent. profit a higher rate may be charged up to the point at which six per cent. can be earned on real valuation.

Settlement of the real valuation of the Cleveland Electric, with the rate-of-fare equation involved, is the point at issue now.

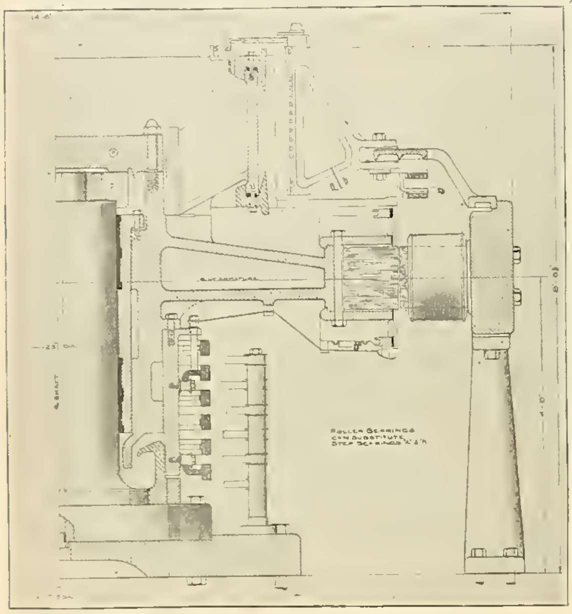
The First 2,000-kilowatt Vertical-shaft Rotary Converter in Service.

The Commonwealth Edison Company of Chicago has the distinction of installing in its regular service the first large vertical-shaft rotary converter in this country, and the first of its size in the world. Two units, in fact, have been installed—a 2,000-kilowatt machine in the Market Street sub-station and one of 1,000 kilowatts capacity in the Randolph Street station, not yet in operation.

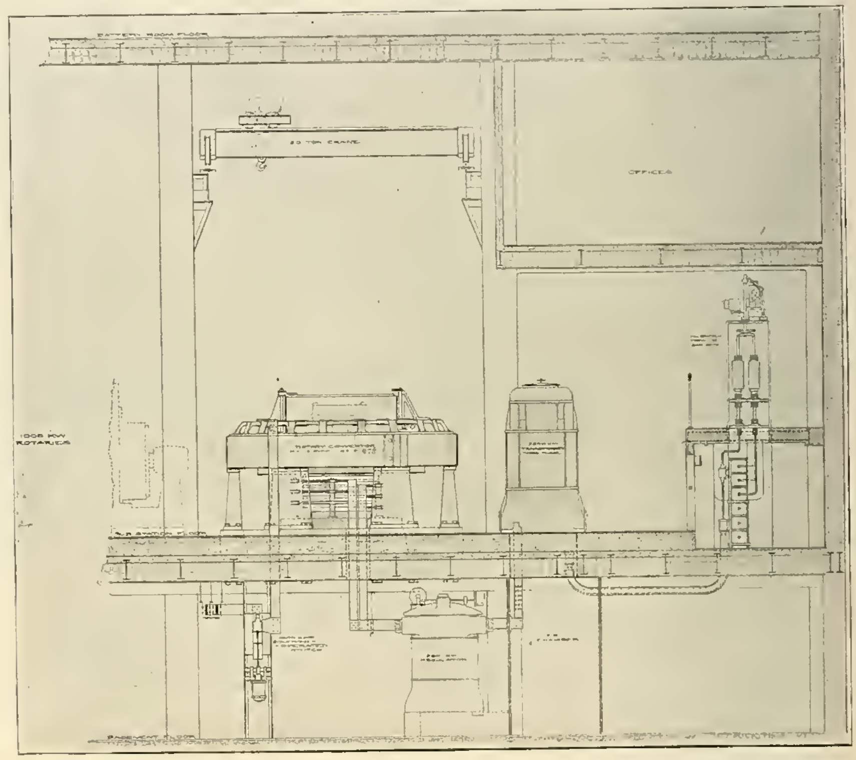
The larger machine, illustrated herewith, was started on December 6th, and its operation was smooth and satisfactory. This date may therefore be taken, probably, as marking the beginning of a new epoch in the development of sub-station practice. There were present when the new rotary was started Mr. Charles W. Stone of Schenectady, N. Y., and Mr. James Lyman of Chicago, representing the General Electric Company; members of the engineering staff of the Commonwealth Edison Company and a representative of the Western Electrician.

Accompanying this article are illustrations showing a vertical section and an elevation of the 2,000-kilowatt vertical-shaft rotary in the Market Street sub-station. A view of the pedestal or shaft before the rest of the machine was assembled is also shown. The elevation shows the relation of the rotary to the other station apparatus and the sectional drawing shows details of the shaft and bearing.

Electrically, the characteristics of the new machine are identical with those of the older horizontal type of rotary made by the General Electric Company, the features of the vertical rotary being in the economy in various points, simplicity and accessibility. Some of the points of advantage are apparent from a comparison of figures. The floor space required for a horizontal rotary of 1,000-kilowatt capacity is 11 feet 2 inches by 11 feet 7 inches; for the vertical machine of this size the



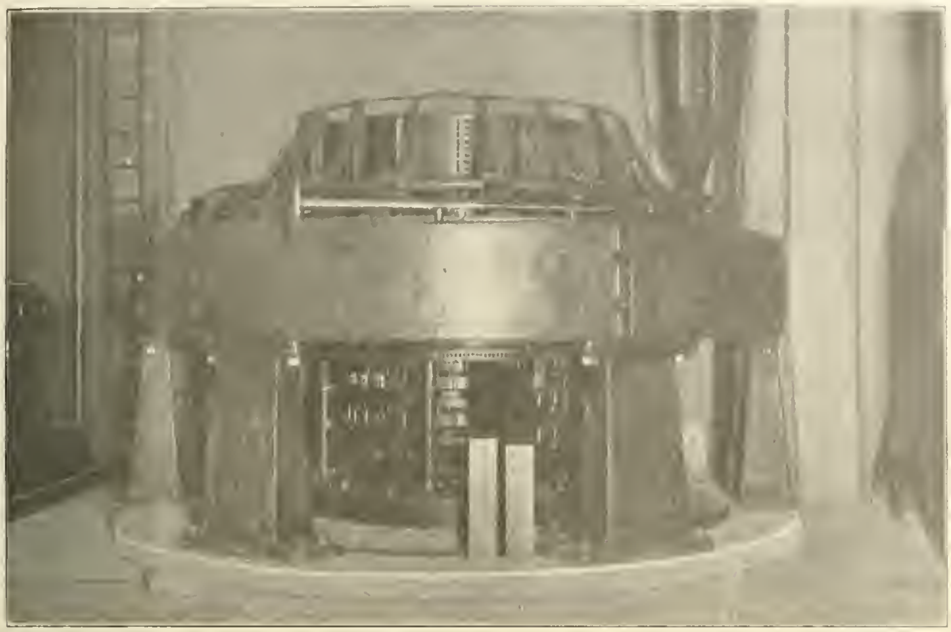
VERTICAL SECTION OF 2,000-KILOWATT VERTICAL-SHAFT ROTARY CONVERTER.



ELEVATION OF 2,000-KILOWATT VERTICAL-SHAFT ROTARY CONVERTER IN MARKET STREET SUB-STATION, SHOWING ITS RELATION TO OTHER APPARATUS.

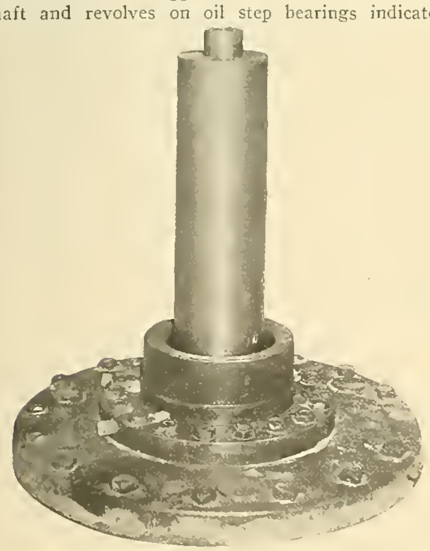
floor space measures 9 feet 8 inches in diameter. For the 2,000-kilowatt machines the horizontal type takes up a space measuring 16 feet 6 inches by 16 feet 8 inches, while the space required for the vertical rotary measures 15 feet 3 inches in diameter.

In many instances clearance is an important matter, and here the vertical type of rotary shows to advantage also. The 1,000 kilowatt horizontal machine measures 9 feet 7 inches above the floor, against 7 feet $3\frac{1}{2}$ inches for the vertical. The height above the floor of the 2,000-kilowatt machines is 12 feet 11 inches for the horizontal and 9 feet 3 inches for the vertical. The vertical type of rotary also shows a gain of approximately 40 per cent. in speed, and there is a saving of about 17 per cent. in weight for machines of similar capacity. A glance at the illustrations shows the advantage in accessibility for adjustment, oiling or repairing. Should it become necessary, the field frame can easily be removed by removing the bolts.



FIRST 2,000-KILOWATT VERTICAL-SHAFT ROTARY CONVERTER IN SERVICE.

The 2,000-kilowatt rotary in the Market Street sub-station revolves at 167 revolutions per minute. The armature is supported from the top of the shaft and revolves on oil step bearings indicated by (A) and (B) in the sectional drawing. The shaft is 23 inches in diameter, or nearly one-half its height. The sleeve bearings on the sides of the shaft are provided only for keeping the armature in alignment. The step bearings shown have proved practical and efficient in every way, and as a further improvement roller bearings are being tried on the Market Street machine in substitution for the bearings (A) and (B).



PEDESTAL OR SHAFT OF VERTICAL ROTARY CONVERTER.

The strong air current set up in the operation of the machine is skilfully directed to prevent heating in the core and commutator. This is an important feature. On approaching the machine a cool atmosphere is readily perceived.

Current is supplied the new rotary through the ordinary medium from the Fisk Street station of the Commonwealth Edison Company at 9,000 volts 25 cycles. It is converted to direct current at 240-300 volts and fed into the three wire network of the Edison system.

There has long been a demand for a practical, efficient converter unit which would yield an economy in floor space. Many sub-stations of some of the large central stations have outgrown their present quarters and are so located that further acquisition of ground is impossible. To these the question of increasing the output is a serious one. Here the vertical type of machine, as now in actual service in Chicago, shows its applicability, as a 2,000-kilowatt rotary of the vertical type takes up little more space than one of half the capacity on horizontal shaft.

The vertical-shaft rotary converters now in use in Chicago were built by the General Electric Company. In the development of this type Mr. C. W. Stone of that company has been especially active during the last two years. The engineering department of the Commonwealth Edison Company has also given the subject much attention, and, co-operating with Mr. Stone, the present machine has resulted. Similar machines are being built for other companies.

Electrolytic Copper.

In an article on "Electrolytic Copper Refining" in the London Times Engineering Supplement, John B. C. Kershaw gives the following interesting details:

The number of electrolytic refineries now operating in the different countries of the world is given below:

America (U. S. A. and Canada)	11	86.5%	of total
United Kingdom	6	8.8%	output.
Germany	9		
France	4		
Russia	2		
Austria-Hungary	2		
Japan	2		
Total	36		

When one considers the nature of the electrolytic refining process, these figures are rendered more remarkable. If a small current of electricity be passed for 15 minutes between two electrodes of pure copper, suspended in a glass beaker containing a solution of copper sulphate and a little free acid, no visible transport of copper from anode to cathode occurs, but if the electrodes be washed, dried and weighed before and after the experiment, a slight change in weight will be found. Copper has, in fact, been dissolved at the anode, and deposited at the cathode by the action of the current, and if the molecular structure of the electrolyte could be rendered visible to the eye, a steady drift of most minute copper particles, or "ions," from anode to cathode would have been seen.

When raw copper, as for example that known in the trade as "blister copper," is substituted for the pure copper at the anode, the same action occurs, but in this case the impurities of the raw copper do not pass into solution, but collect upon the surface of the anode, and finally fall to the bottom of the beaker, as a precipitate or sludge.

Now one cubic inch of copper contains, roughly, 60,000 million million of these "ions," and the number of separate "ions" required to form one ton of copper is inconceivably greater than this. Yet this method of purifying copper, particle by particle, it now enables to produce upon one-half the copper production of the world and a method that would appear to be fitted only to the chemist's laboratory is carried out on a scale of enormous magnitude and extent.

American Society of Mechanical Engineers.

The twenty-eighth annual meeting of the American Society of Mechanical Engineers was the first to be held in the society's new home in the Engineering Societies Building, New York city, the dates being December 3d, 4th, 5th and 6th. Subjects of timely interest were thoroughly discussed, the programme having provided for papers and discussions on such subjects as gas power, foundry practice, superheated steam, power transmission by friction driving, cylinder port velocities, industrial education, etc. Pleasant social gatherings, such as receptions, dancing, etc., were enjoyed and there were several profitable inspection trips, including a visit to the Hudson Companies' tunnels under the North River, the Pennsylvania crosstown tunnel, inspection of the 300 horsepower Watson Stillman gas producer and engine, and other trips.

The meeting was opened on Tuesday evening by Dr. F. R. Hutton, president of the society, who had as the subject of his address, "The Mechanical Engineer and the Function of the Engineering Society." Sessions were held on each of the following three days. After the president had concluded his address an informal reception was held.

The business session, as usual, was held early, and included the election of officers, which resulted as follows: President, M. L. Holman, St. Louis; vice-presidents, L. P. Breckenridge, Urbana, Ill., Fred J. Miller, New York city, Arthur West, Pittsburg; managers, William L. Abbott, Chicago, Alexander C. Humphreys and Henry G. Stott, New York; treasurer, William H. Wiley, New York.

In his address President Hutton outlined at length a plan for making the society a factor in more harmonious effort between engineering societies for greater usefulness and more brilliant achievements. The society, he said, should foster and cause the growth of other organizations, specialized either by their location or by their particular line of study and pursuits. Such affiliated bodies should be entirely autonomous as regards their officers, procedure, rules and financial support. The American Society should then furnish each member of the affiliated bodies copies of the Proceedings and should make provision for complete reports of the meetings of the special organizations for publication in the Proceedings as judged of value.

On the subject of "Gas Power" the following papers were on the programme: "The Rational Utilization of Low-grade Fuels in Gas Producers," by F. E. Junge; "Duty Test on Gas Power Plant," by J. R. Bibbins; "Control of Internal Combustion for Gas Engines," by Prof. C. E. Lucke; "Evolution of the Internal Combustion Engine," by Prof. S. A. Reeve.

An interesting paper on industrial education was prepared by W. B. Russell, and F. E. Ives gave an address on color photography, illustrated by stereopticon views.

The programme contained ten papers on the subject of foundry practice, among which was one entitled "Power Service in the Foundry," by A. D. Williams. This paper is given elsewhere in this issue.

Other papers were: "The Specific Heat of Superheated Steam," by Prof. C. C. Thomas; "Engine Design Adapted for the Use of Superheated Steam," by Max E. R. Toltz; "Power Transmission by Friction Driving," by Prof. W. F. M. Goss; "Cylinder Port Velocities," by J. H. Wallace.

What the College Degree Means in Technical Work.

Success is due, primarily, to the man and not to the institution. A degree from a reputable school is a great help to a man at the beginning of his career, especially if times are dull, positions hard to obtain, and if the man in question can secure also the personal indorsement of the teachers who knew him; but probably no collegiate degree is of any use to a man in his profession after he has been ten years out of school. The college offers a man an opportunity to train himself in those mental, moral and physical qualities which will bring him success. Let each student see to it that he avails himself of his opportunities to the utmost, and success will then be within his grasp.—Prof. George F. Swain in Boston "Tech."

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CORRESPONDENCE relating to electricity or any of its practical applications is cordially invited, and the co-operation of all electrical thinkers and workers earnestly desired. Clear, concise, well written articles are especially welcome; and communications, views, news items, local newspaper clippings, or any information likely to interest electricians, will be thankfully received and cheerfully acknowledged.

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DEPARTMENTS.

IT IS ENCOURAGING to note the general impression in electrical circles that the industrial situation is on the mend. The financial tension due to the monetary stringency has passed its maximum and is subsiding; the crisis in this direction has been passed in safety. Business activity was of course unfavorably affected by the money market, but within the last week or ten days the general situation, particularly in the West, has presented a much brighter aspect. The volume of business has increased; inquiries are coming in more freely; business men are more buoyant and confident; attention is again turned to new projects; collections are easier, and in every direction there are indications of a distinct all-around improvement in business conditions. With a succession of bountiful harvests during the last few years adding to the resources of the country, it was of course inevitable that this reaction from depression should take place sooner or later; and it is gratifying to be able to record the fact that there is every reason to believe, from a survey of the electrical industry, that this upward movement is now fairly under way

STEAM BOILERS are unquestionably susceptible of great improvement in efficiency, but it comes as something of a surprise to learn that competent authorities believe that boilers can be constructed and probably operated to produce about ten times the amount of steam now obtained per square foot of heating surface, and with no difficulty in obtaining dry steam. This belief is expressed in no haphazard or irresponsible way, but is put forth in a government publication and is from the pen of Prof. L. P. Breckenridge of the University of Illinois, engineer in charge of boiler division at the United States government's fuel-testing plant in St. Louis.

Professor Breckenridge thinks it probable that the cost of the boiler plant may be cut down to a fraction of the present figure, at the same time obtaining higher efficiency. He feels that there is good ground for anticipating an enormous improvement in the production of steam power within the next few years. "If so, it will not be the first time that a new arrival in a field has spurred on older forms of enterprise to a higher prosperity than they ever dreamed of before. The competition of the gas engine may be the best thing that ever happened to steam engines and turbines." But it is conceded that a great field awaits the gas engine in the smaller plants, say, of less than 5,000 horsepower.

The practical improvement is to be made, it is said, in the combustion chamber of the boiler furnace. "There is a possibility of increasing enormously the efficiency of a combustion chamber as a burner of volatile matter. Effort in completing a steam-generating outfit of small dimensions must be largely concerned with the construction of a combustion chamber containing many gas-mixing appliances."

The "Study of Four Hundred Steaming Tests," from which these conclusions are taken, is a valuable government bulletin, and the summary of Professor Breckenridge's work, given on the opposite page in this issue, will be read with attention.

ELECTRIC COOKING has many points of advantage, while only one drawback is alleged against it, and that is increased expense due to the cost of the necessary current at prevailing commercial rates. Of course the greater convenience and cleanliness of the electric method are to be offset against this charge, but nevertheless the use of electric-cooking devices could be greatly extended among people of moderate means if a method could be devised to reduce the operating expense. Perhaps this desirable result may be attained by a combination of the electric utensils with the "fireless cooker" or "hay stove." As is well known, these "fireless stoves" are appliances insulated to retain the initial heat of the cooking utensil and its contents. After the operation of cooking is fairly begun on an ordinary stove or range, the kettle or what not can be removed to the "fireless stove," and there enclosed in such a manner that the cooking process is finished in the course of time by the heat already imparted, without the addition of further heat. Now why could not these "fireless stoves" be used with great advantage in electric cooking, resulting in a great saving of current? Only enough electric heat would be required to get the boiling or baking well started. The current could then be shut off, allowing the retained heat to do the rest. There would seem to be no reason why the electric utensil and the fireless stove might not be combined in one compact device, by the use of which, possibly, electric heating might be accomplished at small expense in every household where reasonable comfort prevails. At any rate the suggestion is worthy of investigation, and the Western Electrician commends it to the attention of the designers of electric-cooking appliances.

ONE OF THE most important matters which the central station faces in extending its service is the cost of connecting new customers to its circuits. Any reduction in this cost tends to increase the number of small users of light and power, and there is no question that the expense of the electrical installation is often all that stands in the way of the closing of contracts. Considerable variations occur in the cost of both light and power installations, even in the same company's practice. Thus, in a recent case, the cost of connecting lighting customers varied from $60 to $100. The cost of connecting power customers was $268 for 10-horsepower; $525 for 25-horsepower; $790 for 50-horsepower, and $1,390 for a 100-horsepower installation. Presumably these figures included the cost of the equipment, labor and materials. It is clearly in the interest of the company to reduce these figures if possible.

It is not an easy matter to lower installation costs, but something can be done by advising the customer as to the size of equipment needed in cases where a consulting engineer is not employed. Other sources of economy are the grouping of loads on large transformers and the gradual elimination of small scattered units, the handling of several installation jobs simultaneously or in groups in the same part of the territory, the placing of all the wiring for new customers in the hands of a single wiring contractor in consideration of a reduced rate being granted on the installation, and in the wholesale purchase of the usual wiring supplies and possibly the purchase of motors in large numbers.

MARSEILLES will be the scene of an electrical exposition next year, and reference to it has been made previously in the Western Electrician. Mr. Robert P. Skinner, the United States consul-general in that city, supplies some additional details worthy of the attention of possible American exhibitors. The exposition is organized under the auspices of the city of Marseilles, France, and the commissioners-general are H. Dubs, manager of the Marseilles street railways, and G. Cordier, administrator of the Society of Electrical Energy. Foreign countries and the French colonies are invited to participate in the exposition. It will be held in the new city park, and the buildings are to a large extent now ready. Mr. Skinner has no doubt that it will be profitable to American manufacturers of electrical supplies and machinery of every class to interest themselves in this exposition, and he can probably be of assistance to such in suggesting local firms capable of taking charge of their exhibits.

Until within the last two or three years the southeast of France possessed only a few local electrical installations, according to the consul-general, and they were not of great importance, but several groups of capitalists have lately created a large system of electrical distribution, supplied by a series of hydro-electric establishments now disposing of a force equal to 150,000 horsepower. This electrical energy is already distributed among 400 communes in eight departments having a population of 3,000,000 inhabitants. The rapidity with which all this has been accomplished has opened up considerable possibilities to manufacturers of machinery and supplies prepared to take advantage of the circumstances.

The exposition next year will comprise 17 principal groups, subdivided into a large number of classes. The general plan of the enterprise includes a grand palace, a palace of energy, a palace of traction and mines, an agricultural building with an experimental field in connection therewith, a modern house containing every application of electricity to domestic purposes, and the usual subordinate buildings and amusement enterprises. All exhibits properly entered will be free from customs duty, the exposition grounds constituting in effect a bonded warehouse.

Increasing the Efficiency of Boilers.

A bulletin giving "A Study of Four Hundred Steaming Tests Made at the Fuel-testing Plant, St. Louis, Mo., in 1904, 1905 and 1906," has been issued by the United States Geological Survey. It is written by Prof. L. P. Breckenridge of the University of Illinois and makes a pamphlet of 196 pages, with 35 illustrations. Professor Breckenridge, in his preface, says that the fuel tests discussed in the bulletin were made by the boiler division of the United States Geological Survey fuel-testing plant at St. Louis, Mo. These tests began during the Louisiana Purchase Exposition, in 1904, and have been in progress since that time. The coals tested have been collected from all the prominent fields of the United States. It has been the object to compare fuels by determining the evaporative performance of the boilers when using the various coals. Careful and complete observations have been made with each coal, so that it should be possible for engineers to determine from an examination of the records whether the conditions of the tests were favorable or unfavorable for the character of the coals tested.

Space is not available for quotations from this valuable "Study" at length. However, the result of the work is summarized at the end of the bulletin in "General Conclusions" and "Commercial Considerations," which are given below in full.

General Conclusions.

All the tests that are discussed in this bulletin were made under a Heine boiler with a hand-fired furnace. The principal object of these tests was to determine the relative value of coals for steaming purposes. With this in view each coal was burned to its best advantage for hand firing.

All the tests were made at about the rated capacity of the boiler, carrying a steam pressure of about 80 pounds. The average length of a test was about 10 hours. The only variable conditions were thickness of fire and intensity of draft.

While the average efficiencies are fairly high, better efficiency could be obtained with furnaces and other conditions more especially adapted to particular coals. The average efficiency obtained at the fuel-testing plant is about 10 per cent. higher than is obtained in good commercial plants. This is true for all coals.

The efficiency used as a basis for comparison of coal tests under a boiler is code item 72*. [Code of the American Society of Mechanical Engineers]. This is the ratio of the heat carried away in the steam to the calorific value of the "combustible." In determining the amount of "combustible" burned it was considered that the coal which fell through the grate was never fired. This efficiency 72* is the product of boiler and furnace efficiencies.

Per cent. of completeness of combustion is the ratio of heat evolved in the furnace to the potential heat in the coal ascending from the grate.

The efficiency of the boiler proper is the ratio of the heat absorbed by the boiler to the heat evolved in the furnace. Efficiency 72* is not commonly subdivided into furnace and boiler efficiency on account of the difficulty of determining the actual heat evolved in the furnace.

The true boiler efficiency is the ratio of the heat absorbed by the boiler to the heat available for absorption. This is the true measure of the ability of a boiler to absorb heat.

Inasmuch as efficiency 72* is the product of furnace and boiler efficiency, it increases with an increase of furnace efficiency, which means that efficiency 72* is higher with coals which are more easily and completely burned. Except in extreme cases, it is very little affected by the temperature of combustion. High CO_2 content in the gas analysis is not a definite indication of high efficiency, although some high 72* efficiencies were obtained with high CO_2 content in the gas. The best efficiencies of tests recorded in this paper were obtained with about 10 per cent. of CO_2. High CO is always an indication of low 72* efficiency. It does not by itself account for all of the incomplete combustion, but merely indicates poor conditions in the furnace. The other combustible gases which probably pass up the stack, though occurring in very small quantities, will account for heat loss many times as great as the CO loss.

The true boiler efficiency [E_4] is not of constant value in commercial boilers, but varies somewhat with temperature of combustion and capacity. This variation with temperature is due to the heat absorbed by radiation from the fire and the hot brick walls. To increase capacity there must be a proportionate increase in temperature difference between the first layer of water and the film of gas adhering to the tube. Since the temperature of the water is in most cases constant, the temperature of the adhering film of gases will be raised and the flue gases will leave the boiler at a higher temperature.

In general, the efficiency is affected by the formation of soot and scale on the heating surface and by defective circulation of water in the boiler. These conditions cause poor absorption of heat and higher flue-gas temperature.

The rate of combustion is affected by the chemical composition of the coal, the size of the coal, the intensity of the draft, and, to some extent, by the thickness of the fire and the formation of clinker. Bituminous coals high in "volatile matter" burn more quickly than those high in "fixed carbon." Coals ranging in size from one fourth inch to 1½ inches burn much more rapidly than either very small or very large sizes. This is undoubtedly due to a better distribution of air with these sizes. Fine coal, the formation of clinker and thick fires hinder the passage of air and reduce the rate of combustion. By increasing the draft, more air is drawn through the fuel bed, causing the coal to burn more rapidly.

With higher rates of combustion less air is used per pound of combustible, the temperature of combustion rises, the gases pass through the boiler faster, and after a certain rate of combustion is reached black smoke is produced. Capacity varies almost directly with the rate of combustion. Extremely high or low rates of combustion reduce efficiency.

The presence of ash in dry coal up to about 15 per cent. has very little effect on efficiency and capacity. Above this percentage, however, the efficiency drops.

Moisture reduces efficiency and capacity, perhaps, by hindering combustion.

The presence of sulphur in coal is not detrimental to the value of coal as fuel for steaming purposes except where it exists in certain combinations with other constituents of the ash so as to form fusible clinker which may adhere to the grate.

If there are no other reasons for washing coal than for efficient burning, coal need not be washed, as the efficiency of the furnace and boiler are not increased by washing except with coals of high ash or considerable free pyrites. Washed coal can usually be burned at a higher rate of combustion. The washing of coal does not decrease the per cent. of black smoke produced.

Most coals when briquetted can be burned at a higher rate of combustion. As a rule, briquetted coals burn with little or no smoke.

Bituminous coal should be fired in small quantities every three or four minutes. It is best to fire only on one-half of the grate area at a time. When burning bituminous coal, up to a medium rate of combustion, the production of smoke may be entirely avoided by leaving the furnace doors partly open for a short time immediately after firing. The best thickness of fire ranges from five to 10 inches, varying with the intensity of draft of 0.5 to 0.7 inch under the stack damper.

Most of the eastern semi-bituminous coals, especially the small sizes, cake badly in the fire. When using these coals the fire must be raked frequently. Coal of this class can be fired every five or six minutes, and more can be fired at a time than of bituminous coal. Either the spreading or alternate method of firing may be used. Owing to its tendency to crumble, coal of this class usually reaches the boiler room as fine as slack, which reduces its value as a steaming coal. It can be improved for steaming purposes by briquetting.

Good results can be obtained with lignites if a difference of draft of 1½ to 2 inches of water is carried between the ashpit and the stack. With this draft these fuels may be fired in large quantities every six or eight minutes, the spreading method of firing being used. Rocking grates may be used to good advantage in burning lignites.

For hand firing a furnace with a tile roof and large combustion chamber containing good mixing structures is well adapted for burning bituminous and lignitic coals. The mixing structures cause resistance to the passage of furnace gases, and consequently a higher stack draft must be carried to maintain capacity.

Commercial Considerations.

General.—Inasmuch as the boiler plant is at present the expensive portion of a steaming outfit, and as it probably is possible to cut its cost down to a fraction of the present cost and at the same time obtain a higher efficiency, it is felt that there is good ground for anticipating an enormous improvement in the production of steam power within the next few years. If so, it will not be the first time that a new arrival in a field has spurred on older forms of enterprise to a higher prosperity than they ever dreamed of before. The competition of the gas engine may be the best thing that ever happened to steam engines and turbines.

The statements, theories and proposals made in this study are widely scattered and may not have been plain because they are mathematically involved. For this reason a short summary will be made here of the possibility of so improving the system of working steam-turbine plants that they may be permanently kept above commercial competition from gas-producer and engine plants in large powers. Of course, there is little doubt that a great field immediately awaits the gas engine in smaller plants, say, under 5,000 horsepower. All these suggestions are tentative only.

Boilers.—The authors see no reason why boilers cannot be constructed, and probably operated with entire satisfaction, which will produce about 10 times the amount of steam now obtained per square foot of heating surface, and with no difficulty in obtaining dry steam. The efficiency from coal to steam should easily be made considerably higher than that of a good performance of today. Such a plant would require only a fraction of the present investment in steam plants, buildings and real estate. Perry states in his book, "The Steam Engine and Gas and Oil Engines," that he thinks boilers should be made to do 10 and possibly 20 times the work they do at present.

Furnaces.—It will probably be found on attempting this reduction of dimensions and cost that the limit will be not in the boiler as such, but in the combustion chamber. Burning a large amount of coal on a small grate area is largely a question of draft and continued riddance of ash, but the rate of travel of gases through a combustion chamber is dependent, practically, only on the amount of carbon burned per unit of time, the rate being about the same no matter what the air supply per pound of carbon. As combustion chambers are now constructed for western coals, they are too small, but "small" is a word not to be understood in this connection as referring to volume or length alone. By a "small combustion chamber" is meant a chamber in which either the time spent by the gas in traveling from the front to the rear of the boiler is short or the mixing devices are inefficient or absent. In the discussion of mass action it was stated that mere length of combustion chamber counts for little; that mixing is what counts—and thus there is a possibility of enormously increasing the efficiency of a combustion chamber as a burner of volatile matter. Effort in completing a steam-generating outfit of small dimensions must be largely concerned with the construction of a combustion chamber containing many gas-mixing appliances.

Turbines.—The work on turbines is provisional only, but it is believed that all the assumptions made are on the side of safety; that is, that the over-all efficiency of the turbines working with high superheat and low pressure would probably be greater than estimated.

Van Depoele Trolley Patent Finally Held Invalid.

The United States Circuit Court of Appeals for the Second Circuit, sitting at New York city, in a decision rendered December 4, 1907, has finally held invalid the Van Depoele reissue patent No. 11,872, granted November 13, 1900, for improvements in traveling contacts for electric railways. This was a reissue of Van Depoele's original patent, No. 495,443, and was asserted by the General Electric Company to cover broadly all practical forms of the well-known under-running trolley. The decision is based upon the ground of delay in applying for the reissue. On this point Judge Coxe, in delivering the opinion of the court, said:

"It will simplify the discussion if we assume, without deciding, that the complainant was justified in delaying the application for a reissue until the question of double patenting was disposed of by the highest court to which it could be carried, namely, a Circuit Court of Appeals. Such a decision, as we have seen, was rendered by this court three years, two months and seven days before the application for the reissue, in one case, and two years, five months and 20 days in the other. But it is argued not only that the complainant was entitled to have the question decided by an appellate court, but also to have the decision rendered at final hearing and on plenary proofs. We are not impressed by this contention." * * * * *

"A just regard for the rights of the public demanded, if the patent was to be resuscitated in the form of a reissue, that it should be done immediately; and especially so when the reissue claims were to sweep under the monopoly devices not covered by the claims of the original."

Since 1893 the original patent and the reissue have been the subject of protracted and hard-fought litigation, some 22 prior decisions being reported. In the earlier cases the patent was generally sustained, and in a suit against the Black River Traction Company the reissue was lately sustained by the same Court of Appeals that now holds it invalid, the defense which is now successful not having been urged in that case. The present decision, which finally ends the controversy, was rendered in a suit brought by the Thomson-Houston Electric Company against the Western Electric Company, in which the complainant was represented by Thomas B. Kerr, Esq., and Messrs. Betts, Sheffield, Bentley & Betts of New York, and the defendant by Messrs. Barton, Tanner & Folk of Chicago.

An arrangement has been made whereby the Keokuk (Iowa) Electric Railway and Power Company, which already lights Hamilton, Ill., across the Mississippi River, will supply current at wholesale to the Warsaw (Ill.) electric-light plant, one of the E. B. Hillman properties. The station in Warsaw will be shut down.

ELEMENTS OF ELECTRICAL ENGINEERING.

By Geo. R. Metcalfe.

XLVI.—Storage Batteries.

Storage batteries, also called secondary batteries or accumulators, are batteries in which some chemical change is made by passing current through them, and after thus being charged they are capable of reversing this chemical action and giving out current to the circuit to which they are connected. This operation of charging and discharging may be carried on indefinitely, so that after the battery has been discharged it is again restored to its normal full-charge condition by the application of outside current. In this respect it differs from a primary battery, which, when it is once exhausted, cannot be restored to its original condition by the passage of current.

There are several kinds of storage batteries, all of which consist of metallic plates immersed in some kind of electrolyte. The material of which the plates are made varies in different makes of batteries, but the lead battery is used far more extensively than any other kind. Copper and zinc are also used together, and nickel and iron in two makes of storage batteries, but the lead storage batteries, which were the earliest kind invented, are still used to the greatest extent by far.

The most extensive application of storage batteries is to central-station work. Here the batteries are used to furnish energy during certain hours of the day and to enable the generating machinery to be stopped. They are also used for steadying the load on the engines by charging the batteries during light load and permitting the batteries to assist the engines by discharging on heavy load. They are also used to supply current from local sub-stations, and they are occasionally used to subdivide the voltage, so that a three-wire system may be operated from a single generator.

Outside of central-station uses, they are adapted to furnishing power for portable instruments for supplying current to telephone and telegraph systems, for car lighting and for propelling vehicles.

A few years ago the subject of storage-battery street-railway cars was a very popular one, and numerous storage-battery cars were put into operation. Theoretically this was an ideal system for railway cars, as each car was completely self-contained and could travel over any track desired and carry its power with it. All that was necessary was to supply charging stations at convenient points where the discharged batteries could be removed from the cars and a new set of charged batteries substituted. Several storage-battery roads were built, but the system could never be made a commercial success, although when the equipments were new the cars operated very satisfactorily.

There are two drawbacks which prevented such cars from becoming a commercial success. One is the great weight of the storage battery, which, of course, is added to the weight of the car equipment and which requires correspondingly heavier current to run the car. The other is the rapid deterioration which occurs in the storage battery when subjected to the jars and shocks incident to street-railway travel.

Within recent years storage batteries have been adapted to the propulsion of automobiles, and they have proved very satisfactory in this service for moderate-speed running where there are no grades, or only very light grades. For general traction work, however, they have never proved financially successful.

There are two general types of lead storage batteries, known as the Planté and the Faure, and there are also batteries made by special processes which may be considered a combination of the Planté and Faure types.

Planté Cell.

The Planté cell is made by placing two lead plates in a vessel containing very dilute sulphuric acid and passing an electric current through them. This causes the positive plate to be oxidized, and the electrolyte is decomposed. If the two plates are now connected to a suitable outside circuit, a current is set up in the circuit and the battery begins to discharge, and as the discharge continues the difference of potential between the two plates gradually disappears, and when they are both at the same potential the battery is fully discharged.

The chemistry of the lead accumulator is still somewhat in dispute, as there are a number of complicated reactions which are not yet fully understood. In its discharged condition it is generally believed that both the positive and negative plate of the cell have their active material reduced to lead sulphate, while in the charged condition the negative plate consists of pure metallic lead, while the positive plate is coated with peroxide of lead.

The operation of charging a new Planté plate, as described above, is called forming, and the difficulty of forming Planté plates is the great length of time which the process requires. On first charging and discharging the plate only a very small current can be obtained, because the chemical action takes place only upon the immediate surface of the metals. As the charging and discharging are repeated a great number of times, this active material penetrates deeper and deeper into the metal, leaving a very porous surface which extends considerably into the plate. This forming process requires a large expenditure of electrical energy and is consequently very expensive. Later it was discovered that by pickling the plates in dilute nitric acid and afterward washing them in a solution of sulphuric acid the plates could be much more rapidly formed.

Faure Type.

In the Faure type of battery the active material is pasted on the lead plates in the form of litharge or red lead and then formed in a simple process, instead of being formed from the body of the plate, as in the Planté type. The plates are generally made in the form of grids, and the material to become active is pressed into the holes of various shapes in which these grids are made. This gives a plate of large initial storage capacity, but such plates are not as durable as those of the Planté type, because the coefficient of expansion and of the active material and the lead support are not the same, which causes a tendency to disintegration.

There have been an endless number of storage batteries of the Faure type built, all of which are identical electrically and differ only in the mechanical construction of the grids and the methods employed for securing the active material in place.

Combination Type.

The Chloride accumulator is a type of battery very largely used in this country, and is a combination of the Planté and Faure types. The active material of these cells is made up in small tablets which are laid in molds, and melted lead is forced around them under pressure, resulting in the lead grid containing tablets of active material, which lie close together all over the surface of the plate. These tablets consist of a mixture of lead chloride and zinc chloride, from which the zinc chloride is afterward chemically removed and the lead chloride is reduced in metallic lead. This is but one of a number of combination types, which are too numerous to be described at length here. The object of all these plates is to secure the maximum amount of active material, and at the same time produce a plate which is mechanically strong enough to avoid rapid disintegration.

[*To be continued.*]

Note.—This series of articles, intended to survey, briefly, the whole field of applied electricity for light, power and heat, was begun in the Western Electrician of February 2, 1907.

Municipal Plant Names Lighting Rates.

The City Council of Greenfield, Ind., has established a rate to be charged by the city for the use of electric current from the municipal plant.

The commercial rate by the month for each 16-candlepower incandescent light will be 65 cents

Meter rates by the month will be as follows:

10 K. W. and under	12c. per K. W.
10 K. W. and under 25 K. W.	11c. per K. W.
25 K. W. and under 50 K. W.	10c. per K. W.
50 K. W. and under 100 K. W.	9c. per K. W.
100 K. W. and over	8c. per K. W.
Churches	6c. per K. W.
Motor rate	4½c. per K. W.
Consumers outside city limits	16c. per K. W

Growing Use of Electric Power in Italy.

In the official publication upon the use of electricity as a motive power in Italy, the factory inspectors show a continuous growth in the use of electric motors in that country. Particularly is this true in the northern provinces, where the manufacturing interests center. The report for 1906 shows that at Milan alone about one-quarter of the total new work was put into operation, while the development through the Peninsula was general. One hundred and twenty-five new electrical plants were built, and 114 extensions of existing plants were effected. The total of 239 new installations are spread over 17 provinces, which also serves to indicate the condition of electrical development in the country as a whole.

QUESTIONS AND ANSWERS.

Field Strength, Power Factor, Spark Coils.

E. G. M., Indianapolis, Ind.: (1) How do you find the field strength of a direct-current generator?
(2) What is meant by power factor?
(3) What is a power-factor indicator?
(4) Describe the action of a spark coil.

Answers.

(1) This question is rather vague. The inquirer should state whether he means the field current, the number of lines of force per square inch or the total number of such lines in the magnetic circuit, as each of these is often referred to as the field strength. He should also state whether he means a machine that is already built or one that is being designed.

(2) In an alternating-current circuit the power in true watts consumed as measured by a wattmeter is usually less than the product of the volts across the circuit by the amperes flowing therein. The ratio of the true watts to the volt-amperes, or apparent watts, is called the power factor of the circuit. It varies between one and zero, and agrees with the cosine of the angle of lag or lead.

(3) As its name implies, a power-factor indicator is an instrument for showing what the power factor of a circuit is at any particular instant. These instruments are built by a number of manufacturers and are usually of the switchboard type.

(4) The common spark coil is an induction coil with a primary winding connected through a make-and-break device to a battery or other source of current and with a secondary winding containing a spark gap at the point where the spark is desired. The two windings are mounted on the same iron core. The action is identical with that in an induction coil. When current flows in the primary a magnetic field is set up about it which extends through the superposed secondary winding. When the current is broken the magnetic field vanishes and in doing so develops an electromotive force which tends to send a current through the secondary that would have a magnetic field about it identical with the one that existed. This electromotive force is so great that the resistance of the spark gap is broken down and the induced current jumps across the gap as a spark. When the primary current is re-established a similar electromotive force is induced in the secondary, which is opposite to the previous one. These secondary electromotive forces are therefore alternating and only exist for an instant after the primary is either made or broken.

Rotary Converters for Railway Work.

H. D., Chicago: 1. Why are reactance coils necessary on the alternating-current side of a railway converter?

2. Is the power factor under the control of the operator at all times?

Answers.

1. The load on an electric-railway system is a rapidly fluctuating one, so that automatic voltage regulation by means of a compound field winding is highly desirable in a rotary converter, just as in a regular direct-current generator used for this service. In a regular converter, however, the voltage relation between the alternating and direct-current sides is nearly constant for considerable changes of field strength unless the armature, inductance and transmission-line reactances are high. An alternating current passing over a reactive circuit will decrease in voltage if lagging behind its electromotive force and will increase in voltage if leading. A certain field excitation in a converter gives a minimum armature current corresponding to unity power factor. If the excitation is increased, as it is with increased load when a compound field rotary is used, the armature current will be increased, but will be leading, and therefore will raise the impressed alternating-current voltage on the machine without requiring an adjustment of the generator voltage. To provide sufficient reactance in the line to permit this automatic regulation, reactance coils are therefore used.

2. The power factor of a compound-wound rotary converter as used in railway work is adjustable at any time by variation of the shunt field, but not to the same extent that it is with a shunt-wound rotary without reactance coils in the supply mains.

American Telephone and Telegraph Company Offers to Buy Western Electric Stock.

Although it already owns the majority of the stock of the Western Electric Company, the American Telephone and Telegraph Company, through the Merchants' Loan and Trust Company of Chicago (with which it entered into agreement as trustee for that purpose on November 1st last), now offers to purchase the remaining stock. President E. M. Barton of the Western Electric Company issued a circular to stockholders of his company on December 4th explaining the plan. This plan is described in part as follows in the agreement between the Telephone company and the Trust company:

1. If any stockholder of said Western Electric Company, hereinafter called a seller, shall desire to sell his shares in said company which he owns at the date hereof, or any part thereof, to the Telephone company under the terms of this agreement, he shall on or before the 20th day of January, 1908, or if the parties hereto agree upon a later date, then on or before such later date, transfer such shares to the Trust company. The title thereto shall thereupon vest in the Trust company for the purposes of this agreement, and said Trust company shall be entitled to take all dividends which may be declared thereon.

2. The Telephone company hereby agrees to purchase all shares which may be transferred to the Trust company as aforesaid during the time limited for such transfer, and shall pay for the same to the Trust company on or before October 15, 1908, either—

(a) In convertible four per cent. bonds of said American Telephone and Telegraph Company, dated March 1, 1906, with all coupons not due attached, at the rate of $250 of the face value of such bonds for each share of stock so deposited; the Telephone company also to pay interest on the amount of bonds required for the purchase at the rate of four per cent. per annum from the date of transfer of said shares to September 1, 1908, the date of the maturity of the last coupon which will have matured previous to said date of payment, or

(b) In cash at the rate of $225 for each share, with interest at the rate of four per cent. per annum from the date of transfer of the shares to a date 10 days subsequent to the date of payment therefor.

The right to choose between said forms of payment marked, respectively (a) and (b), shall be vested absolutely in the Telephone company.

In case the total number of shares so purchased from any seller shall not be a multiple of four, then the Telephone company shall make payment to the Trust company in cash for all shares in excess of the greatest multiple of four contained in the number of shares so purchased from each seller upon the terms above recited in section (b).

In his circular Mr. Barton announces that stockholders of the Western Electric Company owning something over 15,000 shares have expressed the intention of accepting the offer. He himself will do so. He further elucidates the offer as follows:

"Any stockholder of the Western Electric Company desirous of making the exchange of his stock in accordance with this agreement may send to the Merchants' Loan and Trust Company his stock certificates indorsed in blank for transfer. The Merchants' Loan and Trust Company will issue a receipt for the stock in negotiable form which will entitle the holder to receive on October 15, 1908, $250 in convertible four per cent. bonds of the American Telephone and Telegraph Company for each share of stock, or, at the option of the Telephone company, cash at the rate of $225 per share. Interest at the rate of four per cent. per annum will be paid on $250 for each share up to September 1, 1908. The bonds will bear coupons representing interest from said date.

"It is to be assumed that payment will be made in bonds. These bonds become due in 1936 and are convertible at the option of the holder at their face value at any time between March 1, 1909, and March 1, 1918, into stock of the American Telephone and Telegraph Company at the rate of about 134¼ per cent. on the par value thereof, but this rate is subject to reduction, however, in accordance with the terms of the indenture securing the bonds if further stock shall be issued by the Telephone company at less than $134.25 per share. That is to say, at the present rate of conversion, the holder of the bonds gives a trifle over $400 in bonds for $300 in stock.

"The present dividend rate of eight per cent. paid by the American Telephone and Telegraph Company on its stock is justified by its earnings.

"Stockholders of the Western Electric Company taking these bonds on the terms specified would then have an assured income at the rate of $10 for each share of stock, and they will have for a period of nine years the option of exchanging their bonds for stock, which, at the present dividend rate, would net from each share of Western Electric Company stock going into the exchange 14.9 per cent. as against the present rate of eight per cent." Mr. Barton concludes as follows:

"Stockholders accepting the exchange before December 15, 1907 (the middle of the current dividend period of the Western Electric Company), will receive interest from November 1, 1907, as though the stock had been deposited on that date."

The American Telephone and Telegraph Company has capital stock of $158,892,100 and has issued $70,000,000 in convertible bonds and $53,000,000 in collateral trust bonds. Under date of November 18th the following statement was made to stockholders: "For the 10 months ended October 31, 1907, the net earnings were $13,715,000, against for the same period of 1906, $11,579,000. October, 1907, showed net earnings of $2,567,000, against $2,004,000 for October, 1906. The earnings of the associate companies are not only showing large increase of gross revenue, but also marked decrease in percentage of operating, even though there has been spent for maintenance $2,000,000 more this year than last. The surplus, or undivided profits, of which this company's share would be several millions, shows a large increase over last year. The company has cash in banks, over $18,000,000. Besides this, it has lately acquired cash assets of several million dollars, and, in addition, a substantial amount of the American Bell Telephone four per cent. bonds, maturing July, 1908."

The Western Electric Company, which, as everybody knows, manufactures Bell telephone apparatus as a very considerable part of its business, has been very prosperous. For the year ended November 30, 1906, its sales were over $69,000,000, as compared with $44,000,000 the year before. For 1907, however, the sales will be less than in 1906. At the annual meeting in February last the outstanding capital stock was $15,000,000. On November 5th an issue of $15,000,000 in five per cent. 25 year bonds was authorized by the stockholders. But it was announced that no part of the issue would be put out at that time.

Decorative Lighting at the Chicago Electrical Show.

The accompanying picture is a reproduction of the perspective drawing of the interior of the Coliseum as arranged by D. H. Burnham & Co., the architects, for the Chicago Electrical Show. The decorative lighting and booth work which will be installed by the Electrical Trades Exposition Company for the third annual show will be as shown in the picture, and will be one of the most artistic and elaborate undertakings of the kind ever installed for a trade show. The Exposition company is assuming a heavy expense in carrying out this scheme, but its efforts will be appreciated no less by the general public than by the electrical fraternity. Not to mention the attractive and interesting electrical exhibits which are assured, the brilliant decorations will merit a large patronage. A preliminary list of exhibitors was printed in the Western Electrician of November 30th. The show begins January 13th and closes on January 25th. Mr. Homer E. Niesz, 1006 Monadnock Building, Chicago, is manager.

Testing Hickory.

Carriage-makers and manufacturers of farm implements as well as the men of a number of other industries which are concerned in the use of hickory will follow with interest a series of tests of this valuable wood about to begin at the Forest Service Timber-testing Laboratory at Purdue University, Lafayette, Ind. A diminution in the hickory supply has been felt for several years, and it is already seen that the growing of hickory must be encouraged if the permanence of a number of industries is to be insured. The importance in this first series of tests by the United States Forest Service lies in the fact that it will determine just what species of hickory are strongest and will give much valuable information to owners of farm woodlots and others who plant trees for profit. When the report on tests is completed, information on the work will be gladly given to all who write to the Forest Service at Washington.

The receivers of the Passenger and Power Company, in Virginia, under authority of Federal court, are preparing to spend $250,000 for improvements in the power station and for building a new substation, to increase the available power and reduce electrolytic action in Richmond. The new capacity of the power plant will be 12,000 horsepower. A new 3,250-kilowatt unit, the largest in the state, is provided for the Twelfth Street plant. The substation will be on Broad Street, between Shaffer and Harrison streets.

The Raising of Power Factors and the Regulation of Potential by the Use of Rotary Condensers.[1]

By Chas. W. Stone.

Modern development in electric motors for driving machinery has been confined almost exclusively to two types of motors, the direct-current motor and the alternating-current induction motor, synchronous motors being seldom used except as a part of a motor-generator set or for similar purposes.

This paper is intended to show some of the effects of the use of the induction motor on the system and also to show some of the advantages to be gained by using synchronous motors.

Synchronous motors, unlike induction motors, run at a certain synchronous speed, independent of the voltage and power factor of the system from which they operate. They also draw a certain mean current from the line with a fixed load. This current input can be varied through a wide range by changing the field excitation. If the excitation is increased with the load unchanged, the current input increases, but is leading in respect to the line current. If, however, the excitation is decreased the current input is increased, but is lagging with respect to the line current.

The induction motor is more like a direct-current motor in its action. The current input is a fixed quantity and is dependent only on the voltage of the supply system and the design of the motor and the load. This current is always lagging in respect to the line current. At light loads the amount of lag is increased, so that with many motors lightly loaded the effect is to lower the power factor of the entire system.

All alternating-current systems used for lighting distribution have in addition to the power load of induction motors a comparatively large number of transformers which when lightly loaded result in lowering the power factor of the system, as do the arc lights, either series or multiple.

Low-power factor on a system means greatly reduced capacity of generators, transformers, lines, etc. The regulation of the entire system is also much poorer.

Alternating-current generators are all rated in kilovolt-ampere output; that is, a 100-kilowatt generator is supposed to deliver its full 100-kilowatt output at 100 per cent. power factor at normal voltage and at normal temperatures, but if the power factor should be 60 per cent. lagging, the energy output of the machine would only be about 60 kilowatts, and yet the current would be the same, and consequently the heating would be the same as when delivering 100 kilowatts at 100 per cent. power factor. Unless the generator were specially designed for the low-power factors, it is also probable that it would not be possible to obtain normal voltage on the machine, as the low-power factor current in the armature opposes the flux set up by the fields, and in consequence tends to demagnetize them, resulting in low voltage. The field current would therefore have to be increased sufficiently to overcome this effect, which would often not be possible, as the voltage obtainable from the exciters might be limited.

The regulation of modern belt-driven generators at unity power factor is usually about eight per cent. At 70 per cent. lagging power factor it would be about 25 per cent. An engine-driven generator with the same regulation at unity power factor would probably be as bad as 30 per cent.; at 70 per cent. power factor a steam turbine-driven generator would be about 20 to 22 per cent.

Transformers are reduced in capacity in a similar ratio to the reduction in capacity of generators. Their regulation, although usually inherently better, being about 1½ to 2 per cent. at unity power factor for small lighting transformers, would be about 4 or 5 per cent. at 70 per cent. power factor. Larger transformers with a regulation of 1 per cent. or better at unity power factor would be about 3 per cent. at 70 per cent. power factor.

The effect of low-power factor on the lines can best be shown by an example:

If we assume a distance of five miles and a load of 1,000 kilowatts and desire to deliver this load at a potential of about 6,000 volts with an energy loss of 10 per cent., each conductor at unity power factor would have to be 79,200 circular mils, at 90 per cent. power factor 97,533 circular mils, and at 60 per cent. power factor 218,000 circular mils; or, in other words, at the lower power factor of 60 per cent. the investment in copper alone would be 2.8 times as much. If the same size of wire were used at both unity and 60 per cent. lagging power factor the energy loss would be about 2.8 times the loss at unity power factor, or about 28 per cent.

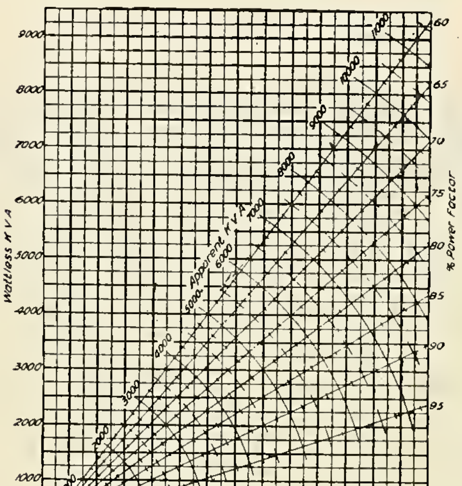
It is apparent, therefore, that if some means can be provided to raise the power factor of the system the apparatus can be operated at its full capacity and with normal regulation.

The synchronous motor can be used for this purpose and at the same time can be used to develop mechanical energy. When used solely to supply leading current to the system they are called rotary condensers.

The most efficient way to use these rotary condensers is to arrange to load them as a motor with 71 per cent. of the capacity, and over-excite their fields sufficiently to make them take normal full-load current. The resultant power factor would then be 71 per cent. leading, and the wattless component or condenser component would be 71 per cent.

If we assume a system with an inductive load of 1,414 apparent kilowatts, the energy load being 1,000 kilowatts, the power factor would be 71 per cent. lagging and the wattless component would be 1,000 kilovolt-amperes. By adding 500 kilovolt-amperes leading the apparent load would be reduced to 1,120 kilovolt-amperes, or a saving of 1,414 — 1,120 = 294 kilovolt-amperes. If, however, we add 500 leading kilovolt-amperes more, it is apparent that only 1,120 — 1,000 kilovolt-amperes, or 120 kilovolt-amperes would be saved, showing the greater value of leading current at low-power factor.

The diagram shows several curves of the relation



CURVES SHOWING RELATION OF ENERGY LOAD TO APPARENT LOAD.

of the energy load to the apparent load and the wattless components at different power factors.

The curves are plotted with the energy component as the base and the wattless components are given at the left. The apparent loads are represented by arcs of circles.

The method of using these curves is as follows: If the energy load is 1,000 kilowatts at 60 per cent. power factor, the wattless component can be found by following the vertical line at 1,000 kilowatts to its intersection with the 60 per cent. power-factor line, and then from this point, if we follow the horizontal line to the left, the wattless component can be read, or 1,350 kilovolt-amperes. Following the same method of procedure, the wattless component at 90 per cent. power factor can be obtained, or 500 kilovolt-amperes, the difference between these two results, would be the amount of wattless energy necessary to supply to the system in order to raise the power factor from 60 per cent. to 90 per cent.

If we refer back to the example previously given, and figure out what the necessary extra investment in copper would be with the low power-factor load with copper at 22 cents per pound, we find that 29,292 pounds more copper is needed with the power factor of 60 per cent. than with the power factor of 90 per cent., or 29,292 by 22, which means a total extra investment in copper alone of $6,444. A synchronous motor of sufficient capacity to accomplish the same result would cost about $4,000, or, in other words, it would cost far less to use the rotary condenser than to pay for the extra copper in the line, and at the same time obtain considerable more capacity from the generators, transformers, etc.

This motor could thus be installed and run idle; i. e., with no load, and simply supply leading current to the line, and pay for itself in a short time.

If the motor can at the same time be used to deliver any mechanical energy, as pointed out above, the saving would be even greater.

It should also be noted that, if the rotary condenser is installed in the generating station, the only gain will be in capacity of the station apparatus and in its regulation. However, if it is installed at the end of the line, it would not only accomplish everything that it would if in the generating station, but would also increase the capacity and better the regulation of the line, transformers, etc.

In general, it would appear that there are few modern central stations of today which are operating alternating-current systems of distribution, that could not find use for such machines. It is also evident that if the companies that use motor-generator sets to transform the alternating current to direct current, would purchase synchronous motors and make them of a little larger capacity than required for the mechanical power, compensation could readily be obtained for the low power factor which of necessity exists in such systems.

Potential Control by Rotary Condensers.

So far the discussion has been confined entirely to the use of rotary condensers to raise the power factor of the system. There is, however, one other very useful function of such machines, which I will describe briefly.

As all transmission circuits have an appreciable ohmic resistance and reactance, there is a certain voltage difference between the generating and receiving ends of the circuit, this difference becoming greater as the load on the circuit becomes greater.

By using a synchronous motor and varying the field excitation, it will readily be seen that the effect of the reactance in the line can be increased, and consequently the voltage drop increased; and, by over-exciting the motor, sufficient leading current can be inserted in the line to overcome the effect of the reactance of the circuit with a consequent increase in potential at the end of the line. It is usually more convenient to maintain a uniform potential at the generating-station bus-bars, which naturally results in too high potential at the substation or center of distribution during the light-load period and too low voltage during the time of heavy load.

The function of the synchronous motor with a Tirrill regulator would therefore be to control the voltage at the center of distribution, keeping it constant at all loads.

The synchronous motor can be used to the best advantage when it delivers full leading current at full load, and full lagging current at light load on the receiving circuit.

As a rule, the average circuit does not have sufficient resistance and reactance to make it possible to use the most economical motor, and it is therefore desirable to insert a small reactance in series with the line. Of course, the reactance should not be too great, or other troubles will appear. In general, it can be said that the total reactance of the circuit which includes the reactance of the transformers should be about 15 to 20 per cent.

In order to get the best results, the synchronous motor should be designed to have good regulation and low saturation, as the Tirrill regulator works best when it is not called upon to take care of more than 100 per cent. change in field excitation. This means that the synchronous motor should be able to deliver from full lagging to full leading current with a change of 100 per cent. in its field. Such a motor is therefore designed to have close regulation. The standard motors as usually built have a short-circuit current of 1½ to two times the normal, and therefore cannot be used to their full capacity as compensators. Nevertheless it is usually better to use the standard motor, as it means quicker delivery, and would probably cost less to build than would the special motor of somewhat less capacity.

The synchronous motor, when used to control the voltage, can also be used at the same time to develop mechanical energy; the relations between the amount of possible mechanical to compensating output being as follows:

Per Cent. Power Output.	Per Cent. Phase Control.
100	0
95	31
90	43
80	59
71	71
50	87

Match Making by Electricity.

A complete power equipment consisting of two 300-kilowatt generators direct-connected to Reliance engines, a 110-kilowatt generator direct-connected to a high-speed engine, a five-panel switchboard, 24 five-horsepower variable-speed induction motors and a number of constant-speed motors for distribution throughout the plant, was recently sold to the Diamond Match Company for its branch factory at Oshkosh, Wis., all of the apparatus being three-phase, 60-cycle, 440 volts.

The unusual feature in connection with this installation is the fact that the match machines, which have always heretofore been group-driven, in this new plant will each be driven by a five-horsepower 1,200-revolution Allis-Chalmers induction motor. It was shown by careful tests that individual drive in this plant will decrease the power consumpton at least one horsepower per machine by eliminating the use of a mechanical speed changer as well as the long countershafts joining the groups of machines in the older installation.

In the process of forming the matches 72 sticks are made at each stroke by as many cutters. These sticks are then forced into countersunk holes of a plate conveyor from which they project at right angles, similar to the bristles of a brush. The motion of the conveyor is intermittent, depending on the speed of the machine, the travel being just sufficient to preserve a row of holes for each stroke

1. Part of a paper read at the annual meeting of the Association of Edison Illuminating Companies at Hot Springs, Va., September 10-12, 1907. Mr. Stone is an electrical engineer of the General Electric Company.

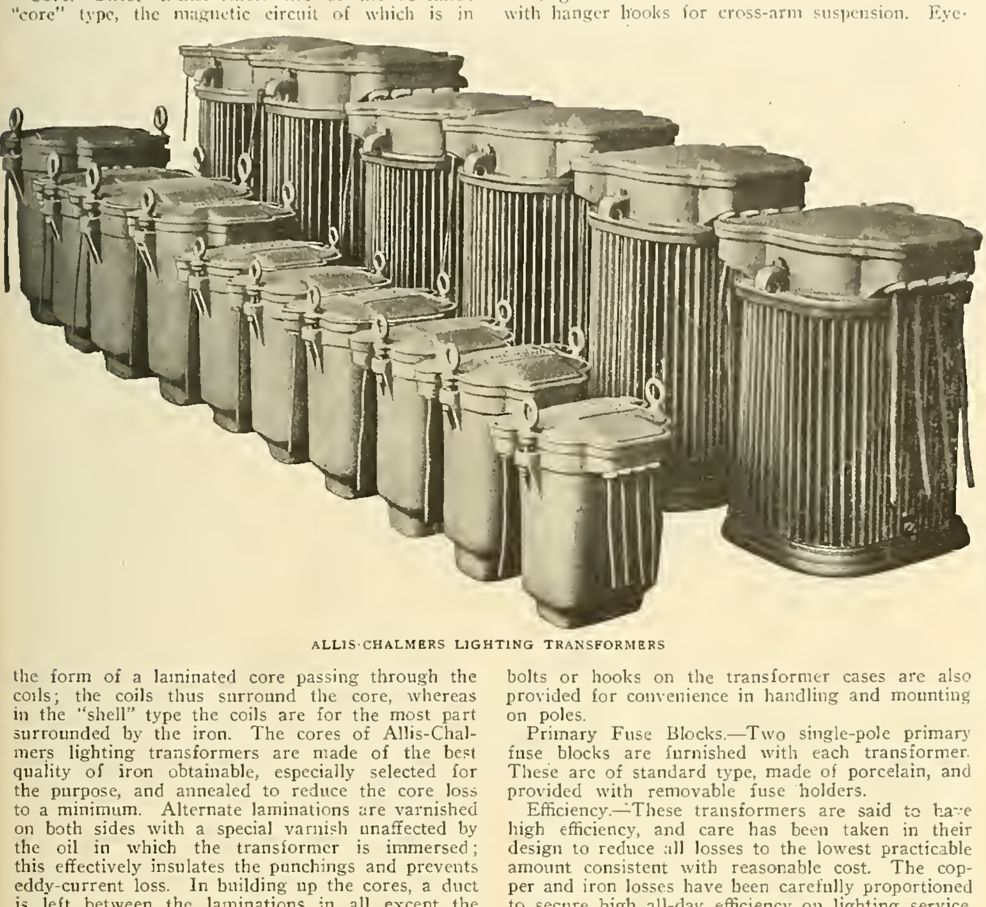
of the cutters. While the sticks are in position in the conveyor they are in turn dipped in molten paraffine and a composition which forms the head. The matches must be dried before packing, and to accomplish this end the conveyor makes a number of loops, exposing the matches to fans.

The test showed that 0.65 electric horsepower is required to drive the speed changer alone; the machine proper consumes 2.5, 2.7 and 3.4 horsepower at speeds corresponding to 160, 194 and 220 strokes of the cutters. Five-horsepower motors were therefore chosen as being of the proper size for the work. It should be explained that speed reduction becomes necessary only during damp weather in order to allow the matches a longer interval in which to dry.

Allis-Chalmers Lighting Transformers.

The transformers made by Allis-Chalmers Company for lighting service are designed for operation on 1,050 or 2,100-volt primary circuits, and made in 16 sizes, ranging from 0.6 kilowatt to 50 kilowatts. They are intended for lighting work on a normal frequency of 60 cycles per second (7,200 alternations per minute), but can be operated on any frequency from 50 to 140 cycles, the efficiency being somewhat better on the higher frequency than on the lower. They can also be operated at 10 per cent. above or below normal voltage, but all standard data regarding efficiency, regulation, etc., are based on operation at normal voltage of 1,050 or 2,100 and normal frequency of 60 cycles.

Core.—These transformers are of the so-called "core" type, the magnetic circuit of which is in



ALLIS-CHALMERS LIGHTING TRANSFORMERS

the form of a laminated core passing through the coils; the coils thus surround the core, whereas in the "shell" type the coils are for the most part surrounded by the iron. The cores of Allis-Chalmers lighting transformers are made of the best quality of iron obtainable, especially selected for the purpose, and annealed to reduce the core loss to a minimum. Alternate laminations are varnished on both sides with a special varnish unaffected by the oil in which the transformer is immersed; this effectively insulates the punchings and prevents eddy-current loss. In building up the cores, a duct is left between the laminations in all except the smaller sizes, thus providing a passage through which oil can circulate and carry off heat from the core.

Coils.—The coils are wound on the two sides of the rectangular iron core, the secondary being placed next the iron. The primary and secondary are subdivided so as to reduce magnetic leakage to a minimum and thereby secure close regulation. The coils are impregnated with insulating compound, after they have been first thoroughly dried out in a vacuum. The insulation between the coils and core, and also between primary and secondary, is prepared from fuller board and mica, which are unaffected by oil. This insulation is approximately cylindrical, and has no sharp bends to cause weak points liable to breakdown. The coils are thin, and so designed that the circulation of oil will carry off the heat from all parts of the windings; in no case is the copper more than one inch from the oil.

Terminal Block.—The terminals of the high-voltage windings connect to a porcelain terminal block, allowing the primary coils to be readily connected in parallel for 1,050 volts or in series for 2,100 volts. Changes in secondary connections are made outside the case by joining up the leads to the secondary mains, so as to give the required series or parallel combination.

Leads.—Both primary and secondary leads are of flexible rubber-covered cable treated so that it will not siphon the oil. They pass into the case through porcelain bushings, into which they are secured cemented.

Case.—For transformers from 0.6 kilowatt to 1 kilowatts the cases are of cast iron with removable cover, held in place by eyebolts. The larger sizes, from 20 to 50 kilowatts, have corrugated sheet iron cases with cast-iron top and bottom. The corrugated sheet-metal cases are used on the larger sizes because they are much lighter and easier to handle than cast-iron and present a larger cooling surface. The tank is entirely separate from the cast-iron top and bottom, and is made of heavy terne sheet. It is oil tight, and is so mounted that the whole transformer can be handled without straining the tank in any way. The tank rests on a cast-iron base and is covered by a cast iron top connected to the base by rods which take the strain when the transformer is lifted by the hooks cast on the top. The top is provided with a cast iron cover to give access to the terminal block. All cases are thoroughly weatherproof and suitably painted.

Insulating Oil.—Each transformer is supplied with enough oil to immerse the coils and core. This oil has been selected as the result of a great many tests on insulating oils, and it has a high flashing point and great dielectric strength. The insulation on the coils is, in itself, able to withstand potentials much in excess of the ordinary working pressure, but the oil offers an additional protection and also serves to conduct the heat from the core and windings to the outer case, thus insuring low temperature rise.

Hanger Hooks.—Each transformer is furnished with hanger hooks for cross-arm suspension. Eyebolts or hooks on the transformer cases are also provided for convenience in handling and mounting on poles.

Primary Fuse Blocks.—Two single-pole primary fuse blocks are furnished with each transformer. These are of standard type, made of porcelain, and provided with removable fuse holders.

Efficiency.—These transformers are said to have high efficiency, and care has been taken in their design to reduce all losses to the lowest practicable amount consistent with reasonable cost. The copper and iron losses have been carefully proportioned to secure high all-day efficiency on lighting service. Standard efficiencies are based on operation at 60 cycles and 1,050 to 2,100 volts primary. For higher frequencies the efficiency will be slightly higher on account of reduced core loss, while on lower frequency the efficiency will be somewhat reduced.

Regulation.—Owing to the manner in which the coils are arranged, the leakage flux in these transformers is reduced to a minimum, thus keeping down the reactance drop. The drop due to the resistance of the coils is limited by winding them with wire or strip of liberal cross-section. The result is that the regulation is close, and the secondary voltage varies but slightly with changes in load, assuming that the primary pressure remains constant. Transformers of from 3 to 50 kilowatts capacity can be operated on the three-wire system with unbalanced load. With normal full-load current on one side and zero on the other, the regulation is equal to the guaranteed regulation.

Ratio.—The primary windings are arranged for 1,050 or 2,100 volts. The smaller transformers, 0.6 to 2½ kilowatts, have secondaries wound for 52.5 or 105 volts; the larger sizes, 3 to 50 kilowatts, have secondaries for 105 or 210 volts.

Heating.—These transformers are designed to operate at moderate temperature, thus avoiding deterioration of insulating material and aging of the iron. They will carry full load continuously with a temperature rise not exceeding 45° C.

Insulation Tests.—The insulation of all Allis-Chalmers transformers is subject to a high potential test to insure that no defects have occurred in manufacture. An alternating electromotive force of 10,000 volts is applied between high voltage and low voltage coils, and between high-voltage coils and iron, for one minute. Between the low-voltage coil and iron an electromotive force of 2,000 volts alternating is applied for one minute. In addition to this, each transformer is run for five minutes at three times normal voltage, thus subjecting adjacent turns and layers of the winding to three times normal pressure, and insuring reliable insulation in all parts of the coils.

Power Service in the Foundry.[1]

By A. D. Williams, Jr.

In view of the progress that has been made in other mechanical lines it is remarkable that the foundry of today remains much as it was in the past. Since it plays a most important part in the industrial economy of all metal manufacturing plants, either directly or indirectly, it merits better treatment than it has received.

Some years ago the chemists turned their attention to the foundry and the results are seen in the replacement of empirical by scientific methods of mixing and melting and in the heat treatment of castings. The concrete results of their experiments are apparent in a reduction of the percentage of castings lost and the production of castings better suited to the purpose for which they were made.

The mechanical end of the foundry offers an interesting field for the engineer, not only in the designing of the castings but in the invention of ways and means suited for their production. To a degree this work has been started, but has been confined to the production of moulding machines and appliances, and the greatest progress has been made in those foundries which are devoted entirely to special lines of work, in which large quantities of castings of the same or similar characteristics are turned out. In the foundry whose output comprises a large variety of castings ranging from bench work to heavy housings and bed plates the methods in use today differ but slightly from those of 20 years ago, the improved facilities consisting mainly in the provision of a better crane service for handling the work.

The principal reason why power is not used to a larger degree in foundry work arises from the fact that few foundries are so designed that the means at hand can be used to the greatest advantage. Machine moulding is limited in its applicability to castings which can be turned out in sufficient quantities to justify fitting up for them. Power can be used for nearly all classes of greensand work, and once the proper fixtures for its use are available it will be found of service in many ways. The foundry crane of today is a vast improvement over that used in the past, but in the matter of improved crane service not only the foundry but the machine shop as well suffer a diminished output per square foot of floor area. Moulding machines, cranes, chipping chisels, grinders, the blower and the cupola elevator are the usual limit of power service in the foundry. A few columns, roof trusses and siding, a crane with its runway, possibly a few jib cranes, a cupola with its charging platform, elevator and blower, some core ovens and a little industrial track are dumped down in a vacant lot and called a foundry. A rough-neck carpenter knocks a few flasks together and sand is spread on the floor. Just as soon as some pig iron, limestone and coke, etc., are delivered the plant is in running order. The machine shop is usually very carefully designed.

The crane service of a foundry is its vital point. There must be crane capacity to handle the heaviest piece to be made, but at the same time it is necessary to bear in mind the fact that there are a number of medium and a greater number of light pieces to be turned out for each heavy casting. A single crane can serve only one floor at a time; the others must wait—in fact two or three floors are often waiting on the crane and must take their turns after the crane has finished handling a load of less than one-sixtieth of its capacity. This scene is not uncommon in the foundry, and that they were "waiting for the crane" is often the excuse for moulds left over for the next heat.

The bridge traveling crane is a most useful machine, but it cannot be in two places at the same time, and as yet no successful method has been devised by which two of them can pass each other either on the same or on different levels; in fact the use of bridge traveling cranes on two levels only adds to the expense and does not supply any advantages over those cases where all of the bridge cranes are on the same level. The jib crane is limited in usefulness as it cannot serve floors outside of its radius, but a number of light-column jib cranes, arranged so that they can be set up and transported from place to place as needed, are very serviceable. This can be accomplished by placing permanent pintle bearings on a number of the columns and by designing the jib cranes so that they can be handled from point to point. The traveling wall crane affords the most satisfactory method of

1. A paper read at the annual meeting of the American Society of Mechanical Engineers in New York, December 5, 1907.

increasing the crane service without interfering with the bridge travelers above and the column jib cranes below its level.

The electric motor offers the most satisfactory method of operating hoisting machinery. This arises from the convenience with which electricity can be delivered to these machines by means of sliding contacts. A further advantage lies in the close control of the movement, which is essential to the gentle handling and accurate placing on the moulding floor. Another distinct advantage of the electric hoist is its ability to hold the load stationary for an indefinite time.

High-hoisting speeds are undesirable; in fact the tendency is to get the hoisting speeds too fast in most shop cranes, high speeds being of service only in the handling of bulk materials and package freight. In the foundry a speed of 10 feet per minute with full load is ample for heavy work, and speeds exceeding 20 feet per minute are sufficient for the lighter hoists. Positive and uniform motion is necessary in handling copes, and the sudden start of the ordinary air hoist spoils a great many moulds. This sudden start occasionally occurs with electrically operated hoists having an improperly designed controller.

One of the important advantages of the electrical distribution of energy lies in the fact that only the exact amount of energy is transmitted, and there are no stand-by leakage losses to cause expense. The occasional grounds which appear on the circuits can be taken care of readily, and if the best modern methods of wiring are used very little trouble is likely to occur from this cause. A good quality of insulated wire, run in some form of metal conduit, should be used; wooden moulding should be avoided. The marine types of receptacles are most satisfactory for foundry service, as the water-tight cover supplied with them is equally efficient in keeping out dust and dirt. These receptacles should be installed liberally, as it is a great convenience to be able to get power just where it is wanted.

Another point of no small value is the kind of flexible connections supplied. These are often simply of lamp cord and are more or less of a nuisance, particularly when they get on the floor, where they are liable to be cut by a shovel, etc. Flexible metal tubing makes a first-class protection for such connections, particularly for those which have to carry several horsepower. Connections of this size will be required where portable tools are used.

There are a number of good makes of electric motors on the market and some that are not so good. A first-class standard motor is desirable, and in equipping a plant it is better to have all of the motors of one make, particularly those of the same size. A little attention to this point will greatly reduce the amount of money it is necessary to invest in spare parts. By a standard motor is meant one which has been made on manufacturing lines in large numbers. In addition to these there are a number of concerns building special motors more or less suited to their special requirements. The designers of such motors are handicapped by the fact that they are not able to avail themselves of the experience gained in the manufacture of a large and varied line. The street-railway type of motor frame, or one which is split on an angle, having two poles or one pole in each portion of the frame, is the most desirable, owing to the facility with which it can be opened up in cramped places for changing armatures or for other repairs. These motors are of the enclosed type and have been developed to work under conditions which would discourage the ordinary machine. The manufacturers of these motors often style them as "very rugged," which is an insult to the workmanship and designing ability which has developed these desirable types of machines. Another feature of such motors is the method of lubrication, in which the car-box journal has been studied and improved. Lubrication is often neglected by careless operatives, and while any machine is better for a little attention, these motors will stand up under poor conditions.

Moulding machines are generally operated by compressed air, but hydraulic power is used with some machines. Compressed air is elastic and this is a disadvantage for many operations, as any alteration in the load causes a corresponding change in the position of the actuating plunger or piston. Some compressed-air hoists have been designed with a governor device that regulates their speed of action, but it is impossible to avoid the troubles due to the elasticity of the air. Another disadvantage of compressed-air machines is the large size of the hose connection required, which is more troublesome to care for than the smaller flexible connection to an electric motor. Compressed air, however, is very useful in cleaning out pockets in moulds and for power-ramming machines. For the latter it presents the only successful driving power. These machines are not as widely used as they might be, and where it is desirable to avoid the long air-hose connection, a portable motor-driven air compressor can be used. The bellows and torch, for blowing out and skin-drying the sand, can be avoided, the former by using the air hose with special nozzles the latter by arranging some sort of a heating device close to the air hose nozzle. An electric heating device might be serviceable for this purpose.

As generally installed, with a central compressing plant, the use of compressed air requires an expensive transmission line, and, in addition, it is impossible to avoid leakage in the joints. Compressed-air leakage does not show, and the pipe lines for this purpose, as usually constructed, are designed to remain tight only long enough to pass the acceptance test. Leakage is a continual drain on the system and shows up in the amount of coal consumed. Except in the large sizes, air compressors are steam-eaters like steam pumps; for this reason the small electric-driven air compressor presents numerous advantages, as it consumes no power when out of use and, if portable, avoids the long pipe line. The disadvantages of long air lines are well illustrated by the fact that in some of the big excavating contracts it has been found very advantageous to install a steam-driven electric-generating station at a point where fuel was available from a railroad siding and transmit electric power to the compressor station located on the work, thus avoiding the losses of a long pipe line or fuel haulage.

Hydraulic power is but rarely used in the foundry. It has advantages for some lines of work. Water being non-elastic, comparatively speaking, it supplies a positive pressure, and while the hydraulic machine can be stalled, it is impossible to break it by legitimate methods when it is properly designed. The pressures carried in hydraulic systems range around 500 and 1,000 pounds per square inch. Where higher pressures are required in certain machines they are obtained by the use of intensifiers. The most serious disadvantage of hydraulic-service systems occurs only where swinging joints are required to convey the pressure and waste water to and from moving machines, as cranes, etc. In the machines themselves the glands are, like all other glands, troublesome to maintain, and are often pulled up so tightly that they greatly reduce the efficiency. The controlling valves also give a certain amount of trouble. The most of the trouble with hydraulic systems arises from the use of dirty, gritty water. An illustration of the advantages of using a clean fluid occurs in the hydraulic wheel presses, in which the same fluid is used over and over again. These machines cause very little trouble from leaky glands. High-pressure hydraulic systems are, however, expensive to install, and it is extremely probable that the best method of utilizing hydraulic power will be to use an electrically driven pressure pump with its accumulator installed close to the floor upon which hydraulic moulding machines are to be used. This would reduce the required amount of pressure and waste line to a minimum. Necessarily this small hydraulic plant could not be placed in the foundry itself, but a small pumproom would be a requisite.

Steam power was at one time the only motive force available and was either transmitted to these places in the foundry where it was required by means of belts and shafts, or small engines were used, driving the different machines by belts. In some cases small gas or other explosion motors are used in a manner similar to the early steam motors. Owing to the fact that small engines are not economical and have several other disadvantages which are familiar to all who are posted on foundry operating conditions, they are not considered as desirable as other kinds of motors. The steam hydraulic crane and elevator, both of which operate on the same principle, are two of the most satisfactory machines devised for foundry service, because they are very simple, and for that reason it is practically impossible for the most careless operator to damage them, except by the most studied neglect. One of the bad features of any transmission system which deals with moist elements such as water, steam and sometimes compressed air, exists in their liability to damage in cold weather by freezing. This danger has to be very carefully guarded against in temperate and cold climates during the night and on all occasions when work is interrupted. To guard against this trouble some form of heat insulation is required.

Which is the best power to adopt depends in a large degree upon the local conditions affecting the plant, and by studying such conditions much better results can be attained than are possible by offhand decisions. A harmonious installation works more smoothly than a miscellaneous assortment, and, in addition, the design should take into account the future growth as a possibility, this matter being often left out and resulting in endless complications when extensions have to be made. Because the largest part of foundry power requirements are intermittent, it is extremely probable that electrical methods offer the most economical solution of the question, but against this the question of maintenance is often of more importance than the economy of operating expenses due to cheaper power.

The class of labor employed in many foundry operations is not possessed of any amount of mechanical skill or electrical knowledge, and for this reason it is advisable that the motive-power portion of the equipment be as nearly "foolproof" as possible and of the simplest possible construction, in order that it may not be damaged by misdirected zeal. The use of electrical power necessitates the employment of one or more men to look after the motors, depending upon the number used, or else a considerable portion of the minor repairs must be made by outside help. Where the foundry is operated in conjunction with a machine shop the matter of maintenance becomes more simple. With steam, compressed-air or hydraulic machinery the question of maintenance is not of such a complicated character as with electrical machinery, owing to the fact that it is much easier to get men who have some primary ideas and break them in to the small repairs required to keep the machines in operating condition. And with the exception of the most extraordinary breakdowns, such machinery can be restored to working order by the use of the facilities ordinarily available in the vicinity of a foundry. This, however, is not always the case in regard to electrical machinery, although since the uses of electrical machinery are extending so rapidly a time will be reached when the question of repairs will be as simple as it is with other types of motors.

Electrical Inspection from the Telephone Manager's Viewpoint.[1]

By Charles M. Mauseau.

The fundamental principle of inspection is to insure the highest care in the protection of the lives of the public, of our employes and of the property of the company. So from this consideration of the subject, it is plain to be seen that the electric company and the telephone company can start hand in hand and co-operate to gain the end which both believe in and which is to their mutual interest. Certainly our first thought should be the protection of human life, and, looking at the matter from a purely business viewpoint, I could state to you gentlemen here that I have signed sufficient vouchers for damages to men who have been injured by reason of defective work and lack of inspection of completed work during my position as general manager to warrant me in saying that I believe it to be economy to have a thorough system of electrical inspection.

Your honorable secretary, Mr. Boyd, and myself have had several opportunities to meet each other in actual work, and I wish to say that I have always found him fair, both to the interests he represents and to the telephone company, and I believe if I could come in contact with him in a few more instances I would have him making suggestions entirely in the interest of the telephone company.

I have brought up the matter of former conference with Mr. Boyd for a purpose, and that is, that when your association or a member of your association is requested to make recommendations by a municipality as to what changes should be made in the existing plant of an operating company, that before you tell them that every part of the plant should be placed underground, you should consider what the life and value of the present plant is, and look at it from the viewpoint of the owning company. There are but few companies which, if allowed to make use of their present plant for its natural life, would not be willing to allow the electrical inspector to dictate how the renewal should be made, and in view of the fact that the municipality has allowed the company to construct an aerial plant, they should allow it to use that plant during its natural life, and this is a point which, to my mind, the electrical inspector should consider very carefully.

As I understand the Code adopted by the association, it is the consensus of opinion of experts employed by the insurance companies in an endeavor to safeguard their interests and to minimize the risks from the electrical hazard. I do not pose as an electrical expert, but I do believe the rules and regulations as laid down by people who know are beneficial, both to the insurer and to the insured. One writer claims that the rules in the Code have no legal status, but I know personally that many lawsuits have been decided on the question as to whether or not the rules of the Code were complied with, and, as you gentlemen know, there are few ordinances relating to electrical inspection now passed by municipalities which do not refer to and cite the Code as adopted by the Western Association of Electrical Inspectors.

The constant increase in the use of electricity, the increase of potential, and the means of conveying the electrical current has increased the fire hazard to such an extent that the value of an inspection by unprejudiced experts cannot be overestimated, and by an unprejudiced expert I mean the man employed by the insurance companies.

My experience shows that all telephone plants are classed the same by insurance men, but I contend that a properly guarded telephone plant, up to specification, is entitled to and should be given a lesser rate than a poorly protected plant. Our president is absent from home, or I would have

1. A paper (condensed) presented at the annual meeting of the Western Association of Electrical Inspectors in St. Paul, Minn., October 23, 1907. The author is general manager of the Northwestern Telephone Exchange Company of Minneapolis.

been able to give you the name of the inspector who examined the plants of the Northwestern Telephone Exchange Company at Fargo and at Grand Forks and who advised our president that he has never made an inspection where there was better protection or more care taken to prevent fire in a telephone exchange than he found at these two places.

It was only a few years ago when the question of joint occupancy of a pole line by a telephone company and an electric-light company would not have been considered on the part of the telephone company, but the advent of two telephone companies in the field and the multiplicity of pole lines on one route has made it absolutely necessary for someone to "double up," and so far we have found it easier and more practicable to join with the electric companies than for two telephone companies doing a local business to make use of a joint pole line.

I wish to state that I believe it to be an impossibility for a municipality to force two telephone companies and an electric company to make use of one joint pole line, but do believe it is possible for one telephone company and an electric company to use jointly one line of poles; but remember this in your recommendations, don't ask three companies to use one pole line, unless you can draw a diagram of how to make distribution from a joint pole without interference.

It may not be generally known to your association, but the Bell telephone companies, next to the Roman Catholic Church, are the largest holders of insured property in the United States, and for this reason our co-operation with your association, in an endeavor to comply with your requirements, and so protect our plants that you can see your way clear to make as low a rate as possible, is a very desirable matter on our part.

There is one criticism I wish to make of your printed Code, and that is that it does not explain as fully as it should the why—the reason—for your rules; and this especially refers to those rules which apply to wiring in buildings. It is the custom with telephone companies and most wiring companies to instruct their apprentices on this class of work, but if your Code and our instructions would explain more fully why work should be done in the manner prescribed, it would not be so necessary that we instruct them (in detail) how it should be done, for they themselves would soon learn to figure out the proper methods and adopt them if the purpose for doing so were brought clearly to their understanding.

Pacific Slope Telephone News.

The strike of 1,500 laborers who were engaged in laying conduits for the Home Telephone Company of San Francisco, which began on December 2d, has been settled and the men will return to work. A reduction of wages from $2.50 to $2.25 per day for trench diggers caused the trouble.

The Pacific Telephone Company has completed its Piedmont Exchange on Forty-fourth Street, Oakland, a reinforced concrete building of two stories.

A deal has been consummated between the Pacific Telephone and Telegraph Company of San Francisco and the Nevada Consolidated Telephone and Telegraph Company whereby the latter will take over the entire system of the former in its territory. The deal is the outcome of a long controversy which culminated when the Nevada company was granted franchises against the desire of the old company. The new company has announced that it will operate its system under the new franchise, and that it will give two per cent. of its earnings to San Francisco. Manager Heidenrich will be retained by the new company. Announcement has also been made that the new concern has purchased all the Alpine Telephone Company's lines, which extend over Douglas County, in Nevada, and Alpine and Mono counties in California. J. F. Adams is president of the company and is arranging for the installation of modern equipment. A.

Telephone Progress in Fort Wayne.

At the recent annual meeting of the stockholders of the Home Telephone and Telegraph Company of Fort Wayne, Ind., the secretary showed by his report a gain of 560 new subscribers during the year, and that both the gross and net receipts were the largest in the history of the company. The long-distance business has increased 25 per cent. during the fiscal year just closed and is now growing at even a greater ratio. Switchboard extensions were made during the year, and the company is now preparing for extensive underground and aerial cable additions. There are 250 stockholders in this company, 95 per cent. of the stock being held by local people.

Orrin F. French, superintendent of telephone construction for Manitoba, with headquarters at Winnipeg, is now securing prices preparatory to buying the necessary supplies for the construction of government long-distance and local systems next spring.

Power-house Extensions of Boston Elevated.

With the additions at Lincoln Wharf, Harvard and Charleston power stations of the Boston Elevated Railway Company, now nearing completion, the total generating capacity for the system will reach approximately 50,000 kilowatts.

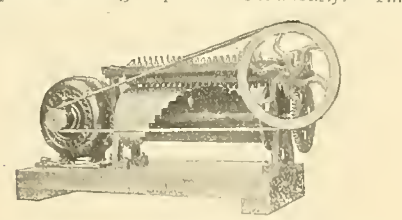
The work of laying out and constructing these station improvements was placed in the hands of Stone & Webster of Boston, in accordance with the recommendations made by this firm for a system of generation and distribution of power which would provide for present and future demands. It was decided to add 5,400 kilowatts capacity to the Lincoln Wharf Station, 2,700 kilowatts to the Charleston and 2,700 to the Harvard power station. Direct-current steam-engine-driven generators were selected as the type of the new units, in order to conform in general design to those already installed in the various stations.

The Lincoln Wharf power station, located on the harbor front, is the largest modern steam plant operated by the company. It supplies power for surface and subway cars operated in the heart of the Boston business district, as well as a large proportion of the power for the elevated system. The old station contained three 2,700-kilowatt 575-volt units driven by vertical cross-compound engines.

The additions to this station required an extension to the power house of 73 by 152 feet. The former boiler capacity was 6,000 horsepower of Babcock & Wilcox boilers; the new equipment includes eight 600-horsepower boilers of the same make. The new power units, two in number, are 2,700-kilowatt Allis-Chalmers direct-current railway-type generators, driven by engines with cylinders 42 and 90 inches by 60-inch stroke at a speed of 72 revolutions per minute. These machines are known as the multipolar, compound-wound type of 570 volts.

A New Electric Sign Flasher.

The Electric Motor and Equipment Company of Newark, N. J., which has installed a large number of flashing devices in cities throughout the country, has developed a new flasher, illustrated herewith, designated as model C. It is designed for use where lamps are required to light one after another until all are lighted, and all are then extinguished, the operation being repeated continuously. This



NEW ELECTRIC SIGN FLASHER.

flasher may be used in a script letter sign where a writing effect is desired and may also be used to produce lightning-stroke effects.

By a change of gearing the drum of the flasher may be made to revolve at any practical speed, and the machine is particularly well constructed in every detail. The drum is used only in a mechanical way and no current passes through it, the iron uprights or the main shaft. The device is simple and compact.

GENERAL TELEPHONE NEWS

The Grant County Telephone Company of Silver City, N. M., has increased its capital stock from $35,000 to $60,000, and will construct a line to Deming, N. M.

Judge Landis of the United States District Court a few days ago served a restraining order by telephone. By this unusual method he stopped the moving of furniture by a bailiff armed with a writ.

The La Crosse Telephone Company of La Crosse, Wis., will increase rates, having adjusted its rates in accordance with a schedule arranged by the State Railroad Commission, which also has authority over the telephone companies.

The Central Union Telephone Company has entered upon the work of extensive improvements and extensions of its plant in Elkhart. The projected merger of the Home Telephone Company with the Central Union at Elkhart is declared off, and both companies will continue to compete for patronage, and each strive to give the better service.

A remarkable test of memory is reported from Logansport, Ind., where Miss Mayme Richardson possesses the distinction of knowing by heart the number of every telephone on the local line. Miss Richardson presides at the information desk, and in a recent test a number of subscribers on different portions of the line asked Miss Richardson for the names of from one to twelve subscribers, giving the numbers, and in every instance her answer was correct.

CORRESPONDENCE.

Continental Europe.

Paris, November 26.—A project of some importance in the way of utilizing hydraulic power in France consists in building a number of turbine plants upon the Doubs River. A concession to this effect has been applied for by Engineer Butticaz, who expects to utilize the St. Point Lake and the basins of the Doubs for this purpose. There are two parts in the present project, concerning different portions of the stream. Each of these is designed to increase the volume of water for running the electric plants. In the first project it is designed to use the basins lying above the point known as Saut du Doubs in order to obtain current for electric traction purposes on the Neuchatel Jura line. The latter railroad will connect Neuchatel, in Switzerland, with Chaux de Fonds and Brenets, and in this case the Brenets Lake will be used as a reservoir. In this way the hydraulic power of the Doubs will be taken off upon a length of 12 miles or more of the stream, and it is proposed to erect three distinct turbine houses. In the first of these plants the head of water will be 78 meters. The second project is even of larger scope, and the St. Point Lake is to serve as a reservoir, raising the level here by 7.5 meters, so as to have a reserve supply of 60,000,000 cubic meters. The water will be taken off by the Loue stream and on it there will be three hydraulic plants erected, with a fourth one to come at a later period. Some 150,000 horsepower is expected in this way. The three plants will have a head of water of about 150 meters.

One of the recently constructed electric traction lines in Austria-Hungary has now been opened for service at Prague. It runs to Bubentsch and Wemberger-Friedhöfe. This is a short line, having but five miles length, but it already carries a good traffic. There are about 30 stations along the line.

The tramway strike at Milan has been a great hindrance to traffic, and at the present time it is not yet over. The strikers held a meeting not long since and appointed delegates which are to confer with the Municipal Council with reference to the matter, so as to come to a solution. On the other hand, the Société Edison, which controls the tramway lines, states that it will not take back the strikers who do not come to work within a certain time.

At Madrid a royal decree, published by the minister of the interior as to the reduced telegraph rates, aroused great protest from the members of the press. The present decree states that the reduced rates which are now in use will be hereafter refused to all persons or firms, including newspapers, press agencies, societies or press correspondents who have not paid the industrial tax and others of the same nature. Some members of the government are opposed to the proposition, and the journalists who are members of Parliament expect to make a protest by means of a motion brought up by Deputy Soriano.

I have already noted some of the electrical features of the Paris Automobile Show. Among others there is an interesting car which is brought out this year by Girardot, the well-known chauffeur and constructor. It belongs to the class of gasoline-electric cars, using a small electric motor mounted directly on the gasoline-engine shaft in connection with a storage battery, so that the electric motor can be called upon to aid the car in hard places. This system is proving a favorite, as there are a number of firms who are bringing out such combination cars this year. The Girardot automobile has a four-cylinder gasoline motor and a four-pole dynamo of round form. Tudor battery cells, 24 in number, are connected upon the dynamo and run it as a motor when need be. Another new car is the "Ampère." In this case there is an electromagnetic friction clutch which transmits the movement from the gasoline motor to the rear axle. The clutch contains a number of friction disks which are applied by throwing current into coils contained in the clutch, and the disks can be coupled or released at once by means of a switch. As to the electric lighting of the show, it is even more brilliant than last year, especially the main avenue in front of the Grand Palais, which is bordered by columns and incandescent-lamp designs. The front of the Invalides Annex is also lighted in a very tasteful manner. Inside the Grand Palais there are some portions of the show which are lighted by mercury-vapor lamps and others by tantalum lamps. A. DE C.

New York.

New York City, December 7.—A delay has occurred in the proposed investigation by the Public Service Commission into the affairs of the electric lighting concerns of this city owing to the fact that the Merchants' Association, which was expected to furnish the complaint signed by 100 consumers, on which the commission was to take action, deemed it inadvisable that the inquiry be carried on at the present time. The matter has been in the hands of Commissioner Maltbie. Despite the attitude of the Merchants' Association the Public Service Commission may start the inquiry without waiting for a complaint. The commission had depended on the association for much of the data which was to have been used in the inquiry.

A letter sent to the Board of Estimate of this city by the Public Service Commission contains a table of the commission's probable expenses for 1908. It will require $1,095,000 of the taxpayers' money to meet expenditures, which the commission says will be necessary to carry out the provisions of the law under which the board was formed. In addition the commission receives from the state $150,000 a year.

When questioned by a New York World reporter concerning his alleged prediction a year ago that by December, 1907, horses would have disappeared from the streets, Thomas A. Edison is quoted as saying: "When I first completed my battery I thought it was so perfect that I could improve upon it no further. But as my experiments progressed I discovered that science, my master, had played a little joke on me and had only let me see a little way into the future instead of a long way. I may yet hit upon a battery that will practically never wear out."

For the first time in the history of any navy a first-class battleship was docked by searchlight when the 16,000-ton battleship Minnesota was brought Tuesday morning to the navy yard to have its bottom painted for the voyage to the Pacific. The searchlights of the Connecticut, Virginia, Rhode Island and Ohio were used, and the new departure was a success.

Justice O'Gorman has refused to the Queens Lighting Company a writ of mandamus, compelling the board to grant a franchise and the mayor to sign it. The company made application some time ago, and the board had a franchise drawn up and approved of it. While it was in the mayor's hands the board rescinded its own action. Controller Metz suggests that in matters of this kind, when the city is asked to grant franchises to companies which intend doing business in undeveloped territory, the franchise be awarded to the highest bidder.

At the general offices of the company in Philadelphia on December 3d the stockholders of the Bell Telephone Company voted to merge the Pennsylvania and the Chesapeake and Potomac Telephone companies with the Bell corporation. In order to provide for this it was voted to increase the capital stock from $30,000,000 to $60,000,000, enough of the increase being set aside to purchase the outstanding stocks of the two merged companies. This proposition has been before the stockholders of the Bell Telephone Company for some months and has attracted considerable interest and attention by reason of the fact that it greatly strengthened the Bell Company and gives it control of another extensive range of territory. The proposition to change the name of the corporation from the Bell Telephone Company of Philadelphia to the Bell Telephone Company of Pennsylvania was also approved. The board of directors was increased from 12 to 15 members. Officers were elected as follows: Chairman of the board, Theodore N. Vail; president, U. N. Bethell; vice-president, F. H. Bethell; general manager, P. L. Spalding; general contract agent, L. H. Kinnard; superintendent of plant, J. C. Howell; chief engineer, Nathan Hayward; division contract agent, J. H. Crosman.

Adrian H. Joline and Douglas Robinson, the Federal receivers of the Metropolitan and New York City Railways, have obtained within the last few days the control of a fund of $814,000 belonging to the Central Crosstown Railway Company, one of the leased subsidiaries of the Metropolitan Street Railway, which they found, upon taking office, tied up under a six months' certificate of deposit with the banking firm of August Belmont & Co. It is said that the receivers, soon after they took office, discovered that this money, constituting a construction fund derived from the proceeds of the Central Crosstown mortgage of 1904, had been put in the keeping of Belmont & Co. only a week or so before the application for receivers for the New York City Railway, which was followed soon after by the application of the Metropolitan itself to be brought under the general receivership. It was held under a certificate of deposit issued by Belmont & Co., which provided that the street railway could not draw the $814,000 for a period of six months. W.

Dominion of Canada.

Winnipeg, December 6.—The Civic Board of Control of this city has brought the power scheme into the limelight again by a motion passed at a session of the board instructing Prof. Louis Herdt and William Kennedy of Montreal and Colonel H. N. Ruttan, city engineer, to take up the details of the power-plant specifications and report fully on any necessary changes before new tenders can be called. The action of the board is important, as it practically means that new tenders are to be called for the construction of the civic plant at Point du Bois.

The British Columbia Electric Street Railroad Company has just completed the purchase from the Vancouver owners of their Dominion charter for an electric-railway line from the international boundary at Blaine, Wash., to Vancouver. This line is a section of the electric road proposed between Vancouver and Seattle, practically paralleling the Great Northern Railroad for the whole distance. At the same time the British Columbia company has acquired extensive water privileges at Lillooet to supply current to the proposed line. R. H. Sperling, Vancouver, B. C., is general superintendent of the British Columbia Electric Street Railroad Company. Director Gifford of the same company has left Vancouver for St. Paul to interview J. J. Hill regarding the possible electrification of the Great Northern Railroad between Vancouver and Seattle. The object of the British Columbia company in securing the charter for the line between Blaine and Vancouver is to impress on the Great Northern people the necessity of that company electrifying its road and obtaining power from the British Columbia company.

M. G. Reid, chief engineer of the Colonial Engineering Company, Montreal, Que., has made an offer to the Toronto City Council to establish a gas producer plant for $2,875,000 and to supply arc lights to the city for $56 per lamp per annum and also to supply power at about one-third the present price.

The Calgary City Council has awarded the contract to the Calgary Transmission and Power Company to supply power to the city for five years at a rate of $30 per horsepower 24 hours a day. The company is to have its plant completed by March, 1909, and to supply 6,000 horsepower. It is said that a rival concern, the Calgary Portland Cement Company, offered to build a plant up the Bow River and to supply power at $20 per horsepower 24 hours a day on a two-year contract. In Calgary it is said that the Portland Cement Company will obtain an injunction to prevent the council from signing the contract until an investigation has been held.

The Stark Telephone, Light and Power System, which supplies light, power and telephones to Toronto Junction, Ontario, has been obliged to go into liquidation. The liabilities are given at $127,000, outside of a bond issue of $400,000. The plant is being operated by the assignees. The company was incorporated in 1902 with a capital of $1,000,000. It also supplies light at North Toronto, Etonbrook Township, York Township, and has a controlling interest in the plants at Oshawa and Bowmanville, all in Ontario. R.

Michigan.

Detroit, December 7.—Two of the Westinghouse single-phase locomotives to be used in the Grand Trunk Railway tunnel at Port Huron have been delivered. They will not be placed in service until the other five arrive. It is expected that electric service will be begun on Christmas night.

Saginaw promoters plan to buy the Detroit, Flint and Saginaw Railroad when it is sold by the Genesee Circuit Court, where receivership proceedings are soon to come up for final disposition. It is said that sufficient money has been raised for the purchase, if the bondholders do not force the bidding too high, and it is understood that they do not care to continue in control. The road is now on a paying basis.

Mayor Thompson of Detroit decided not to oppose the test of the tee rails by the Detroit United Railways, after having received letters from leading cities that tee rails have proved satisfactory. He has also decided that it will not be necessary to go on the junket to inspect tee rails, for which $700 has been appropriated by the Council. His inquiries have convinced him that it is not necessary to incur the expenses of the trip.

By a vote of 142 to 18, it was decided at a special election at Trenton to sell the lighting plant to the Detroit Edison Company. The price is to be $8,000. The contract provides for at least 20 street arcs at a price of $62.50 for service from half an hour after sundown until 1 a. m. and $65.50 for all-night service. The company will also sell power to the village for the operation of the waterworks, the company to receive one-half of the gross receipts, the sum not to be less than $175 a quarter. The term of the contract is 30 years.

Linden is considering a proposition of the Michigan Electric Lighting Company to install a plant if 250 incandescent lamps will be used. Thirty-two-candlepower street lamps are being considered.

The Boyne City Council has granted the petition for four additional arcs at $70 each and for the lighting of one street by 32-candlepower lamps at $11.50 each. If the experiment with incandescent lamps is not satisfactory, they will be replaced by arcs. D.

Indiana.

Indianapolis, December 7.—In the case of the Lafayette and Logansport Traction Company, seeking to combine with the two steam roads in establishing and maintaining an interlocking device, the Indiana Railroad Commission has ruled that the interlocker should be rebuilt so as to include the traction company, the latter to bear all the expense and pay the Vandalia the sum of $1,036.67. The expense of operating the interlocker is to be apportioned among the three roads, the traction company bearing the larger portion, because of its greater number of trains.

A meeting of traction men, merchants and farmers was held at Mt. Vernon during the week in the interest of the projected electric railway from Mt. Vernon, Ind., to Mt. Vernon, Ill., connecting with the St. Louis lines in Illinois and the Evansville lines in Indiana. The proposed route would include Fairfield, Grayville, Albion and New Harmony in Indiana.

A meeting of the joint executive board representing 340 motormen in the employment of the Indiana Union Traction Company, held a meeting at Anderson on the 5th inst., to arrange to take up the matter of a new wage contract with the company for 1908. A committee was appointed to prepare a schedule for the new year.

The Terre Haute, Indianapolis and Eastern Traction Company is preparing to install electric-light service in the homes of a number of residents, principally farmers, along its line west of Terre Haute. It is understood that the company expects to give such service in a number of localities along the line.

The proposition to sell the Richmond municipal electric-light plant is again being agitated. The Light, Heat and Power Company, a strong competitor of the municipal plant, has offered to buy the municipal plant at an appraised price, the appraisal to be made by competent men. The company also states that it will accept a new franchise which will thoroughly safeguard the city in the matter of rates. The managers of the company say that there is insufficient business in Richmond for two light plants. It is evident that the sentiment to sell the city plant is much stronger than when the proposition to purchase was made a year ago. Consequently, the Council has appointed a special committee to make an investigation as to whether or not the city plant has proven a financial success. Improvements costing $29,000 have just been completed, and whether this will increase the ratio of business so as to make the plant more profitable will be considered in the investigation.

The Winona Water and Light Company of Warsaw, according to a report made to the City Council, has lost during the last 11 months over $5,000. The Winona company is offering to enter into partnership with the city, or will sell the plant outright to the city.

The president of the Retail Merchants' Association of Evansville denies that the association is advocating or otherwise encouraging the construction of a municipal light plant in Evansville. On the contrary, he says, a number of the members have publicly denounced Mayor Boehne's scheme for municipal lighting because of the general failure of such plants. They cite the local waterworks system as a distressing example. S. S.

Illinois.

Peoria, December 7.—The City Council of the city of Virginia has renewed the contract of the Virginia Electric Light Company to light the streets at a figure considerably lower than the former one. The contract is for a period of five years.

The St. Louis, Terre Haute and Quincy Traction Company has increased its capital stock from $25,000 to $50,000. At the meeting held in Springfield this week it was decided to push the work and secure the necessary capital to build the road. The following-named officers were elected: President, Edward Yates of Pittsfield; vice-president, H. C. Simon of Virden; secretary and treasurer, F. W. Knollenberg of Quincy.

The City Council of Peoria has passed the ordinance requiring the Western Union Telegraph Company to put its wires underground in the central part of this city. The company will pay to the city the sum of $500 a year, which will be taken out in messages sent by the city.

The Gillespie Electric Railway Company has been incorporated with a capital of $30,000 to build and operate an electric railway between the city of Gillespie and the mines in Macoupin County, the principal office to be in Gillespie. Incorporators and first board of directors: H. T. Bycroft, R. H. Isaacs, H. W. Rice, G. W. Schmidt and S. P. Preston, all of Gillespie, Ill. V. N.

Northwestern States.

Minneapolis, Minn., December 7.—A company has been organized for the purpose of building an electric railway from Lidgerwood, N. D., to Veblen, S. D. It is capitalized at $500,000 and is headed by E. A. and J. H. Movius of Lidgerwood.

The city of Washburn, Wis., has purchased the plant of the Washburn Light and Power Company, paying $22,518 therefor. This does not include the power house and dam, which the city has leased for 15 years.

The city of Sleepy Eye, Minn., has purchased a new generator from the American Electrical Company of St. Paul, and will install a day current.

The construction of an interurban electric railway from Clinton, Iowa, to Dubuque is said to be assured and the survey has been completed. This will complete a system from Dubuque to Davenport. F. J. Wilcox is the promoter of the new line.

The gross receipts of the street-railway company at Superior, Wis., during the last fiscal year were

$200,991. This is an increase of $24,066 over the previous year.

A new company has been organized at Mitchell, S. D., and has been granted a franchise for an electric-lighting system.

With the first of the year the Minnesota Railroad and Warehouse Commission will include all electric and other suburban railways in its jurisdiction. This will take in the Twin City Rapid Transit Company's lines to Stillwater and to Lake Minnetonka. The rules now applying to the steam roads will be extended to the electric lines, including the enforcement of the four per cent. gross-earnings' tax. The Supreme Court has already decided that these lines are common carriers, and no opposition to the action of the commission is expected. K.

Pacific Slope.

San Francisco, December 4.—At the last meeting of the city trustees of Sacramento, the report of C. L. Cory, a consulting engineer of San Francisco, was filed on the proposed municipal electric-lighting plant, which can be installed for $237,200, according to the estimates.

The United Railroads of San Francisco has begun to operate electric cars on Ninth Street, between Mission and Brannan. This is the first time cars have been run over that portion of the Polk, Larkin and Ninth Street line since the fire.

The Lake County Power Company has been incorporated at Kelseyville, Cal., for the purpose of absorbing the old corporation organized two years ago to provide the city with electricity for lighting and gas for fuel. The power for generating the electricity will be secured from natural gas. The men behind the new organization are George P. Low of San Francisco, G. S. Cutler of Calistoga, Robert Polk of Upper Lake, Judge M. S. Sayre and G. H. Henderson of Lakeport.

The Rogue River Electric Company has been incorporated to take over the Condor Water and Power Company, including the dam and power house at Gold Ray, and the light and power system extending through the Rogue River Valley supplying electricity to the towns of Grants Pass, Gold Hill, Central Point, Medford, Jacksonville and Ashland, Ore. C. R. Ray is president, and J. C. Stoddard secretary. Both are with the Condor Water and Power Company at present. The capital stock is $700,000.

The engineers of the Great Western Power Company, which acquired property on Brooklyn Basin, south of Fifth Avenue in East Oakland, Cal., are now at work with the intention of preparing for the construction of a large auxiliary electric power plant there. Steam turbines are to be used. M. A. Viele of the company states that 50 teams are engaged at the present time in hauling freight to the works above Oroville. No delay has been occasioned in this work by reason of the financial disturbance. A.

PERSONAL.

A memorial service for the late Prof. C. P. Matthews was held in Fowler Hall, Purdue University, on December 4th. Prof. J. W. Esterline and others spoke.

A London press dispatch of December 10th contains the disquieting intelligence that Lord Kelvin has been confined to his bed for two weeks with chills. His condition is said to be serious.

Mr. E. B. Hillman of Quincy, Ill., former president of the Illinois State Electric Association and proprietor of electric-light and power plants in Warsaw, Barry and Wyoming, Ill., and Hamburg, Iowa, was a Chicago visitor on Saturday last.

Mr. C. E. Freeman, formerly professor of electrical engineering at Armour Institute of Technology, has been in New York city for nearly two months as direct assistant to Mr. Bion J. Arnold in the investigation of traffic conditions in the New York subways.

Mr. William B. Foshay is about to take charge of the Fort Dodge (Iowa) Light and Power Company as manager. Mr. Foshay is an experienced central-station man, having had experience in Tarrytown, N. Y., and later serving as assistant manager of the Water, Light and Gas Company of Hutchinson, Kan.

Mr. W. W. Watterson has been appointed superintendent of the Peoria, Bloomington and Champaign line of the Illinois Traction Company and has taken up the duties of the position, with his headquarters at Bloomington. He will retain the office of superintendent of the line between Lincoln and Springfield.

Marcellus Hopkins of Chicago, president of the South Side Elevated Railroad Company, died at his home on December 7th of pneumonia. He had been sick but a few days. Mr. Hopkins had been general manager of the South Side Elevated from 1893 up to about a year ago, when he was chosen president. He was born in Maine in 1844 and came to Chicago in 1863, entering a steam-railroad career as brakeman and rising to a division superintendency. In 1893 he became receiver of the Chicago and South Side Rapid Transit Company and was made general manager when the property was turned over to the present company.

The marriage is announced of Mr. Leroy Purdy Sawyer and Miss Jessamine Almeda Pike on December 4th in Cleveland. Mr Sawyer is known in the prosaic paths of commerce as the energetic manager of the Buckeye Electric Company. He is heartily congratulated. Mr and Mrs. Sawyer will be "at home" after March 1st at 2053 East Ninety-sixth Street, Cleveland, Ohio.

It is said that an offer has been made to Prof Dugald C. Jackson of the Massachusetts Institute of Technology, Boston, to become the temporary technical assistant of the expert accountant engaged in devising a system of bookkeeping by which the city can keep informed of the financial operations of the Chicago Telephone Company under the new ordinance.

Morrison F. Tyler, president of the Southern New England Telephone Company, died at his home in New Haven, Conn., on December 4th. He was 59 years old. Mr. Tyler first turned his attention to the telephone business in 1878, and five years later became the president of the Southern New England Telephone Company. He became treasurer of Yale University in 1900, when he retired from the professorship of general jurisprudence in Yale law school. He held the place of treasurer for four years, when the rapid extension of the telephone business forced him to resign.

Mr. William B. Hale of Mexico, pleasantly remembered by many friends in Chicago, where he was electrical engineer for the Western Electric Company and chairman of the Electrical Section of the Western Society of Engineers in 1904 and 1905, has opened an office at 1a Independencia No. 6, City of Mexico, as a consulting electrical engineer. Mr. Hale, who has been in Mexico over two years, is a capable engineer and speaks and writes Spanish fluently. He is prepared to make examinations, estimates, appraisals, etc., or to supervise installations, in any part of Mexico. His knowledge of the requirements and conditions peculiar to Mexico should be particularly valuable in reporting on propositions involving electrical work in which American investors may be interested. Withal he is a man of the highest character, as all his Chicago acquaintances will cheerfully testify.

WILLIAM B. HALE.

ELECTRIC LIGHTING.

An electric-light plant is to be built in Cohasset, Minn.

G. L. Hudkins has been granted a franchise for an electric-light system in Beloit, Kan.

Gastonia, N. C., has appropriated $2,000 for improving the electric-lighting system of the town.

The Chickasha (I. T.) Water Power Company will build an electric-light plant. C. E. Ross is engineer.

Central City, Neb., will vote on an ordinance granting a franchise to the Central City Electric Light Company.

The electrical construction in the proposed technical high school in Newton, Mass., will cost about $40,000. The contracts have not been awarded.

An electric-lighting system is being constructed in King's Mountain, N. C., the power to be supplied by the Southern Power Company of Charlotte, N. C.

The Citizens' Light and Power Company of Oklahoma City has been organized with a capital stock of $250,000 and will furnish light and power in the Putnam district.

The Union Electric and Power Company of St. Louis has increased its capital stock from $10,000,000 to $18,000,000, half of the increase being paid. The additional capital will be used to develop the company's properties.

The Ottawa (Ont.) municipal electric commissioners and the Ottawa Electric Light Company have agreed to $29,000 as the price of the street-lighting plant. The city offered $24,000 and the company offered to accept $31,000. The city will take over the plant on December 20th.

Sealed proposals for the construction of a system of electric-light works will be received by the Town Council of Chinook, Mont., at the office of its clerk, until 2 o'clock p. m., December 21, 1907, when the same will be opened and publicly read. Proposals sent by mail should be addressed to John C. Duff, town clerk, Chinook, Mont., and marked "Proposals for a system of electric-light works." It is the intention of the town of Chinook that the builder under the specifications shall cover all of the apparatus, supplies, machinery, building and everything pertaining to the entire installation in any way. Plans and specifications can be obtained by addressing the town clerk.

The Citizens' Electric Company, located at Macon, Ga., has decided to apply for a franchise upon the installation in office of the new City Council. A former application was "turned down," but Mr. W. J. Grace, representing the new company, says that the application will be filed as soon as practicable.

A dispatch from Charlotte, Mich., says that J. A. Mikesell has been appointed receiver for the Charlotte Electric Company on application of the Union Trust Company of Detroit as trustee for the Guardian Trust Company of Cleveland, which represents the minority bondholders of a $30,000 issue, due in 1920, on which the interest payments have been defaulted.

The Iron Mountain Electric Light and Power Company, Iron Mountain, Mich., has lately let contracts for new electric generating and arc-lighting equipment, comprising a 250-kilowatt Allis-Chalmers alternating-current generator, 10-kilowatt belted exciter, a five-panel switchboard and 75 Adams-Bagnall arc lamps of the latest pattern. The generator is of the revolving-field, two-bearing type, belt-driven.

The Minneapolis Electric Motor Company has secured the contract to install a complete electric-lighting plant at Cannon Falls, Minn. The capacity will be 60 to 75 kilowatts, the three-phase alternating system being used. A franchise has been granted for 20 years, with a street-lighting contract for 10 years on a meter basis. L. F. Blinco is the grantee. E. E. Rines, Minneapolis, is the consulting engineer.

ELECTRIC RAILWAYS.

Traffic on the Chicago and Oak Park Elevated Railway main line in November averaged 47,133 passengers a day, a decrease of 2,639 compared with November, 1906. With transfers the daily average was 49,128 passengers, a decrease of 2,254.

The Massachusetts Railroad Commissioners have received a petition for the approval of an issue of 20,218 shares of additional stock by the West End Street Railway Company of Boston, the proceeds to be paid to the Boston Elevated Railway Company for additions, improvements and alterations in the West End company's property, the amount being $2,135,750.

The claim of the Guaranty Trust Company of New York to something over $1,500,000 against the Chicago Union Traction properties has delayed the reorganization plans. It is the only trustee which has not approved of the plan by which the Chicago Railways Company is to take over the properties and operate them in accordance with the traction settlement ordinance. The Guaranty Trust Company demands that its claim be paid in cash, which can hardly be assented to, and Judge Grosscup, who conducted a hearing on the petition to transfer possession of the properties, must rule on the claim. This now seems to be the only hindrance to the reorganization.

The first electric railway to operate its line on the 1,200-volt direct-current system, which is said to have proved entirely feasible, is the Indianapolis and Louisville Traction Company. This road is 41 miles long, connecting Seymour, the southern terminus of the Indianapolis, Columbus and Southern Traction Company, with Sellersburg, the northern terminus of the Louisville and Northern Railway and Lighting Company. The power house is located at Scottsburg, being about the center of the route. The feeding pressure at the power station is 1,200 volts between the single No. 0000 grooved trolley and the rails. Two Allis-Chalmers engines of the well-known heavy-duty type, 26 by 48 inches, operating non-condensing at 120 revolutions per minute, drive in pairs four 300-kilowatt, 600-volt generators, with armatures mounted commutator to commutator on the engine shaft, the combined output being at 1,200 volts. In addition to operating its cars at this pressure the company maintains a line from Sellersburg to Louisville, a distance of 14 miles, at 600 volts pressure; consequently cars are now being run successfully over sections of trolley fed with current both at 1,200 and 600 volts.

PUBLICATIONS.

L. E. Myers of Chicago has issued a booklet of vest-pocket size telling about "Municipal Lighting Plant Failures." Forty plants are listed in alphabetical order.

The Frank Mossberg Company of Attleboro, Mass., has just issued Catalogue No. 10, which covers a large line of bells, wrenches, sheet-metal stampings, punching and forming dies, special tools and machinery. The catalogue is well illustrated.

Two interesting bulletins have just been published by the Mechanical Appliance Company of Milwaukee, Wis. No. 60 describes in detail the construction of Watson motors and generators of the AW type. In No. 61, devoted to Watson motor applications, are shown some 50 clear views of different applications of these motors to machine driving. This collection of views gives a good idea of the wide field that the large electric motor has invaded and is particularly interesting in showing the adaptability of the Watson motor for all classes of service.

Muralt & Co., engineers of New York city, issue an attractive monthly house organ bearing the title Electric Trunk Line Age. The second number, for November, contains the first installment of an article by J. M. Graham, vice-president of the Erie Railroad, on "The Valtellina Line" in Italy.

The Chicago Fuse Wire and Manufacturing Company has issued "Catalogue No. 21," descriptive of "Union" switchboxes. These boxes are made for new and old work and they take all makes of switches and receptacles. This little pamphlet should be of considerable service to contractors, as it shows various forms of Union sectional switchboxes, tandem boxes and describes also the company's new reversible ear which can be attached to all switchboxes if specified. This new reversible ear is featured in the catalogue, and it is said that "contractors say this ear is perfection."

Single-stage, motor-driven, centrifugal pumps built for any capacity and condition of service within the range of their adaptability are described in Allis-Chalmers Company's Bulletin No. 1608. This pump is very simple in construction; nevertheless, in order to secure maximum efficiency, the design is carefully worked out to meet the requirements of the service for which each is intended. As they are valveless and operate with very little vibration, they are useful for use as circulating pumps for cooling systems, surface or barometric condensers; for hot-water heating; for mine service; for industrial plants, etc. The publication will be sent to anyone interested upon receipt of a request.

A friction clutch designed for the heaviest work, with particular regard for simplicity, durability and ease of adjustment, is described in Allis-Chalmers Company's Bulletin No. 4001, entitled "The Reliance Friction Clutch." Ordinarily, the pulley hub of a friction clutch is cut down to economize space on the shaft, and the bearing surface supplied will not properly carry the strain of a tight belt. The strain of the Reliance friction clutch, on the contrary, has an even distribution, it being made with either three or six arms, arranged in sets of three. Each of the sets is connected with an equalizing ring by toggles, and this ring is free to move sideways, so as to equalize the strain on the three arms. The pressure, also, instead of being regulated with springs, can be set according to the load the clutch has to carry by means of adjusting nuts and eyebolts.

"Direct-current Indicating Instruments, Type D," is the title of Bulletin No. 4552, recently issued by the General Electric Company. The bulletin describes and illustrates the construction of these switchboard instruments and gives dimension diagrams of instruments and shunts, full-sized views of the scales, and data regarding catalogue numbers, capacities, prices, etc. Damping is obtained by means of Foucault currents generated in an aluminum frame on which the coil is wound. The magnets are carefully hardened and aged, and an unusual high torque, combined with light moving elements and small magnetic air gap, make reasonable the manufacturer's claim of long life with continued accuracy. The frame is pivoted in a jewel bearing, and the whole assembled in a round cast-iron case, which protects it from stray fields and renders the instrument dustproof.

Three interesting booklets have been published recently by the Sangamo Electric Company, Springfield, Ill. Bulletin No. 10 describes the Sangamo integrating wattmeters, types D and E, for direct and alternating current, respectively, that are used for service meters principally. Bulletin No. 11 describes the similar meters adapted for switchboard work. This bulletin is a handsome one and contains a large number of diagrams of connections, dimensions, applications of current shunts and transformers and of potential resistances and transformers. A pamphlet of 64 pages gives valuable information to salesmen and engineers about Sangamo and other types of meters. Section two of this pamphlet is a reprint of a paper on "Electricity Meters," by R. C. Lanphier, read before the Illinois State Electric Association in September, 1906, afterward appearing, with special illustrations, in the Western Electrician.

The Bristol Company of Waterbury, Conn., is issuing three new bulletins covering its electrical instruments. Bulletin No. 61 describes recording voltmeters, in 12 pages, illustrated, and is very complete. Bulletin No. 62 describes recording ammeters and lists a new form of portable instrument which is now being manufactured, and is attractive in its makeup. Bulletin No. 63 covers a line of recording wattmeters, and is somewhat larger than the others, having 19 pages. This bulletin, besides illustrating the new portable form of wattmeter, also shows a complete list of single-phase, two-phase and balanced three-phase alternating-current instruments, something that was absent from former bulletins. These catalogues will be appreciated by engineers, who are usually in a quandary as to the best type of instrument applicable to the loads for which they intend to design and will be found helpful in locating the proper instrument.

A well-illustrated booklet of information on modern methods of way maintenance has just been published by Cook's Standard Tool Company of Kalamazoo, Mich. Descriptions and illustrations of labor-saving track appliances are given, including track drills, track tool grinders, car jacks, track jacks, cattle guards, etc.

SOCIETIES AND SCHOOLS.

The regular meeting of the Ithaca branch of the American Institute of Electrical Engineers was held on December 6th in Sibley Dome, Cornell University. The topic was "The Practical Aspects of Steam-railroad Electrification." H. H. Norris is secretary of this branch.

The annual meeting of the directors of the Underwriters' Laboratories was in session in Chicago this week. Among those present were the president of the National Board of Fire Underwriters and C. M. Goddard, secretary of the New England Insurance Exchange. Some tests were made at the laboratories.

Proceedings of the Ohio Electric Light Association, 1907, have been issued in the usual book form. The volume contains the papers, discussions and other transactions at the thirteenth annual meeting held in Toledo last August. Mr. D. L. Gaskill of Greenville is secretary and Mr. Douglas A. Brown of Cincinnati official reporter.

The paper on "Comparative Performance of Steam and Electric Locomotives," by Albert H. Armstrong (see Western Electrician of November 16th last), was discussed on December 3d before the Purdue branch of the American Institute of Electrical Engineers by Dean C. H. Benjamin and by Messrs. W. T. Small and C. R. Moore of the electrical department.

Among the flourishing societies at Iowa State College, Ames, Iowa, is the local branch of the American Institute of Electrical Engineers. The membership of this branch includes one member, 10 associate members and 30 student members of the Institute. Meetings are held twice a month at which papers presented at the New York meetings of the Institute are abstracted and discussed. Original papers are also read.

The "Year-Book of the American Institute of Electrical Engineers, 1907," is a book of 244 pages, 6 by 9 inches. It contains the list of officers, committees and members, the constitution, standardization rules, and other general information about the scope and membership in the Institute. The growth of the latter is strikingly shown by the following figures: May 1, 1901, 1,260; May 1, 1903, 2,229; May 1, 1905, 3,460; May 1, 1907, 4,521; October 1, 1907, 5,089. On August 1st of this year the membership was subdivided as follows: Honorary members 2, members 547, associates 4,312, giving a total of 4,861. Copies of this year-book will be sent to members and associates and to anyone interested in the work of the Institute sufficiently to seek admission to it as an associate, on application to Ralph W. Pope, secretary, 33 West Thirty-ninth Street, New York city.

A special course of evening lectures will be given at Science Hall, University of Washington, Seattle, Wash., this winter and next spring. There will be five lectures on telephone work by C. E. Fleager, superintendent of construction in Washington, Idaho and Oregon for the Pacific Telephone Company. The dates of these are December 11th and 18th and January 8th, 15th and 22d. Central-station practice will be the subject of James D. Ross, electrical superintendent of the Seattle municipal electric-light and power system, whose dates are February 18th and 25th and March 3d, 10th and 17th. John Harisberger, general superintendent of the Seattle-Tacoma Power Company, will lecture on electric power transmission on April 14th, 21st and 28th. While the lectures are primarily intended for students, all others interested are cordially invited to attend without charge. Carl Edward Magnusson, professor of electrical engineering at the University of Washington, can give more detailed information.

MISCELLANEOUS.

At Little Chute, Wis., an effort is being made to persuade the village authorities to adopt an ordinance regulating electric wiring. It is said this work can be carried on at a small cost by the Kaukauna city inspector, who spends considerable time in this territory.

A Berlin dispatch says that on December 7th one of the large Berlin electric works gave a private exhibition of an elaborate new police-alarm installation just completed for the city of Rio Janeiro. It represents a cost of $500,000. Its special feature is a system of 580 patrol boxes, to be scattered throughout the city, keys to which may be purchased by trustworthy citizens, enabling them to turn in police alarms just as fire alarms are now turned in by the police. In order to identify the person who turns in a police call his numbered key cannot be extracted except by the authorities.

An alleged invention in the wireless transmission of power is reported from Lyons, France, of which Consul John C. Covert says: "It may be called an extension of the wireless use of electricity. It is still kept a secret, and it seems that only one person in Lyons possesses a knowledge of all the facts on the subject. All the work in perfecting the invention was carried on in the country at the castle of a prominent manufacturer of Lyons. Recently the first experiments were tried, and a miniature street car was moved over a flat space by electricity communicated from a distance of several yards. The invention is being tried in Marseilles on a street-car line and applied to several different kinds of machinery."

The United States Civil Service Commission announces an examination on January 8, 9, 10, 1908, at several cities in each of about 50 states, territories and island possessions to secure eligibles from which to make certification to fill two vacancies in the position of mechanical and electrical draftsman, one at $1,200 and the other at $1,500 per annum, in the office of the chief of ordnance, War Department, and vacancies requiring similar qualifications as they may occur in any branch of the service. The examination will consist of the subjects: Mathematics, calculations, materials, electricity, drafting, training and experience. Applicants should at once apply either to the United States Civil Service Commission, Washington, D. C., or to the secretary of the board of examiners at any place mentioned.

Periodical meter calibration is of importance to every central station, and although there is no question regarding the accuracy of making the test with indicating instruments, it is important that some means be provided by which, without decreasing their reliability, the tests can be made more conveniently and quickly. The Thomson high-torque induction test meter, described in Bulletin No. 4549 recently issued by the General Electric Company, Schenectady, N. Y., is intended for this service and consists of a Thomson induction meter registering revolutions of the disk instead of having a dial giving the kilowatt-hours. The meter also contains current coils of different capacities, so that by connecting each in circuit successively, a wide range of capacity for the tests is obtained while using the meter near the full load of the different coils. The test meter is connected in series with the meter under test, and a comparison made of the respective number of revolutions of the two disks in a given time. A simple calculation reduces the results to watt-hours for the two meters, and the percentage of error, if any, in the meter under test is quickly determined. Accuracy is maintained in the test meter by simple calibrations, and the parts are readily accessible. The bulletin contains a description of the method of operation and diagram showing method of making the test.

TRADE NEWS.

Receivers have been appointed for the Electrical Vehicle Company of Hartford, Conn.

Beginning December 9th all offices connected with the Stone & Webster organization in Boston will be located in the company's building at 147 Milk Street, corner of Batterymarch Street.

J. W. Taylor, traveling representative of the Beardslee Chandelier Manufacturing Company of Chicago, has accepted a local position with Edward Miller & Co., at their Chicago branch, located corner of La Salle and Lake streets, Chicago, and will be found there after January 1, 1908.

The National Battery Company announces that, owing to its increasing business, it has taken possession of the entire building at No. 236 West Fifty-fourth Street, New York, one door west of Broadway, which contains several times the floor space of the present office and depot. In the new location the company will be fully equipped to handle everything pertaining to battery requirements of automobile manufacturers, dealers and owners.

At a special meeting of stockholders of the Westinghouse Air Brake Company, held in Pittsburg on December 3d, it was decided to increase the capital stock of the company from $11,000,000 to $14,000,000. The new issue is to be distributed among present stockholders in the form of a 25 per cent. stock dividend. This will leave $250,000 worth of the issue in the treasury to be disposed of when needed. The company is reported to be in a strong financial condition and to have orders on its books that will keep the plant busy for several months.

The K. & B. Company of Philadelphia, dealer in special electrical supplies, will on January 1st move into its new quarters at the southeast corner of Eighth and Chestnut streets. The new location will give about five times the present floor space and will increase the facilities of the company to maintain its reputation for high-class material at low prices. In this company's large stock will be found electrical mouldings, cross arms, insulator pins and brackets, signs and flashers, telephone booths, elevator signal and controller cables, incandescent lamps, electrical heating apparatus, switchboards and panelboards, arc lamps, rheostats and motor starters, etc.

BUSINESS.

The Lake Shore and Michigan Southern Railway recently purchased a 250-kilowatt Allis-Chalmers engine-type generator (240 volts, two phase, 60 cycle) and a 15 kilowatt exciter unit for addition to the power equipment of the Chicago, Indiana and Southern Railway Company, a subsidiary line. The new generator will be installed at Danville, Ill.

C. H. Chalmers, vice-president and general manager of the Electric Machinery Company of Minneapolis, visited Chicago last week, and while in the city closed an order for a large alternator. This machine is of the gas-engine driven type, with a capacity of 120 horsepower. Mr Chalmers reports business in the Northwest as quite satisfactory.

Following is a list of the Electric Machinery Company's recent sales: Cannon Falls, Minn., complete alternating current station equipment, 60 kilowatt belted, three phase; State Training School, Red Wing, Minn., 30 kilowatt direct connected engine type, Faribault, Minn., 30 kilowatt engine type; Hong Kong Electric Company, Ltd., Hong Kong, China, large order for alternating current generators; Minneapolis Brewing Company, Minneapolis, new 150 kilowatt direct current generator, direct connected to Corliss engine, 100 revolutions per minute, also a three panel switchboard.

ILLUSTRATED ELECTRICAL PATENT RECORD.

Issued (United States Patent Office) December 3, 1907.

872,324. Magnetic Wedge. Sven R. Bergman, Lynn, Mass., assignor to the General Electric Company. Application filed April 10, 1907.

A slot-closing device consists of a bundle of iron wires fastened together and insulated from each other or of a roll of japanned magnetic cloth.

872,327. Plunger Elevator. John W. Brown, London, England. Application filed February 6, 1904.

This is a hydraulic elevator with an electric motor driving the pump.

872,329. Controller. Arthur T. Crocker, Schenectady, N. Y., assignor to the General Electric Company. Application filed March 3, 1906.

The controller actuates an emergency device through an operating member. A catch restrains this member. Upon release of the controller handle the latter trips the catch.

872,343 and 872,344. Speculum. Frank E. Griswold, Geneva, Ohio. Applications filed March 11, 1907.

Two forms of this surgical instrument are covered. Each has a miniature electric lamp for illuminating internal parts of the body. One terminal of the lamp is connected to a binding post and the other is connected to the speculum metal tube.

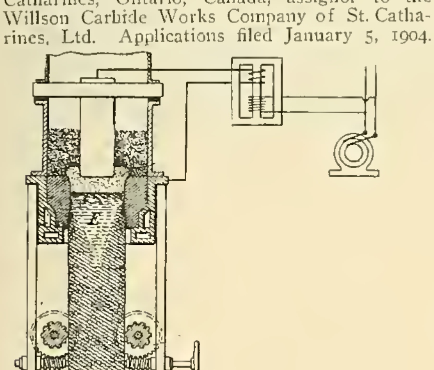
872,349. Motor-controlling System. John D. Ihlder, New York, N. Y., assignor to the Otis Elevator Company, Jersey City, N. J. Application filed July 28, 1905.

Two reversing switches are operated by electromagnets. An additional electromagnet has its coils connected to the coils of the other magnets in such a way as to prevent more than one switch being operated at a time.

872,350. Gas Burner. William V. D. Kelley, Newark, N. J. Application filed June 3, 1907.

A bent thermostat with a depending end is mounted on the burner tube near the flame. The end lies between the poles of a permanent magnet. A regulating cock thus varies the flow of gas as the thermostat affects the magnet.

872,351. Manufacture of Calcium Carbide, etc., and 872,352. Electric Furnace. Jesse C. King, St. Catharines, Ontario, Canada, assignor to the Willson Carbide Works Company of St. Catharines, Ltd. Applications filed January 5, 1904.



NO. 872,351.—MANUFACTURE OF CALCIUM CARBIDE.

The carbide is produced by passing the mixture through a zone of fusion in an electric furnace provided with a die having walls enclosing the zone and with means for withdrawing the material from the die progressively as it hardens into a solid pig. (See cut.)

872,356. Motor-driven Boat. Hermann Lemp, Lynn, Mass., assignor to the General Electric Company. Application filed May 27, 1905.

A number of continuously running explosive engines are connected to propeller shafts through electrical means controlled from the pilot house.

872,400. Electromagnetically Operated Mechanism. Johann M. Anderson, Boston, Mass., assignor to Albert and J. M. Anderson Manufacturing Company, Boston, Mass. Application filed January 20, 1906.

An electromagnet has its armature mounted on a lever. Locking devices hold the lever in the position it moves to when the magnet is energized. Another magnet is connected by means of toggle levers so as to release the locking device.

872,430. Electric Alarm. Frederick I. Johnson, Barrington, R. I. Application filed September 1, 1905.

A master alarm clock has a series of contacts in the path of its hands. In a number of rooms dials with adjustable hands and contacts are placed and connected with the master clock. When the latter indicates the time set on any other dial an alarm is rung alongside this dial in that particular room.

872,432. Electrical Apparatus. Charles J. Klein, New York, N. Y., assignor to Ralph Abraham Schoenberg, New York, N. Y. Application filed March 18, 1907.

A push-button switch adapted for use as a molding switch has a removable connecting member whereby the switch may be installed within a wall box or casing.

872,436. Liquid Meter. John W. Ledoux, Swarthmore, and Norman Z. Ball, Philadelphia, Pa., assignors to the Simplex Valve and Meter Company, Camden, N. J. Application filed April 20, 1906.

The flow of liquid regulates the action of an electrical mechanism which operates the recording mechanism.

872,474. Electrical Measuring Instrument. William E. Sumpner, Birmingham, England. Application filed October 19, 1905.

A phase indicator has a polyphase iron-cored electromagnet producing a rotary field through which a conductor moves that carries a current whose phase relation to the rotary field is that of the source to be indicated.

872,493. Track Grinder. Warren W. Annable, Grand Rapids, Mich., assignor to C. Vallette Kasson, Chicago, Ill. Application filed August 11, 1906.

This machine is used in connection with track welding work. A motor is used for driving the abrasive wheels and for propelling the car on which the machine is mounted.

872,497. Internal-combustion Engine. Alexander Campbell, Halifax, England. Application filed November 13, 1906.

A form of spark plug is described.

872,503. Magnetic Igniter. Charles E. Duryea, Reading, Pa. Application filed September 14, 1906.

One of the electrodes is reciprocating under the action of an electromagnet.

872,511. Toy Aerial Swing. Harry G. Hawekotte and Henry W. Klausmann, Indianapolis, Ind. Application filed September 14, 1906.

A battery motor drives a rotating tower to which are attached a number of swings.

872,513. Oil Switch. Edward M. Hewlett, Schenectady, N. Y., assignor to the General Electric Company. Application filed July 30, 1904.

The switch is of the double-throw type and has locking devices tending to hold it in open position. (See cut on the next page.)

872,515. Automatic Motor-control Apparatus. George H. Hill, Schenectady, N. Y., assignor to the General Electric Company. Application filed May 21, 1906.

This speed controller is provided with automatic actuating means and electrical means for limiting the motor current to different values for different loads and speeds.

872,523. Grab-bucket Hoist Apparatus. Sam H. Libby, East Orange, N. J., assignor to the Sprague Electric Company. Application filed March 7, 1906.

Two motors are used—one for opening and closing the bucket, the other for raising it. The bucket is lowered by gravity. The motors drive drums upon which the ropes going to the bucket are wound.

872,524. Hoist Controller. Sam H. Libby and Isaac F. Baker, East Orange, N. J., assignors to the Sprague Electric Company. Application filed March 7, 1906.

This is the controller for the two motors of the above hoist. It operates the motors in a predetermined order.

872,528. Gearing. George W. Mascord, London, England. Application filed January 9, 1905.

An electrically controlled lever operates clutches between the motor shaft, a driven shaft and a slow-speed shaft.

872,530. Method of Sealing Metal in Glass. George H. Meeker, Media, Pa. Application filed April 18, 1907.

This process for sealing oxidizable wires into incandescent-lamp stems consists in heating the glass tube to plastic condition without oxidizing the wire, quickly pressing the heated tube together without admitting air and finally reheating the stem.

872,535. Frequency Changer. Jakob E. Noeggerath, Schenectady, N. Y., assignor to the General Electric Company. Application filed December 4, 1905.

This frequency-changing set comprises two rotary converters electrically connected together on their direct-current sides and direct-connected mechanically. The two machines have different numbers of poles. (See cut on the next page.)

872,549. Current Converter. Leonard Wilson, Schenectady, N. Y., assignor to the General Electric Company. Application filed January 4, 1906.

An inverted rotary converter is mechanically connected to an alternating-current generator which has its armature connected in series with a number of points on the rotary armature.

872,550. Induction Motor. Ernst F. W. Alexanderson, Schenectady, N. Y., assignor to the General Electric Company. Application filed November 9, 1905.

A compensator connects the primary winding so as to have simultaneously two different pole numbers having a ratio of one to two. The rotor is arranged to offer a low resistance for currents induced by the large number of poles and a high resistance for the small number of poles.

872,559. Alternating-current Motor. Friedrich Eichberg, Berlin, Germany, assignor to the General Electric Company. Application filed December 18, 1905.

This single-phase commutator-type motor is started by short-circuiting the armature through one set of brushes on a line displaced from the primary magnetization and supplying current to another set of brushes 90 degrees away, so as to produce a field displaced from the primary magnetization.

872,563. Control System. George H. Hill, Schenectady, N. Y., assignor to the General Electric Company. Application filed November 27, 1905.

A series parallel controller of the separately actuated switch type has a number of resistance switches and a master controller governing the motors through them.

872,569. System of Insulation for High-voltage Electric Conductors. Fred M. Locke, Victor, N. Y. Application filed April 9, 1907.

A series of petticoated insulators is arranged in pairs on horizontal pins. Each pair is mounted end to end. The end pins are held by vertical supports. (See cut on the next page.)

872,570. Railway Switching and Signaling Apparatus. William Macomber, Buffalo, N. Y., assignor to the General Railway Signal Company, Buffalo, N. Y. Application filed March 15, 1904.

This system provides an electric motor for moving the rail switch and co-operating indicating signals.

872,571. Internal-combustion Engine. Fritz Moser, St. Aubin, Switzerland. Application filed December 14, 1906.

An electric ignition device is described.

872,572. Electric Meter Case and Support. Thomas E. Murray, New York, N. Y. Application filed July 13, 1907.

A base has mounted on it a back plate and a flanged plate. The meter cover encloses the flange in a recess formed around its inner wall.

872,581. Alarm Apparatus. Lawrence W. Pennington, Worcester, Mass. Application filed December 15, 1905.

A gas burner is provided with contacts of an electric circuit containing an alarm which is sounded when the gas is turned on.

872,593. Hygrometer. George L. Warnken, Jamestown, Cal., assignor to the Warnken-Congdon-Coffer Company, Jamestown, Cal. Application filed February 25, 1907.

An electrically operated valve controls the supply of fuel to a heater. The hygrometer is also connected to an electric bell that rings when the moisture becomes excessive or deficient.

872,613. Railway-signaling Apparatus. Frank L. Dodgson and Winthrop K. Howe, Buffalo, N. Y., assignors to the General Railway Signal Company, Buffalo, N. Y. Application filed November 27, 1905.

The train carries an electromagnet for normally holding the brake system inactive. When a signal is set in the "stop" position the electromagnet is shunted and the brakes applied.

872,623. Indicating Device. Walter A. Hall, Lynn, Mass., assignor to the General Electric Company. Application filed June 6, 1906.

An electric regulator has a rotary switch with a spiral on its shaft. A pointer engages the spiral and is moved thereby.

872,628. Telephone Pay Station. George A. Long, Hartford, Conn., assignor to the Gray Telephone Pay Company, Hartford, Conn. Application filed November 16, 1905.

This prepayment system is adapted to be used with automatic telephones. The transmitter current is normally open between fixed blocks. When a coin is deposited in the slot it completes the circuit between the blocks. When the receiver is hung up the coin drops into the coin box.

872,629. Sparking Device. Harry A. Miller, Pasadena, Cal., and Benjamin G. Gilbough, Chicago, Ill. Application filed February 14, 1906.

A vibratory electrode is mounted upon a gas-actuated piston so as to come near a fixed electrode in the firing cylinder.

872,631. Audible Warning Signal for Railway Crossings. Charles D. Anderson and Ashby G. Stout, Louisville, Ky., assignors to the Union Railway Signal Company, Louisville, Ky. Application filed May 27, 1907.

An electric-bell circuit is closed by contact brushes on a car as it reaches special contact rails near the crossing.

872,656. Electrically Heated Can-capping Machine. Montgomery H. Johnson, Utica, N. Y. Application filed April 5, 1907.

The soldering irons are provided with electrical heating coils.

872,670. Metering Panel Board. Arthur C. McWilliams, Chicago, Ill. Application filed May 8, 1906.

The conductors cross each other at right angles in parallel planes. The points of intersection are provided

This process for carburizing iron or steel consists in heating the carbon by an electric current confined to it.

872,756. Insulator. Frederick C. Scherer and Henry C. Fashbaugh, Columbiana, Ohio. Application filed October 19, 1906.

The insulator body is threaded to fit the pin, and it has a groove about the outside near the middle for receiving the wire, which is held in place by a cap that screws down over the top of the main body.

872,759. Electrolytic Ship-bottom Protector. John H. Schoneberger and George W. Frazier, Allegheny, Pa., assignors to the Pittsburgh Electrolytic Manufacturing Company. Application filed September 14, 1906. Renewed October 9, 1907.

A casing has two openings in contact with the sea water. An electrode is mounted in the casing, but insulated therefrom. This electrode is connected by a conductor to the skin of the vessel.

872,798. Signaling System. Clarence W. Coleman, Westfield, N. J., assignor to the Hall Signal Company. Application filed May 1, 1906.

This is a modification of No. 872,713.

872,802. Trolley. Gustav Ehmann, Canton, Ohio. Application filed June 19, 1906.

A trolley-harp construction is described.

872,985. Art of Producing Aluminum and Other Metals. Henry S. Blackmore, Mount Vernon, N. Y. Original application filed April 18, 1903. Divided and this application filed September 23, 1904.

This process submits the substance to electrolysis with an electrode containing a carbide of a different metal which is decomposed by one of the ingredients of the substance and thus reduces the latter to the metallic form.

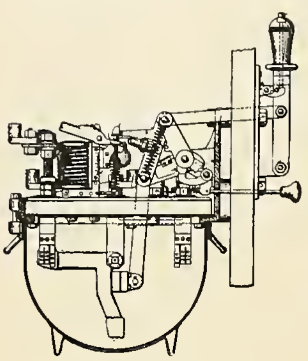
872,986. Elevator. John W. Brown, East Sheen, England. Original application filed February 6, 1904. Divided and this application filed February 18, 1907.

This is a modification of No. 872,327.

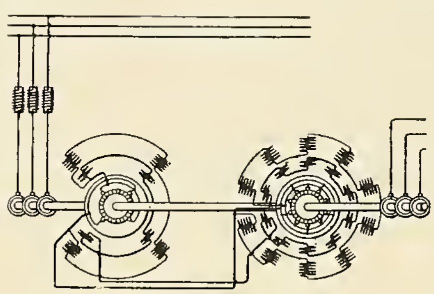
872,990. Control Apparatus. Arthur T. Crocker, Schenectady, N. Y., assignor to the General Electric Company. Original application filed January 9, 1905. Divided and this application filed March 21, 1907.

A controller of the drum type has brake-controlling devices and a circuit-breaker moved by a cam on the shaft.

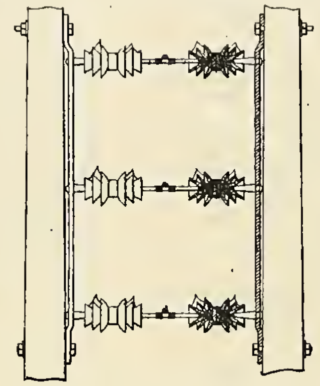
872,991. Control Apparatus. Arthur T. Crocker, Schenectady, N. Y., assignor to the General



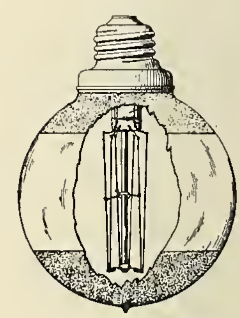
NO. 872,513.—OIL SWITCH.



NO. 872,535.—FREQUENCY CHANGER.



NO. 872,569.—HIGH-VOLTAGE INSULATOR.



NO. 872,936.—TUNGSTEN LAMP.

with caps for reserving fuse plugs as electrical connectors.

872,674. Safety Guard for Trolley-wheels. Frank J. Nolan, Buffalo, N. Y., assignor to the Automatic Trolley Guard Company, Buffalo, N. Y. Application filed November 26, 1906.

This guard has upwardly converging side portions connected by a central pocket wherein the trolley wire is supported.

872,680. Automatic Releaser for Firedoors, Fireshutters, Etc. Henry J. Podlesak, Chicago, Ill. Application filed July 5, 1902.

When the temperature reaches a dangerous point a thermostat closes a number of circuits which effect the release and closure of the doors.

872,684. Motor-control System. Walter J. Richards, Norwood, Ohio, assignor to the Allis-Chalmers Company. Application filed April 29, 1907.

A motor controller is arranged when moved in one direction to vary the electromotive force impressed on the motor armature and when moved in the other direction to vary the resistance in a local circuit supplied by the motor armature.

872,688. Electrical and Thermal Cupping Device. Edward S. Saighman, Chicago, Ill. Application filed December 30, 1903.

A flexible suction cup has a flexible water bag covering its sides and top so as to permit it to be lowered upon the surface to be treated.

872,708. Induction Motor. Bernard A. Behrend, Norwood, Ohio, assignor to the Allis-Chalmers Company and the Bullock Electric Manufacturing Company. Application filed August 31, 1906.

This motor has a squirrel-cage rotor with short-circuiting rings and end heads clamped to the end laminæ of the core, the rings having radial ribs serving as fan-blades.

872,713. Signaling System. Clarence W. Coleman, Westfield, N. J., assignor to the Hall Signal Company. Application filed June 22, 1906.

A signal normally set at danger is operated by a liquefied gas working on a diaphragm. A track circuit is adapted to vary the pressure of the gas and thus move the signal.

872,720. Controller-operating Mechanism. Carl Fleming, Norwood, Ohio, assignor to the Allis-Chalmers Company and the Bullock Manufacturing Company. Application filed January 31, 1907.

Means for returning the controller drum to "off" position are provided, which do not operate, however, till the drum has reached a certain position and has been released there by the operator.

872,724. System of Distribution. Edward M. Gerry, Norwood, Ohio, assignor to the Bullock Electric Manufacturing Company. Application filed October 19, 1905.

A synchronous motor is used for maintaining the power factor of the system constant. This drives its own exciter. An auxiliary motor subject to power-factor changes regulates the field of the exciter.

872,755. Cementation Process. Marcus Ruthenburg, Lockport, N. Y. Application filed January 17, 1906.

872,824. Electric Telegraphy. Isidor Kitsee, Philadelphia, Pa., assignor of one-half to William J. Latta, Philadelphia, Pa. Application filed March 16, 1905.

Two lines are provided with polarized relays and an electromagnet and are thus adapted to receive reversals, translate them into Morse characters and transmit them to the second line.

872,829. Electric-circuit Controller. Harry W. Leonard, Bronxville, N. Y. Application filed June 1, 1903. Renewed June 3, 1907.

This is a starting box provided with a release magnet which holds a restraining arm against the action of gravity.

872,832. Telephone Box Hanger. John G. Malaby and Charles E. Oxford, Foreman, Ark., said Malaby assignor to said Oxford. Application filed February 19, 1907.

The mounting of a wall-telephone box is described.

872,843. Semaphore Safety Alarm. George L. Pettygrove, Berkeley, Cal., assignor of one-half to C. E. Lootbourrow, Oakland, Cal. Application filed July 10, 1906.

The semaphore arm carries train-order clipboards, the removal of which closes an alarm circuit.

872,828. Electrode. Robert J. Wisnom, Virginia City, Nev. Application filed October 3, 1906.

An anode consists of a number of pockets of vegetable fiber containing granular peroxide of lead. A wire is embedded in a transverse pocket at the top of the others.

872,893. Electric Damper Regulator. John D. Bowne, New York, N. Y., assignor of one-half to John W. Slawson, New York, N. Y. Application filed November 15, 1906.

A pressure-actuated tube governs an electric switch for a reversible motor which drives the damper mechanism.

872,898. Trolley-harp. James L. Chase, Ayer, Mass., assignor of one-half to Ralph J. Joslin, Webster, Mass. Application filed July 18, 1907.

The harp head has laterally separated cheeks, one having a socket and the other a boss for holding the trolley-wheel shaft.

872,909. Electrically Wound Clock. Arie De Vos, Minneapolis, Minn., assignor of one-half to S. S. Still, Des Moines, Iowa. Application filed September 10, 1906.

An armature of an electromagnet raises a weight when moving toward the magnet and opens and closes the circuit by its movements.

872,936. Tungsten Electric Incandescent Lamp. John A. Heany, York, Pa. Application filed January 19, 1905.

A high-voltage lamp is arranged with a number of hairpin-shaped filament units in series and supported by fine spiral springs at the loops of each unit. Connections and additional steadying means are provided at the other ends. (See cut.)

872,938. System of Control, and 872,939. System of Motor Control. George H. Hill, Schenectady, N. Y., assignor to the General Electric Company. Applications filed October 31, 1904, and April 7, 1906, respectively.

These are modifications of No. 872,563.

Electric Company. Application filed January 9, 1905. Renewed September 18, 1907.

This patent covers further details of the one above. An electromagnetic escapement limits the speed of operation of the controller.

872,993. Insulator. Arthur S. Deem, Reading, Pa., assignor of one-half to Isaac Bear, Reading, Pa. Application filed July 6, 1907.

An insulating cleat has two members with registering grooves and lugs whereby shoulders are formed on opposite sides of the grooves.

Reissue.

12,727. Hygrometer for Regulating Humidifying and Heating Systems. Stuart W. Cramer, Charlotte, N. C. Application filed September 3, 1907. Original No. 811,383, dated January 30, 1906.

A dry and a wet thermometer are each arranged to close the circuit of an electromagnet which controls another circuit that regulates the supply of the heating medium.

PATENTS THAT HAVE EXPIRED.

Following is a list of electrical patents (issued by the United States Patent Office) that expired December 9, 1907:

442,104. Electric Signal for Engines. M. Conley, Chicago, Ill.
442,126. Electrical Note Recorder. S. D. Locke, Hoosick Falls, N. Y.
442,139. Multiple Telegraph or Telephone. A. M. Rosebrugh, Toronto, Canada.
442,140. Circuit for Electric Railways. F. W. Sabold, Albany, N. Y.
442,145. Multiple Switchboard System. C. E. Scribner, Chicago, Ill.
442,173. Electric Motor or Dynamo-electric Machine. C. E. Dressler, New York, N. Y.
442,187. Method of and Apparatus for Manufacturing Secondary-battery Electrodes. J. G. Johnston, Denver, Col.
442,203. Separating Diaphragm for Electrolytic Cells. I. L. Roberts, Brooklyn, N. Y.
442,204. Diaphragm for Electrolytic Cells. I. L. Roberts, Brooklyn, N. Y.
442,208. Speed Regulator for Electric Motors. W. W. Schiffmann, St. Paul, Minn.
442,267. Telegraphy. E. B. Ives, New York, N. Y.
442,287. Incandescent-lamp Socket. G. W. Hunt and A. E. Rich, Brooklyn, N. Y.
442,332. Electrolytic Apparatus. I. L. Roberts, Brooklyn, N. Y.
442,333. Apparatus for Use in Electrolysis. I. L. Roberts, Brooklyn, N. Y.
442,334. Electrolytic Apparatus. I. L. Roberts, Brooklyn, N. Y.
442,335. Process of Treating Asbestos. I. L. Roberts, Brooklyn, N. Y.
442,336. Carbon Electrode and Method of Making the Same. I. L. Roberts, Brooklyn, N. Y.
442,365. Electric-tracton Increasing System. M. W. Dewey, Syracuse, N. Y.
442,385. Electric Leak or Flow Detector. G. S. Neu, New York, N. Y.
442,390 and 442,391. Secondary Battery. J. K. Pumpelly, Chicago, Ill.
442,407. Electric Railway. M. J. Wightman, Hartford, Conn.
442,459. Electric Motor and Frame. A. Schmid, Allegheny, Pa.
442,473. Electric Bell. C. B. Beers and W. B. Tuttle, Bridgeport, Conn.
442,497. Printing Telegraph. W. W. Taylor, Mansfield, Mass.
442,516. Galvanic Battery. C. E. Dutton, Jr., Washington, D. C.

WESTERN ELECTRICIAN

EVERY SATURDAY

Vol. XLI. CHICAGO, DECEMBER 21, 1907. No. 25

Electro-pneumatic Train-movement Control at the Junction of Three Railroads in Chicago.

At Western Avenue, near Kinzie Street, Chicago, three large steam railroads come together from the west, northwest and southwest, and for some distance east utilize a common right-of-way to their respective terminals. The roads are the Chicago and Northwestern, the Chicago, Milwaukee and St. Paul and the Pittsburg, Cincinnati, Chicago and St. Louis, commonly called, respectively, the Northwestern, the St. Paul and the Pennsylvania lines. Chicago is, of course, a great railroad center, and when it is remembered that the Western Avenue crossing of the three roads mentioned is probably the busiest one in the city, it follows that a switching and signaling system which effectively controls the movement of trains at such a point with the least labor and best results must be of more than ordinary interest.

Besides numerous side tracks, there are 10 main through tracks at this crossing—four of the Northwestern, four of the St. Paul and two of the Pennsylvania. Two more main tracks are being added by the last-named company to come under the train-control system. Not only do numerous suburban and through passenger trains pass over the Western Avenue crossing, but long, heavy freight trains must also be taken into account, and, to add to the complexity, the yards where many of the trains are made up are located just west, and the trains must pass in and out through the crossing. East of the crossing all this traffic, amounting to about 1,400 movements a day, must be handled on six tracks.

With the old system of switching at this crossing, to avoid accidents, many delays were occasioned, and as traffic increased the need of a better system became urgent. Work on the plans for a new system was taken up about two years ago and resulted in the decision to install an electro-pneumatic interlocking system.

The present comprehensive system for this important crossing was put in by the Union Switch and Signal Company, handled through the Chicago office. It has now been in satisfactory operation for several weeks. The work was done under the supervision of the Chicago, Milwaukee and St. Paul road, whose signal engineer, Mr. L. R. Clausen, wrote the specifications. The plans and specifications were approved by Mr. W. McC. Grafton, signal engineer of the Pennsylvania lines west of Pittsburg, and Mr. J. A. Peabody, signal engineer of the Chicago and Northwestern road.

All switches and signals are operated by air valves, which are electrically controlled from one machine in a centrally located interlocking tower. While the whole system is necessarily quite complicated, its operation, once installed, is remarkably easy of control, and the possibility of collision is remote. Once a train has been given a route through the network of tracks, it is impossible for the leverman to set up a conflicting route for another train until the first train has cleared its switches and the fact is demonstrated to the leverman through track circuits.

Of the accompanying pictures, Fig. 1 shows the home signals installed for the three roads just west of the crossing, and also gives an idea of the general layout. Fig. 2 (next page) shows the home-signal bridge of the Northwestern road, looking east, the interlocking tower from which the signals and switches are operated showing in the distance at the left. Fig. 3 is a view of the interior of the second story of the interlocking tower, showing the lever machine and signaling apparatus. The plan of the track layout may be seen on the chart.

About 1,800 feet west of the home-signal bridges shown in Fig. 1 are distant-signal bridges, which, on account of smoke, do not show in the picture, and are not necessary for a general description of the system. Similar home and distant signals are located east of the crossing.

Air pressure for operating the switches and signals is furnished from two Westinghouse motor-compressors located in the Franklin Avenue power house of the St. Paul road, which is located about 3,000 feet from the interlocking tower. The motor-compressors are operated from 220-volt direct-current circuits supplied from the power house. Each compressor has a capacity of 37½ cubic feet of free air per minute. As the pressure falls below 80 pounds or rises above 95 pounds, the compressors are automatically cut in or out. A condenser is provided at the power house through which the air passes to remove moisture.

The air reaches the Western Avenue plant from the Franklin Avenue power house through a two-inch main, and another two-inch main extends the full length of the interlocking plant between the home-signal bridges. From the latter, branch leads are taken off to the various air cylinders in the system. For the operation of a single switch or derail and detector bars a five-inch cylinder is used. One end of a double slip and detector bars requires a six inch cylinder, and a movable point frog with one end of a double slip and detector bars is operated by a 7½-inch cylinder.

These cylinders are placed on the ground beside the track where needed and are protected by a removable iron casing. The cylinders are operated by attached magnets at the will of the leverman in the tower.

An excellent feature of this electro-pneumatic system is that all switches, frogs, etc., move exactly with the lever in the hands of the towerman, so that, should a switch refuse to move on account of a chunk of coal or other obstruction too strong to be forced by the power of the air cylinder, the leverman will be aware of the irregularity and his signals will not permit the approach of the train until the intended operation is completed. Furthermore, all other movements will be locked out by the interlocking system until the former movement is disposed of.

FIG. 1. ELECTRO-PNEUMATIC INTERLOCKING SYSTEM AT THE JUNCTION OF PENNSYLVANIA, NORTHWESTERN AND ST. PAUL RAILROADS IN CHICAGO.

As mentioned, Fig. 3 gives a view of the second floor of the interlocking tower, where the control of the entire system is centered. The interlocking machine has a frame for 119 levers. It is 25 feet 9 inches long by 6 feet 1 inch in width. In the present installation there are 48 levers for 49 switches and derails, 10 movable-point frogs and 11 double slips with movable-point frogs. There are also 28 levers for 47 signals, making 76 working levers, besides 11 spare levers and 32 spare spaces. When the two additional tracks are in service on the Pennsylvania line the 11 spare levers will be utilized, seven to be added to the switches, etc., and four to the signals. The top row of levers shown on the machine are for the switching, and the lower row for the signaling.

The leverman has before him a schedule of all regular train movements through the system. An annunciator and indicator board at the wall back of the interlocking machine warn him of the approach of trains and show when a route has been cleared. Special orders for train movement can also be received by the operator by telegraph or telephone.

The electric plant is very simple, considering the important work which it performs. It is located on the ground floor of the interlocking tower. Two sets of Westinghouse 11-S-6 storage batteries of six cells each and having a capacity of 400 ampere-hours each are charged from a small motor-generator set located in the tower, the motor being operated by 220-volt direct current from the Franklin Avenue power house. Normally one set of batteries will always be fully charged for a reserve supply. The motor-generator set runs continuously with the second set of batteries floating on the line, furnishing power for operating switches, derails, slips, frogs and signal magnets and for the track circuits.

The small switchboard in the tower was specially built for the Union Switch and Signal Company

Interlocking Tower in the Distance.

FIG. 2. HOME-SIGNAL BRIDGE OF THE NORTHWESTERN ROAD.

and is so arranged that either set of batteries can be charged from the generator end of the motor-generator set. This switchboard controls the tower lights, signal lights, motor-generator set and interlocking service from either set of batteries.

All signal and tower lights are on the 220-volt direct-current circuits of the Franklin Avenue power plant of the St. Paul road.

Track circuits are installed through the interlocking system through which the high-speed home signals are controlled. A variable-resistance coil is put in each track lead from the power mains for the track circuits, so that when trains are on track circuits an excessive amount of current will not be used. Coils may be adjusted from zero to 25 ohms to suit the different track conditions. For the guidance of the leverman, track indicators are installed in the tower for each track which show a white light when tracks are not occupied and red lights when trains are on the tracks. These high-speed home signals are also selected through controllers on the facing point of derails, switches and the movable-point frogs, in addition to being selected on the machine combination board.

Track circuits are also installed for the control of the distant signals, and a half-mile track circuit is installed in advance of each distant signal. Through this half-mile circuit and the circuit between the distant and home signals are operated [illegible] train annunciator with single stroke bell to notify the leverman in the tower of the approach of trains.

FIG. 3. NEW ELECTRO-PNEUMATIC INTERLOCKING MACHINE IN THE WESTERN AVENUE TOWER, CHICAGO.

Conduits for all wires and cables are placed two feet in the ground. Junction boxes or manholes are placed at each cross lead to the switches, derails, frogs, etc., and at each signal bridge. All wires to cross leads are cut through slate terminal boards in junction boxes and manholes. The electric-light wires are enclosed in separate conduits in all cases, so that the higher voltage cannot interfere with the switch and signal circuits.

In the case of the Pennsylvania and St. Paul roads, the top semaphores of the signal bridges control the high-speed through movements and the lower arms the slow-speed diverging routes. Only the high-speed arms are placed on the bridges of the Northwestern, the slow-speed routes being controlled by dwarf signals along the track. The added equipment on the Northwestern bridge shown in the pictures is part of the company's block signaling system.

This new electro-pneumatic interlocking system is attracting considerable attention. It is one of the largest plants ever installed by the Chicago office of the Union Switch and Signal Company, of which Mr. V. K. Spicer is western manager, and Mr. W. M. Vandersluis is signal engineer and superintendent of construction.

Notable Equipment of a San Francisco Store.

The Metropolitan Electrical Construction and Supply Company of San Francisco, of which Mr. Frederick G. Cartwright is manager, has completed a notable installation of electric wiring for Kragen's, a new store on Market Street, at a total cost of about $25,000. It is the largest main service connection in San Francisco. In order to supply the current the San Francisco Gas and Electric Company ran a new main feeder from station C on Stevenson Street, and this connects the store with the main switchboard independently of the regular street mains.

Kragen's is now one of the most brilliantly lighted stores in the United States. The lighting is on the three-wire, 220-volt, direct-current system. There are nearly 20 direct-current motors used about the six-story building and three electric elevators. About 5,500 one-hundred-watt Gem lamps of 50 spherical candlepower each have been installed. There is a large electric sign on the roof and the signs at the line of the second story have borders of incandescent lamps.

This is the largest condulet installation west of Chicago. The lighting distribution approximates throughout the entire building 15 watts per square foot of surface, exceeding, it is said, any other building of its kind in this country. In the ceiling and sides of the main entrance the 50-candlepower lamps are spaced 12 inches between centers. In the windows the lamps are 18 inches between centers and throughout the ceilings of the store 36-inch centers are used. An interesting feature is seen in the showcases, which are lighted interiorly by the use of Greenfield flexible conduits and tube lamps.

The lighting consumption runs all the way from 40,000 to 60,000 kilowatt-hours, and the present consumption is at the rate of over 50,000 kilowatt-hours per month. The wiring contract was signed on August 20th last and the lights were ready for use on November 21st.

North American Company Gets Clark Properties in St. Louis.

The Laclede Power Company and the Edison Electric Illuminating Company of St. Louis have been acquired by the Union Electric Light and Power Company of St. Louis, a subsidiary of the North American Company. The price at which the properties were obtained from E. M. Clark & Co. of Philadelphia is reported from St. Louis as $3,000,000.

It is said that there is now an understanding between the Clark interests, the North American and the Illinois Traction System whereby each is to have its own field without interference from the others. The North American Company, according to the alleged agreement, will operate the lighting and street-railway properties in St. Louis and will not enter the territory of the Clark syndicate, which has the Eads Bridge line, the East St. Louis street railway, the East St. Louis and Alton line, the Granite City, Madison and Venice line, the East St. Louis and Belleville line, the East St. Louis and Granite City line, the Lebanon and O'Fallon line, the Edwardsville and Collinsville line, the electric-light plants at East St. Louis, Granite City, Madison and Venice, and the electric and gas plants at Alton.

The Illinois Traction System operates lighting plants as well as street and interurban railways, and in addition to its extensive system farther north has franchises and rights-of-way in East St. Louis, Edwardsville, Venice, Madison and Granite City. It has its own bridge across the Mississippi under construction and has rights-of-way over numerous streets in St. Louis with terminal facilities in the heart of the business district. It also has the right to do a local business between the bridge and its terminus. It is understood, however, that the company will not compete for local business, but will limit its efforts to the interurban express and passenger traffic, and, it is said, will be given the use of the North American tracks for this business.

The McKinley officials have been considering the building of a line to Meramec Highlands or Valley Park, with the ultimate intention of forming a Missouri system connecting St. Louis and Kansas City, a line from Staunton, Ill., in the direction of Sullivan, Ill., and a line from Venice or Sterlings, Ill., in the direction of Cairo, but it is indicated that the local understanding could not be applied to these projects.

Steam-railroad Electrification.

At the regular meeting of the Cornell University Branch of the American Institute of Electrical Engineers on December 6th, an enthusiastic audience of 273 greeted the speaker, Mr. W. N. Smith, electric-traction engineer of Westinghouse, Church, Kerr & Co. Mr. Smith's paper was the first formal Institute paper presented before the Cornell University Branch, and it was entitled "Practical Aspects of Steam-railway Electrification." The speaker dwelt particularly upon the necessity of a study of electrification from all points of view. Projects should be examined from two viewpoints —one that of electrification proper and the other that of railroad operation. Under the first heading the relationship of the manager and the consulting engineer was discussed. Under the second were considered the relationship of the financial or economic, the engineering construction and the transportation or operative subdivisions of railroad operation. Particular attention was paid to the matter of single-track-railroad operation, from the point of view of capacity of train movement.

In the discussion Prof. H. W. Hibbard, head of the railway mechanical engineering department of Cornell University, expressed his appreciation of this treatment of the problem. Professor Hibbard felt that, to a certain extent, the steam-railroad man has been ignored in the electrification problem. He emphasized that there is no antagonism to electrification on the part of steam-railroad men where the conditions seem to warrant its introduction. He did not feel, however, that electrification should be forced upon steam railroads, but rather that it should be adopted as necessary when conditions fully warrant such adoption. The steam-railroad man is first and foremost a transportation engineer, regardless of the source of motive power.

Prof. V. Karapetoff discussed the problem from the viewpoint of power supply, comparing the steam locomotive to a "power plant on wheels." He also drew attention to the gasoline-electric car as having a bearing upon the subject of the evening.

The informal smoker after the meeting was an important feature of the gathering, and was largely attended. Simple refreshments were served by the entertainment committee, and music was supplied by local talent.

Combined Voltmeter and Wattmeter for Lamp Testing.

In the commercial testing of electric incandescent and arc lamps the quantities most usually measured are the drop in potential in the lamps and the energy consumed by them. In order that the testing apparatus may be as compact as possible, it is desirable that a single instrument be provided that shall be capable of measuring both of these quantities independently, and it is further desirable that the instrument be so constructed as to be portable.

A new type of instrument designed to meet these needs has been invented by Paul MacGahan of Pittsburg, Pa. The instrument has just been patented in this country and the patent assigned to the Westinghouse Electric and Manufacturing Company. The electrodynamometer principle has been made use of in a novel manner in designing the instrument.

Its construction will be made clear by the drawings shown herewith, of which Fig. 1 is a plan view, partly in section. Fig. 2 is a cross-section along the line (II.) of Fig. 1, and Fig. 3 is a diagrammatic representation of the circuits of the instrument. The type shown is particularly adapted for use in lamp testing.

Rigidly fastened upon the inner or rear face of an insulating plate (1) by means of screws (2) are insulating blocks (3) to which coils (4, 5, 6 and 7) are secured, the coils being arranged in pairs with the faces of the members of each pair opposing one another. Two other coils (8, 9) are mounted, by means of suitable brackets (10), upon a shaft (11) that is provided with bearings (12, 13) at its upper and lower ends, respectively, the coils being thus pivotally supported respectively between the members of the pairs of stationary coils. The inner end of a spiral spring (14) is secured to the upper extremity of the shaft and the outer end is connected by means of a bracket (15) with a manually rotatable member (16) that may be operated by means of a knurled head (17). A pointer (18) that is carried by this rotatable member is adapted to be moved over annular scales (19 and 20), the former of which is graduated in volts and the latter in watts. An opening (21) is provided in the insulating plate, through which projects the free end of a pointer (22) that is attached to the movable coil (9), the pointer co-operating with an index (23) on the upper side of the plate (1) to indicate balancing of the torque of the instrument with the torsion of the spiral spring (14) as in an ordinary electrodynamometer.

The coils (4, 5, 6 and 7) comprise two inter-coiled windings (24, 25), which are respectively of low and high resistance, the winding (24) being connected between a binding post (26) and a contact terminal (27) of a switch (28) that further comprises contact terminals (29, 30 and 31) and conducting segments (32, 33) that are mounted upon a switch lever (34) adapted to engage contact terminals (27, 30) or (29, 31), respectively.

The winding (25) is connected in series with a resistance (35) between contact terminal (31) and one terminal (36) of a socket (37) for an incandescent lamp or other suitable translating device, the terminal (36) being also connected to conducting strip (32), and the other terminal of the stocket being connected to a binding post (38).

The switch lever is adapted to be operated by means of a knurled head (39) that is located upon the upper side of the plate (1) and that is provided with a pointer (40) which co-operates with indices (V and W) upon the plate to indicate whether the instrument is adjusted to measure volts or watts.

The movable coils (8, 9), which are composed of a comparatively high-resistance conductor, are connected in series with a high resistance (41) between the binding post (38) and the conducting piece (33) on the switch lever (34). A resistance (42) that is approximately equal to the resistance of the winding (24) is connected between the contact terminals (29, 30), and one terminal of the resistance is connected to the binding post (26).

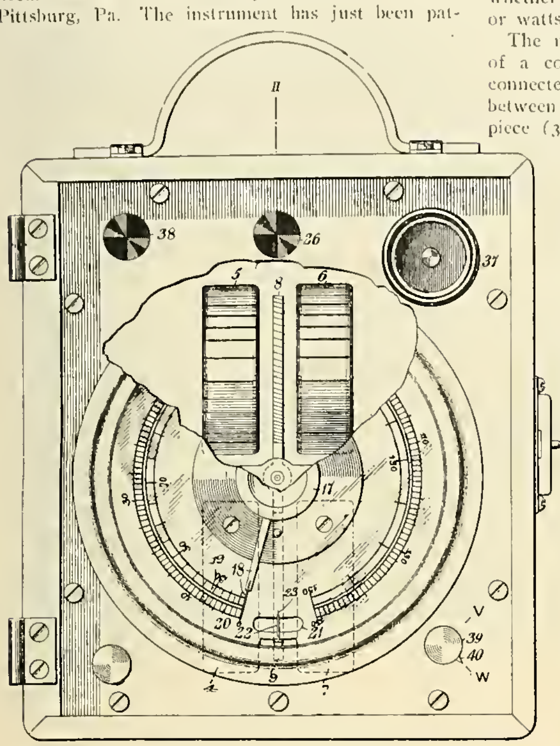


Fig. 1. Plan View. Partly in Section.

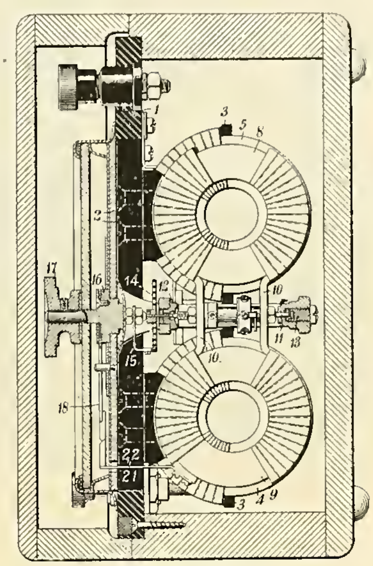


Fig. 2. Cross-section.

MACGAHAN'S COMBINED VOLTMETER AND WATTMETER.

In the operation of the instrument a lamp or other translating device is placed in the socket (37) and the instrument is connected to an external circuit (not shown) by means of the binding posts (26, 38). If it is desired to measure the drop of potential in the lamp, the knurled head (39) should be rotated until its pointer registers with the index (V), the conducting strips (32, 33) being thereby caused to engage contact terminals (29, 31), respectively. The translating device is then connected in series with the resistance (42) between the binding posts, and a circuit is also established in shunt to the translating device through the movable coils (8, 9), resistance (41), conducting piece (33), contact terminal (31), the stationary winding (25) and resistance (35). The pointer (22) will then be deflected to the left, and in order to return it to a position opposite the index (23) it becomes necessary to turn the knurled head (17) and the attached pointer (18) in a clockwise direction, the deflection from the zero position of the pointer (18) necessary to effect this adjustment being a measure of the potential and indicated upon the scale (19) in volts.

If it is desired to measure the energy absorbed in the translating device, the knurled head (39) should be caused to occupy the position shown in Fig. 1, when conducting pieces (32, 33) will engage contact terminals (27, 30), respectively, and the translating device will be connected in series circuit with the stationary winding (24) between the binding posts by the engagement of the conducting strip (32) with contact terminal (27), a circuit being established also through the movable coils (8, 9), resistance (41), conducting segment (33) and contact terminal (30) to the binding post (26).

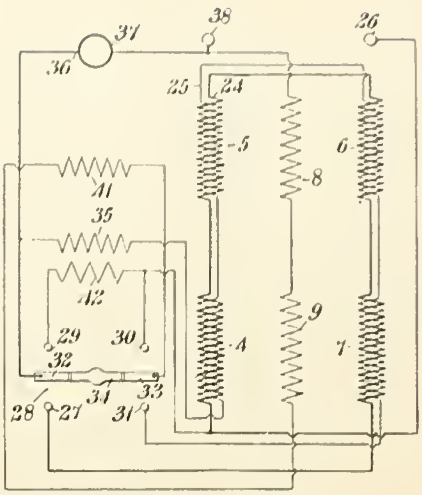


Fig. 3. Diagram of Circuits.

MACGAHAN'S COMBINED VOLTMETER AND WATTMETER.

It will be observed that the stationary winding is thus connected in series with the translating device, while the movable coils are connected in shunt thereto, so that the quantities measured by the instrument will be the watts of energy expended in the translating device, which will be indicated upon the scale (20).

The resistance of the circuit that includes the translating device is approximately the same whether the instrument is operated as a wattmeter or as a voltmeter, because, in the one case, the winding (24) is in the circuit and in the other case, the equivalent resistance (25) is introduced. The amount of resistance in the circuit in shunt to the translating device is less when the instrument operates as a wattmeter than when it operates as a voltmeter, because in the former instance only the resistance (41) is included in the circuit and in the latter instance both resistances (35 and 41) are included, these differences being for the purpose of providing scales of convenient proportions.

Institute Meeting in New York.

At the meeting of the American Institute of Electrical Engineers in New York on the evening of December 13th these papers were presented: "An Exhaust Steam-turbine Plant," by Henry H. Wait of Chicago, read by C. O. Mailloux; "The Westover CO_2 Recorder," by C. O. Mailloux of New York, read by the author; "The Ratio of Heating Surface to Grate Surface as a Factor in Power-plant Design," by Walter S. Finlay, Jr., of New York, read by the author.

Dr. J. A. Holmes of the government fuel-testing plant spoke on the subject of the conservation of the fuel and other natural resources of the country.

Those discussing the paper of Mr. Finlay were Prof. C. E. Lucke of New York, Albert A. Cary of New York, F. V. Henshaw of New York, J. P. Sparrow of New York, J. E. Moultrop of Boston, W. F. Wells of Brooklyn, Walter T. Ray and Henry Kreisinger (jointly) of the United States Geological Survey, W. L. Abbott of Chicago, A. Bement of Chicago, and the author. (See page 484.)

Mr. Wait's paper was discussed by Francis Hodgkinson of East Pittsburg, Pa., and J. R. Bibbins of Pittsburg.

Copper.

In November the production of copper in the United States, Mexico and Canada fell off 34,898,000 pounds, as compared with November, 1906, a drop of 36 per cent. In 11 months of the present calendar year the production of copper on the American continent has shown a decrease of 128,000,000 pounds. Of this decrease 101,535,000 pounds represents the falling off in the Butte camp. During November the only district to show an increase was Utah, and the output of copper from that state for last month was the largest in its history, nearly 10,000,000 pounds, some estimates placing the figure even higher. This is an increase of nearly 100 per cent. over the production of November, 1906. The Lake region maintained its production, the November figures only falling off 834,000 pounds. The loss in Arizona amounted to nearly 8,000,000 pounds, and Mexican production likewise fell off about 8,000,000 pounds.

On December 17th the market for copper was weak, prices ranging from 12½ to 13¼ cents a pound.

Detector for Current Theft by Shunting Meter.

A favorite method of dishonest persons for defrauding central-station companies has been to make a shunt around the series coil of the recording watthour-meter so as to form a by-pass about that instrument. This has sometimes been done without tampering with the meter itself or even breaking its seal. All current passing through this shunt or by-pass is, of course, not recorded by the meter and is manifestly stolen from the company. If the shunt is removed when visits by the inspector are anticipated, this theft may go on for a long time without detection by the company.

A device to disclose this shunting of the circuits around electric meters has been invented by William L. Saunders of Denver, Colo. A United States patent was recently granted him on the invention. The device operates on a simple principle. An automatic reversing switch is provided which reverses the connections of the two service wires every time the circuit is interrupted; if the meter has been shunted, the shunt on reversal forms a

with two depending integral fingers (23). The length and width of the lever and the distance between the fingers on each contact plate is such in relation to the location of the mercury wells that when either of the extremities of the lever is depressed its four fingers will simultaneously dip into the four wells at the corresponding end of the base plate. The lever is furthermore provided at its upper surface with a centrally located, upwardly extending, inverted V-shaped projection or ridge (24), the vertex (25) of which extends transversely of the lever. At each side of this projection and at equal distances from the fulcrum is a transversely extending depression or groove (26), into which the inclined surfaces of the ridge (24) lead.

The solenoid is located in relation to the base and lever so that the vertical center line of its core, if extended downwardly, will pass through the center of the base, and consequently through the fulcrum of the lever. A downwardly pointing wedge (27) depends from the lower extremity of the core, the upper end of the wedge being piv-

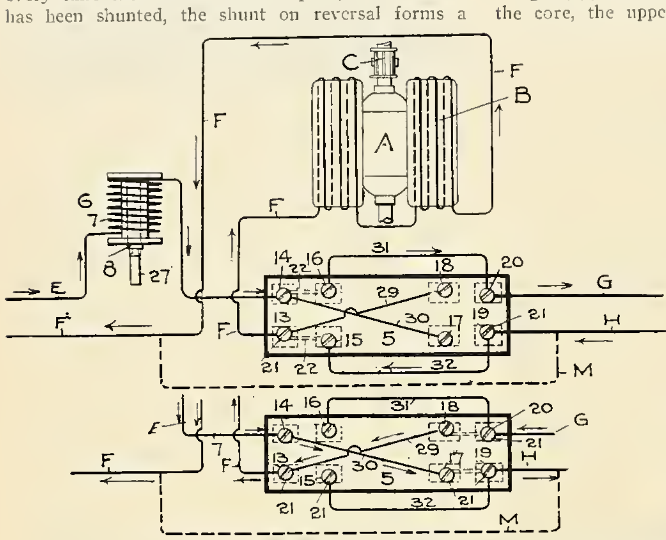


Fig. 1. Diagram of Connections.

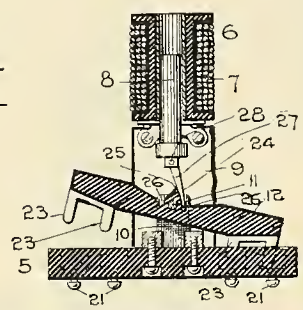


Fig. 2. Reversing Switch.

DETECTOR FOR CURRENT THEFT BY SHUNTING METER.

short-circuit of the line, blows the fuses on completing the circuit again, and thus cuts out the fraudulent consumer.

The details of the device are disclosed by the accompanying drawings. Fig. 1 shows diagrammatically the circuit of the series coils of a common meter in connection with the new attachment; the pressure circuit is not shown. Fig. 2 shows a vertical section through the center of the reversing switch.

In Fig. 1, (A) represents the armature and (B) the field of the driving mechanism of the meter, (C) the commutator, (EF) the leading-in wires, (GH) the service wires, and (M) the wire or connection employed by the fraudulently inclined consumer to shunt the circuit in the leading-in wire (F) and the service wire (H), which form the meter loop when the switch is in the position shown in the upper part of the figure.

The new attachment is preferably located in the meter box, or it may be placed in a separate casing, depending on circumstances as well as on the style and size of the meter. It consists of a suitably supported base plate (5), upon which is mounted the vertically extending solenoid (6), comprising the coil (7) and soft-iron core (8). The solenoid is held in elevation above the base plate by an upright (9), to which it is secured, and which extends from the side of the base. Plate (5) is also provided with a centrally located metal forked bearing block (10), to which is fulcrumed at (11) the oscillating lever (12).

Eight mercury wells (13, 14, 15, 16, 17, 18, 19 and 20) are formed by depressions in the upper surface of the base plate and are divided into two sets of four, at equal distances from the center of plate (5). The wells comprising each set are furthermore arranged into two pairs, placed along parallel lines, transversely of the base plate, and the mercury in each well of the two sets connects with one of a series of set-screws (21) screwed into the lower surface of the insulating base.

Lever (12), which is composed of insulating material, is provided at each of its outer extremities with metal contact plates (22), oppositely secured along the sides of the lever and each provided

otally secured thereto at (28). Normally, when the core is in its raised position and one of the extremities of the lever is down, the lower sharp end of the wedge extends above the inclined surface of the projection on the raised end of the lever, so that should the core descend, by reason of demagnetization of the solenoid, the lower edge of wedge (27) would enter the groove on the corresponding side of the fulcrum. The force with which this action takes place is sufficient to reverse the position of the lever.

To facilitate an explanation of the operation of the device as well as its connection with the various wires leading to and from the meter, the solenoid, as illustrated in Fig. 1, has been separated from the base and the latter shown in an inverted position. The base having been secured to any convenient portion of the meter, the setscrews leading to the outer pair of mercury wells at each end of the base are respectively connected with the leading-in wires (EF) and the service wires (GH). For convenience in describing, the ends of the base corresponding with the leading-in and service wires, respectively, may be designated as the leading-in end and the service end of the apparatus.

The two wells (13, 14), comprising the outermost pair at the leading-in end, are electrically connected by means of wires (29, 30) with the diagonally opposite wells (18, 17) of the inner pair at the service end of the device, while the two wells (19, 20) of the outermost pair at the service end have been electrically connected with the directly opposite wells (15, 16) of the innermost pair at the leading-in end by means of wires (31, 32). Now, supposing that the leading-in wire (F) passing through the meter has been connected with the service wire (H), by means of the shunt (M), and the fingers (23) at the leading-in end of the device are dipped in the mercury wells, as illustrated in the upper part of Fig. 1, the current flowing through (F) which under normal circumstances would have passed through the field of the meter and by means of the electrically connected wells (13, 15) and wire (32) to the service wire (H), now flows directly to the latter through shunt (M), while the return current at (G), being

connected with the coil of the solenoid, passes therethrough by means of wire (31) and connected wells (14, 16) to wire (E). The meter is in this case deprived of the greater portion of the electric current, and in consequence does not register the full amount of electricity consumed.

Now, presuming that the current of electricity is interrupted by reason of shunting off of the consumer's load or a momentary failure of the supply, the solenoid, being momentarily de-energized, will allow the core to drop, and wedge (27), sliding along the inclined surface and engaging the groove (26) at the raised end of the lever, will cause the latter to reverse its position, with the result that the contact between wells (13, 15) and (14, 16) at the leading-in end is broken and wells (17, 18) are respectively connected with wells (19, 20) by means of fingers (23) on the plates (22) at the corresponding or service end of the device (see Figs. 2 and lower part of 1). The wells (13, 14) at the leading-in end being connected with the diagonally opposite wells (18, 17) at the service end, the current coming through wire (F) will, at the moment the flow of electricity is resumed, instead of passing to (H) and returning through (G), cross over through wells (19, 17) and wire (30) to the wire (E), thus establishing a short circuit between (F and E), causing the blowing of the fuse and consequent interruption on the current. It is thus evident that the use of this device in case a shunt is passed in the circuit wires (F and H) will, at each interruption of the current, substantially reverse the connections between the leading-in and service wires.

Electrical Conditions in Peoria.

The electrical inspection ordinance at Peoria, Ill., is being rigidly enforced, and the rules and regulations of the National Electrical Code are governing all new wiring, with the exception that wall frames are permitted with flush switches in lieu of boxes, and mortar bushings are sometimes omitted at the base of plastered partitions. Both signal and lighting companies are doing considerable underground work, and much of the fire-alarm system will be in conduits before winter is over. When completed, this improvement will make possible the removal of all poles from the business district except those used to support trolley wires

The City Council has ordered the city electrician to inspect the overhead wires belonging to the local traction company. A great deal of this system is said to be poorly supported, and frequent accidents occur. The water pipes are reported to be damaged by electrolytic corrosion, due to improper bonding of rails and the absence of track wires.

Possible Changes in the Code.

The annual meeting of the electrical committee of the Underwriters' National Electric Association will be held in March, 1908, in New York city. The day and place of the meeting will be announced later. As usual, the provisions of the National Electrical Code as they now exist will form the principal topic for consideration, and it is requested that any desired change in, or addition to, the Code, be forwarded to C. M. Goddard, secretary of the committee, 55 Kilby Street, Boston, on or before February 1, 1908, in order that it may be printed in the bulletin and the committee and other interested persons may thus have opportunity to consider it in advance of the meeting. Final action on suggestions not received in season for consideration by the committee before the meeting can only be taken by unanimous consent.

As heretofore, the meeting will be open to all interested, and such persons will not only be welcome, but are urged to be present and give the committee the advantage of their experience and advice.

Lord Kelvin Is Dead.

As the Western Electrician goes to press, the sad news is received from Glasgow that Lord Kelvin, the great physicist, died on December 17th. He had been ill a fortnight, the immediate cause being a chill. About a week before the end serious complications set in, and hope was then abandoned, owing to the patient's advanced age—he was in his 84th year. He lost consciousness on the day of his death and passed away peacefully. Until the time of his fatal seizure, Lord Kelvin preserved remarkable vigor of body and mind. He leaves no heir and his title becomes extinct.

An account of Lord Kelvin's life and work, with a late portrait, will be presented in the Western Electrician of next week.

Electrical Machinery Used in Coal and Coke Operations.

By W. B. Spellmire

The total annual capacity for the production of pig iron by the United States Steel Corporation at the present time is about 25,000,000 tons. This enormous production makes the company a correspondingly large consumer of coke for use in its furnaces. With the exception of a comparatively small percentage, all the coke which is used is supplied by its subsidiary companies. The two principal operators furnishing this coke are known as the H. C. Frick Coke Company and the United States Coal and Coke Company. The mines and works of the former are located in Pennsylvania in what is known as the Connellsville district, largely comprising Fayette and Westmoreland counties. Those of the United States Coal and Coke Company are located at Gary, McDowell County, W. Va. Both of these companies are operated along the same general lines.

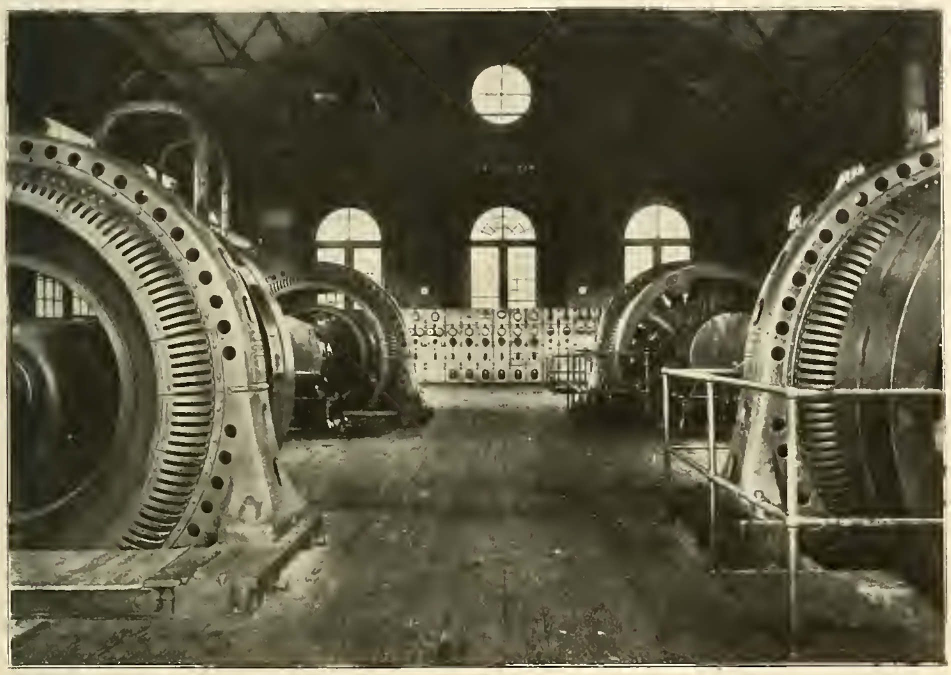
The H. C. Frick Coke Company at present owns about 70 separate coal mines, each mine having its own set of ovens, which it supplies with coal. The number of ovens at each mine ranges from approximately 100 to 800, depending upon the output of the mine and other conditions. These are located close to the openings of the mines and conveniently arranged in relation to railroad sidings. The coke ovens are, with few exceptions, of the beehive type, into which the coal is introduced at the top. The residual heat and that of the adjoining ovens starts the coking process, in which the volatile portion of the coal is driven off through the top of the oven into the atmosphere. When all of the volatile matter is driven off, the bed of coke is raked out at the bottom and loaded into cars for shipment.

In coal mining power is used for operating haulage locomotives inside the mines, also for operating pumps which remove accumulations of water in the mines. A third equipment for power is for driving large ventilating fans. In shaft and slope mines power is also required for hoisting purposes. The dictates of modern practice are to use electric motors of proper design for all the above requirements. From the mine the coal is carried to a tipple, whence it is discharged into what are known as coke-oven larries. These are small steel cars equipped with electric motors for propulsion and supplied with chutes for discharging the coal into the ovens. It is customary to arrange the ovens on either side of the track on which the larry runs, coal being discharged from both sides. The electric motors on the larries are small railway-type machines. Electrically operated drawing machines are used for removing the coke from the ovens. The machine draws the coke out of the oven by a scraper, discharging it on to a conveying belt, whence it is dumped directly into freight cars. Two motors are used on this machine; one is of the series-wound railway type and the other a shunt-wound constant-speed type.

The operations of the H. C. Frick Coke Company at its Yorkrun plant are of special interest on account of modern features. Of the ovens here 100 are especially selected and so connected by flues as to conduct the hot gases from the ovens to the boiler house. The heat discharged from the coke ovens represents an enormous waste, and its use under the boilers therefore saves the use of a corresponding quantity of coal to produce the same heat; thus a large amount of heat is economically obtained at Yorkrun. It is roughly estimated that the heat developed by each oven is the equivalent continuously of 18 horsepower.

The complete electrical machinery equipment of the power house and all the sub-stations was built by Allis-Chalmers Company.

The power house is supplied with four alternating-current generators rated at 400 kilowatts, 2,300 volts, three-phase and 25 cycles. The equipment is complete with motor and engine-driven exciters. In the main power house is located a rotary-converter sub-station supplied with two 200-kilowatt rotary converters and six 75-kilowatt step-down



ALTERNATING-CURRENT GENERATORS AND SWITCHBOARD IN POWER PLANT FOR COKE OVENS AT YORKRUN, PA.

transformers. All the machinery in the power house is controlled by a large 17-panel blue Vermont marble switchboard, with complement of oil switches, indicating and recording meters. The rotary converters supply direct current at 600 volts for haulage locomotives and coke-oven larries at the Yorkrun mine. Alternating current is used for pumps, mine fans, hoists and scrapers.

Within a radius of between two and three miles there are located at various points four additional rotary-converter sub-stations. Each is equipped with one 200-kilowatt rotary converter, three 75-kilowatt step-down transformers and complete switchboard. These sub-stations are located so as to supply both alternating and direct current for mining and coking operations required by one or more mines. The switchboard in the main station is provided with feeder panels for the sub-station feeder lines. By means of integrating and recording meters a record of the power consumption is afforded at each mining and coking operation.

Additional mining and coking operations can be supplied from this same power house by running additional high-tension lines. Instances arise, however, where this is not practicable. Where locations are too remote, or when intervening property cannot be traversed by high-tension lines, it becomes necessary to install separate isolated plants. A number of such plants are now being installed to meet the increased demand for coke. At the Phillips mines two 100-kilowatt direct-current railway-type generators with switchboards are being installed; also at Ronco mines two 200-kilowatt direct-current engine-type railway generators with switchboard are being started, and at Dearth mines two 200-kilowatt direct-current engine-type generators with switchboard.

The power house of the United States Coal and Coke Company at Gary, W. Va., is equipped with two cross-compound heavy-duty Allis-Chalmers Corliss engines driving 750-kilowatt 6,600-volt generators. In sub-stations there is a total of 27 75-kilowatt transformers used for rotary converters. The general layout of this plant is similar to that of the H. C. Frick Coke Company at Yorkrun, except that waste heat from the ovens is not used.

Southwestern Electrical and Gas Association.

A meeting of the executive committee of the Southwestern Electrical and Gas Association was held in the office of Secretary R. B. Stichter, Juanita Building, Dallas, Tex., on December 4th, with President H. T. Edgar of Fort Worth in the chair. Others in attendance were W. B. Tuttle of San Antonio, J. P. Crerar of Denison, J. D. Oliger of Cleburne, J. F. Strickland of Dallas, A. E. Judge of Tyler and H. M. Moore of Austin.

After various items of routine business had been transacted a communication was presented asking that the association contribute to a fund of the coal operators in Arkansas, Indian Territory and Texas in an endeavor to get the freight rates on fuel reduced. After considerable discussion it was unanimously decided that it would be unwise for the association to take any action at the present time in this matter.

A communication was received from Mr. W. W. Freeman, secretary of the National Electric Light Association, New York city, suggesting closer co-operation between the various local organizations, which would tend to benefit all concerned. The secretary of the association was instructed to write the secretary of the National Electric Light Association and thank him for his communication.

It was decided that the members of the executive committee should confer with the general passenger agents of the different railroads of the state with a view of obtaining reduced rates for the next convention of the association to be held in El Paso, Tex., in May, 1908; and until the question of rates was finally settled it was thought best not to set a date for the next meeting but to defer action on this matter until the next meeting of the executive committee. It was the sentiment of all members present that the El Paso meeting would be the largest in the history of the association.

President Edgar, Secretary Stichter and J. A. Myler, Jr., manager of the Dallas Gas Company, were appointed a committee of three to arrange for all papers to be read at the next meeting.

The question of exhibits for the El Paso meeting was brought up, and it was decided that arrangements be left to a committee of supply men appointed at the San Antonio convention.

The secretary was instructed to gather such information as directed by the president of the association regarding taxes both ad valorem and special, cost of street improvements, donations, etc., as would be of benefit to the association, and the executive committee requested that all members of the association give the secretary every aid possible in the procuring of this information. This information is to be compiled and filed in the office of the secretary for the future use of the members of the association only.

European Syndicate to Develop Canadian Electrical Resources.

It is announced that a syndicate of European capitalists has been organized with a capital of $10,000,000, through the efforts of Rodolphe Forget, M. P., of Montreal, for the purpose of carrying out several large enterprises in Canada, including the improvement and development of waterpowers in Ontario and Quebec. One of the engineers employed by the syndicate has been in Canada for two months making careful inspection on which he will make his report. The syndicate will, it is understood, construct electric railways in the rural districts of the province of Quebec, and especially on the Island of Montreal. It will assist in developing the plants of the Montreal Light, Heat and Power Company, the Quebec Railway, Light and Power Company, and the electric development and improvement of the Toronto street railway. It is the intention to have engineers look over the western provinces as a field of operations and investment. It is said that the work of the syndicate may also be extended to the development of waterpowers.

Coming Northwestern Convention.

The next annual meeting of the Northwestern Electrical Association will be held on January 15 and 16, 1908, at the Hotel Pfister, Milwaukee. This date falls at the time of the Chicago Electrical Show, and no doubt nearly all of those in attendance at the Milwaukee convention will come to Chicago—two hours' run on the railroad—after the convention is over to "take in" the electrical display at the Coliseum. Roger N. Kimball of Kenosha, Wis., is secretary and treasurer of the Northwestern Electrical Association.

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CORRESPONDENCE relating to electricity or any of its practical applications is cordially invited, and the co-operation of all electrical thinkers and workers earnestly desired. Clear, concise, well written articles are especially welcome; and communications, views, news items, local newspaper clippings, or any information likely to interest electricians, will be thankfully received and cheerfully acknowledged.

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DEPARTMENTS.

TO VERTICAL-SHAFT turbines, generators and motors is now added the vertical-shaft rotary converter. With characteristic alertness, the Commonwealth Edison Company of Chicago is the first of the central-station companies to use this new rotary, of which it has two examples—a 1,000-kilowatt unit and a 2,000-kilowatt machine. The latter was put into service at the Market Street sub-station on December 6th, as readers of the Western Electrician are aware. The changes from the familiar horizontal-shaft rotary are entirely in mechanical construction. The advantage of the newer type lies principally in the saving of space—both clearance and floor space—often an important consideration in city sub-stations, where real estate is expensive.

FOUNDRY PRACTICE has not, perhaps, attracted as much attention as it ought from electrical men in connection with its possibilities in motor equipment. Power applications in the foundry are receiving increasing attention, as is shown by the paper on the subject by Mr. A. D. Williams, Jr., before the recent annual meeting of the American Society of Mechanical Engineers and printed in the Western Electrician of last week. The author says truthfully that the electric motor offers the most satisfactory method of operating hoisting machinery, and he further points out that the crane service of a foundry is its vital point. He gives a number of practical points in relation to the use of electric power in the foundry, and these deserve the attention of sellers of electrical machinery and of electric current.

IN LINE with the improvement in steam boilers of which we spoke last week is the paper on "The Ratio of Heating Surface to Grate Surface as a Factor in Power-plant Design," by Mr. Walter S. Finlay, Jr., read at last week's meeting of the American Institute of Electrical Engineers in New York. This paper, with a portion of the voluminous discussion which it evoked, is given in this issue. Mr. Finlay described a double-grate arrangement applied to 18 of the boiler furnaces in the Fifty-ninth Street plant of the Interborough Rapid Transit Company in New York city, with the idea of increasing the capacity without great sacrifice in economy. Here a second stoker was installed in each furnace with an area of 80 per cent. of the original stoker. As to results, the author found that "in this particular case double-stoker operation covers the entire range of single-stoker operation and adds an increase of capacity proportionate to its larger grate surface with but slight loss in economy, and that the increase of 71 per cent. in capacity was accomplished with no loss in economy." This result is certainly very interesting, and moreover may be of much importance in future furnace design. However, the plan is not without its critics, as the discussion showed, and it seems evident that it is not adapted to all conditions. However, central-station companies using steam to generate power are greatly interested in boiler forcing and boiler capacity, owing to the exigencies of the peak load, and therefore this up-to-date paper and the comments made upon it will be read with care.

A NOTABLE traction experiment is about to be begun in Cleveland, where Mayor Johnson appears to have "won out" in his contest with the Cleveland Electric Railway Company. The outcome of the November municipal election convinced the company that further resistance to the Johnson three-cent fare and revocable-franchise policy would be futile, and it was ready, after six years of warfare and litigation, to settle its affairs with the city on the basis proposed by the mayor. Since that announcement was made, negotiations have been carried out by the traction company and the City Council in a most harmonious and promising way. The company agrees to surrender all its unexpired franchises and to reorganize itself as a "holding company" under a revocable franchise. It agrees to consolidate with the quasi-municipal "Threefer" company, as the Cleveland people call the three-cent line which Mayor Johnson caused to be organized, and to be satisfied with a return of six per cent. on the actual capital now represented by its physical assets and its franchises. It also agrees to bind itself by a clause in the new ordinance to turn over the line to the city at any time at the demand of the Council, and at a price impartially fixed plus a 10 per cent. bonus. Both sides have selected representatives to appraise the assets of the traction company and to fix the other terms and conditions of the transfer, including the personnel of the directorate of the holding company. The city is prepared to give the company a security franchise to insure it against any confiscation or loss in the event of depreciation of the property through mismanagement or of failure to meet obligations.

This plan is quite different from the plan adopted in Chicago, by which the city gets 55 per cent. of the net receipts, and its practical operation will be watched with interest.

VIGOROUS STEPS should be taken to punish severely the men or boys who either through wanton mischief or with criminal intent take wire from transmission lines in lonely districts or destroy insulators by using them as a mark to shoot at. One instance is told by our Peoria correspondent: "The lightning storm of last week developed trouble on the Illinois Traction Company's high-tension transmission line. The trouble was finally located, and was found to be caused by hunters shooting away the high-tension insulators. Twenty-two were found to be defective and all had to be replaced. The company has posted a notice offering a reward of $50 for information that will lead to the arrest and conviction of the guilty persons." This is no isolated case, nor is Illinois the only state in which these depredations are committed. We have heard of some very ingenious methods adopted to take wire from poles even when transmitting current at high potential, but it would serve no useful purpose to set forth how this perverted cleverness is manifested. But the tampering with transmission circuits is a serious matter to power-generating companies, particularly exasperating because usually there is no trace to the offenders. If existing laws are inadequate, others more stringent should be enacted before the power companies resort to the last expedient of patrolling their lines by armed guards.

OUR NEIGHBORS to the north and south, Canada and Mexico, are alike in that both are extensively interested in hydro-electric power transmission at the present time. Of Canada it is said that nearly every important city is interested in the transmission of hydro-electric power. This is true of Montreal, Ottawa, Toronto and Hamilton, while Winnipeg has taken steps to build its own plant. Canada has great waterpower resources, and hope is entertained that at some future day the country will be independent of coal for manufacturing purposes. This is particularly important, because Canada is a large importer of coal.

Turning to Mexico, the rapid rate at which applications are being made to the Federal government for concessions by persons who have planned to install hydro-electric plants is worthy of attention. It is declared that the waterpower afforded by the numerous rivers of Mexico, particularly in the more mountainous districts, where the principal mining camps are situated, is sufficient to generate electricity for operating the machinery of all the mines and mills and other industrial plants in the country. Already some of the largest hydro-electric plants in the world have been installed here, notably that of the Canadian syndicate at Necaxa, which supplies Mexico City, Puebla, El Oro and other places with electric power. This syndicate has expended many millions of dollars in installing its plant and in constructing its long transmission lines and sub-stations. The available waterpower of the rivers throughout Mexico is being rapidly acquired by persons who contemplate the early installation of hydro-electric plants. In many instances these plants are to furnish power and light for mines. In other cases they are to provide electric lights for towns.

These numerous projects are no doubt based on sound economic considerations, for in Mexico also coal is expensive, while there is a growing demand for power. The plants to be built will require much electrical machinery and apparatus, most of which, no doubt, will be supplied from the United States.

Special Lighting of Downtown Streets.

At an interesting meeting of the Chicago section of the Illuminating Engineering Society held at the Grand Pacific Hotel on the evening of December 12th the subject was the special lighting of downtown streets such as is being proposed for a number of the business streets in Chicago at present. No set paper was presented, but an informal discussion of the subject was indulged in. To aid in this discussion the following questions had been suggested:

"1. What are the relative merits of the following lamps for such special street lighting? (a) incandescent lamps, (b) common arc lamps, (c) luminous arc lamps, (d) flaming arc lamps, (e) gas mantle clusters or gas arcs, (f) Nernst lamps. This question involves a discussion of whether on a business street other than a boulevard the object should be to produce striking and spectacular effects rather than an artistic effect.

"2. If incandescent lamps are used, what height and spacing of posts and what candlepower of lamps per post would be desirable for Chicago downtown streets?

"3. If flaming arcs are used, what should be the height and distance apart of posts, and should lamp-posts be placed opposite or alternated?

"4. On streets where there are street railway poles, is it desirable to add to the number of poles on the street by erecting separate lamp-posts, or should extensions or brackets placed on the street-railway poles be used?

"5. With an arrangement of lamps which results in a great contrast in the illumination immediately around the post as compared with the illumination midway between posts, is it possible to produce a well-lighted effect on a street, or will the contrasts defeat this purpose?

"6. With lamps such as the flaming arc and the horizontal glower Nernst, which throw a large proportion of their light downward in the vicinity of the post, is it possible to modify the natural distribution by means of globes or reflectors in such a way as to produce more uniform illumination on the street, thus allowing a greater distance between posts?"

At the call of Chairman Keech the discussion was opened by J. R. Cravath, who had acted as illuminating engineer for the Dearborn Street Improvement Association, which started the recent agitation for better street lighting in Chicago. He said that as a preliminary an investigation was made of the character of lighting of a number of well-lighted streets in this country. The cities studied were St. Paul, Minneapolis, Denver, Los Angeles, Columbus (Ohio), San Antonio (Texas) and New York. From these a mass of data was collected, showing among other things that for general street illumination the enclosed arc and the incandescent lamp were almost exclusively used on the best-lighted streets in those cities and that the energy expenditure for this purpose varied from 26.4 to 2 watts per lineal foot of street, depending on the system used and the intensity of illumination desired.

The Dearborn Street lighting committee had been instructed to plan a lighting scheme that would make that street the best illuminated thoroughfare in the world. At first ornamental posts with artistic incandescent lamp clusters were suggested. The use of the ordinary enclosed arcs was discouraged as incandescent clusters could be obtained with as good an efficiency as these arcs. Mr. Cravath recommended the use of the tungsten lamp, placing five 40-candlepower lamps of this type on each post and spacing the posts about 50 feet apart.

Later a sentiment sprang up among the property owners in favor of the flaming-arc lamp. As this would give a rather startling effect, and, on account of the concentrated light distribution below the lamp, the speaker fought shy of the proposition at first. If an insufficient number of lamps were provided very uneven illumination would result, i. e., under the lamps it would be intensely bright and midway between them comparatively dark by contrast. The ordinary enclosed arc gives a broader distribution than the flaming arc. There was no question, however, that the flaming arc would give the maximum light flux that could be obtained, for it throws out about five times as much light as the enclosed arc using the same watts.

In considering the subject with the committee he warned them against placing the lamps too far apart, as it would result in a series of bright and dark spots, and a patchwork appearance was to be avoided. Placing the lamps opposite each other was not desirable for the same reason. He therefore recommended the placing of 72 lamps in the stretch from Van Buren Street to the river (a little less than three-quarters of a mile), a lamp being placed every 50 lineal feet and alternated from one side to the other. This alternating is not unsymmetrical as can be seen from its general use in Chicago. It would therefore place the lamps 100 feet apart as measured along the curb line.

In regard to the height of the lamps, a height of 20 feet would cause the illumination underneath the lamps to be six times as bright as that midway between them. A height of 25 feet causes this figure to be three and one-half times, and a height of 30 feet still further reduces it to twice the brightness below that it is between the lamps. In view of the spacing recommended, 25 feet was the best height to place the lamps. Another reason for this great height is to avoid the glaring effect of the lights on the eyes. This height also would place the lamps at about the tops of the street railway trolley poles, which it was later decided to use instead of a new set of posts. Most illuminating engineers, however, favor placing flaming arc lamps at a height of more than 30 feet.

After some deliberation the committee decided to adopt the scheme, but reduced the number of lamps from 72 to 44. The latter number provides two lamps at each street intersection and three for each ordinary block. The lamps will be placed on each alternate trolley pole, giving a spacing in the interior of the blocks of about 117 lineal feet, or 234 feet from pole to pole along the curb line.

This spacing, however, defeated the effort to secure a uniform light distribution. It was therefore suggested that an attempt be made to spread out the light from the lamps. This had never been done before with flaming-arc lamps, but if it can be done with incandescent lamps, why not with these? The speaker advised the use of a glass hemisphere below the center of the lamp supported by an ornamental housing and containing one or more conical light deflectors serving to direct more of the rays toward a horizontal direction. About this time Mr. V. R. Lansingh happened to be in the city, and he suggested the construction of a special Holophane enclosing globe made of two concentric hemispheres with a small air space between them. The outer one should have a smooth outer surface and a Holophane inner surface, while the inner hemisphere should have a Holophane outer surface and a smooth inner one, the two hemispheres being sealed together at their upper edges to exclude dust. This type of globe is being made and will be tried. It should solve the problem, for it gives the distribution desired and at the same time will be easy to clean when trimming the lamp.

F. J. Pearson said that recently he had been asked to advise the South Park commissioners in regard to improved lighting of Michigan Boulevard, and he was pleased to note that the recommendations for Dearborn Street agreed with the suggestions he had made for the boulevard, since each plan had been drawn up independently. He favored a height of 28 or 30 feet for flaming-arc lamps. Experiments in Paris and London with these lamps had shown that the best results could be obtained with the spacing, alternating arrangement and height recommended. Mr. Pearson thought that the Dearborn Street committee would be disappointed with the results after cutting down the number from 72 to 44 lamps. If done at all it should be done well to give an excellently lighted street. The efforts to get good diffusing globes should be encouraged, as in them lies the hope for getting a uniform distribution. The great height at which the lamps are to be placed is particularly suitable for Dearborn Street on account of its many high buildings, the fronts of which should receive some illumination, else they would look gloomy by contrast with the bright sidewalk and street surface. A good height is also desirable to prevent dulling of merchants' efforts at window lighting.

Mr. Bingham, when called on to state the attitude of the gas interests, said they were ready to demonstrate that any street could be lighted as satisfactorily as desired by the use of mantle gas burners. The Welsbach Street Lighting Company, which he represented, was eager to secure a contract for lighting a Chicago street on the scale proposed for Dearborn Street so that it could show by comparison what could be done with its system. The company is now using the inverted mantle burner and placing one, two or three on a post at regular intervals along the street. With this new type better efficiency is obtained and the ornamentation could be improved. Over 200,000 upright mantle burners are now in use in this country and they are operating satisfactorily at a much less cost than electric lamps. The speaker admitted that gas companies have had a hard time in overcoming the prejudice in favor of electric lamps and that these were their only competitors. With the newer systems they are having great success, however, and have displaced quite a number of arc lamps. The mantle burners have the great advantage that they throw most of their light horizontally. He would place two lamps in clear globes on a post at a height of 10 feet and place the posts 50 feet apart. In regard to effect on electric signs, he said this should not be considered, and he was in favor of taking down all these signs, as they are superfluous and marred the appearance of a street.

L. Friedmann said that it was desirable to light up the fronts of the buildings as well as the street alone to give a better effect. Therefore the flaming arc was especially suitable for this purpose, as it could be mounted at a considerable height.

Mr. Bingham replied that the street and sidewalk should be illuminated, as that is where the vehicles and pedestrians needed the light. Of late years street lamps have been gradually coming down to a lower level. The tower-light system formerly used at Detroit and elsewhere has been abandoned because it lighted up the heavens and threw very little light where it was needed.

Albert Scheible said that he was glad to hear from a gas man, as in these days they are likely to be overlooked in illuminating engineering propositions. In regard to the arc towers in Detroit, he had always understood that they were abandoned because, as the height of buildings became greater, they cast more pronounced shadows. As to effect on window lighting, a merchant wants to show his wares to the best advantage and desires his windows to be bright. The effect of flaming arcs on window lighting should not be overlooked.

L. G. Shepard thought that the lamps should not be placed so as to mar street signs, as these are a great attraction on any thoroughfare. They alone throw considerable light, and he suggested as a solution of the street-lighting problem that if sufficient signs were put in the street lighting could be abandoned.

Mr. Clark of the People's Gas Light and Coke Company hoped that the company would not be held responsible for the lighting of North Avenue by gas "arcs," as that was an entirely independent movement started by the merchants of that street. It was an example of what might be expected from the individual efforts of such men. One has two or three gas arcs in front of his store and several of his neighbors have none. Such spasmodic lighting was not to be recommended. Still there is room for a number of systems, and there are bound to be several used on any business street.

A. L. Eustice said that this Dearborn Street proposition should be given special attention, as it is one of Chicago's best streets. Therefore the lighting should be cheerful and not spectacular. The flaming arc would doubtless have that effect. Electric signs are a very cheap form of advertising. From a business viewpoint the effect on sign and window lighting should be considered and no lighting scheme adopted that would clash with these systems now used by so many of the merchants.

Mr. Cravath believed that all curves of distribution from the inverted gas burner he had ever seen showed it to have the same small zone of distribution below the lamp as the flaming arc. For outer district street lighting a moderate intensity is all right, but for downtown lighting much higher intensity is needed on account of the large number of other conflicting lights.

W. E. Barrows, Jr., said that the magnetite or luminous arc lamp has a good efficiency and an excellent horizontal distribution which would peculiarly adapt it to such street lighting. Further, it does not have the glaring effect of the flaming arc, and he could not see why it was not considered.

Mr. Friedmann explained that the magnetite lamp gives a distribution much like the incandescent lamp, but to get still better results a reflector is used giving the maximum light 10 degrees below the horizontal. The magnetite lamp was not seriously considered because it looks much like the old open-arc lamp and is operated on a similar circuit. The lower electrode burns 150 hours and costs five cents; the upper one lasts about 3,000 hours and costs about 50 cents.

W. R. Bonham showed that the Westinghouse magnetite lamp was the inverse of the General Electric lamp referred to, in that it has the iron oxide electrode on the top and the copper electrode on the bottom. It therefore gives a good horizontal distribution without the need of reflectors.

Mr. Pearson wanted to emphasize the fact that the Dearborn Street illumination was on the spectacular order and therefore not typical of ordinary street lighting. Streets vary a great deal in their nature and the character of each should be considered on its own merits and a lighting scheme employed that is suitable. Residence and business streets require different treatment and the amount of traffic must also be considered.

The discussion was concluded by Alderman Taylor, chairman of the lighting committee of the Dearborn Street Association. He wanted it understood that the property-owners do not seek a spectacular lighting but a distinctive one. The association was formed for paving, lighting and general improvement of the street. It had decided to put the lamps on the trolley poles to prevent too great a number of poles encumbering the curb line. A number of other streets had formed improvement associations after theirs, notably La Salle, Clark and Madison streets, and that was why the Dearborn Street people were anxious to get the best that the illuminating engineers offered, as their example would doubtless be followed by these and other streets. It was desirable also to avoid experimenting with different systems on different streets, as uniformity is important if the best results are to be obtained for the city as a whole.

The next meeting of the Chicago section of the Illuminating Engineering Society will be held at the Coliseum in connection with the Electrical Show next January. The subject for discussion will be "The Lighting of Small Residences." This meeting will also be the annual meeting for the election of officers for the ensuing year.

Ratio of Heating Surface to Grate Surface as a Factor in Power-plant Design.[1]

BY WALTER S. FINLAY, JR.

Power-plant design in its modern development, is controlled solely by the specific application of general laws modified and molded to suit special requirements. To attempt the construction of a comprehensive ruling from the results of a particular line of investigation in some particular plant, and then to advise the general use of such ruling as conducive to economical operation, would cause confusion, possibly resulting in a wholesale rejection of the good with the bad. However, the value of specific results and their publication lie in the opening up of a line of technical thought, or in adding information to some subject, from which specific deductions or particular application may be made.

The results obtained in the investigation which was primarily the foundation of this paper should be looked upon merely as specific, but whose bearing upon the general subject, by means of a general development, may be of value, particularly in certain new phases of plant design.

As a fundamental and almost initial point of attack in the comprehensive subject of steam power-plant design, the ratio

$$\frac{\text{heating surface}}{\text{grate surface}}$$

has been a value fixed from the beginning of results of commercial usage, and the expression of the same in empyrical formulas or figures suited to the requirements of this or that designer, builder or manufacturer.

A summation of practice from early engineering times to values developed by the most modern idea gives a great range to this ratio; namely, from the extreme value as advised by Dalton in 1839 of 10 to 1, to modern values up to 70 to 1, used, not only in locomotive, but even in power-plant practice. Of course the primary object in view has already been the adaptation of values to produce the maximum useful effect; but the question now arises as to whether "maximum useful effect" is not being interpreted as maximum economical efficiency with reference to fuel only, as a primary consideration, and with an undue subordination of total plant costs. By total plant costs are meant, of course, the combined fixed charges resulting from interest on plant investment, depreciation, taxes, etc., and operation and maintenance charges.

Properly to investigate the subject in its particular applications would require an extremely tedious and complicated study of innumerable individual requirements; but for a general survey assumptions based upon commonly accepted values will suffice to direct the attention to the point involved.

Assuming a plant first cost of $125 per kilowatt equipment, including turbo-generators, boilers equipped with stokers, with, say, 60 to 1 ratio, the following relative costs may be assumed:

Total cost per kilowatt	$125.00	100	per cent.
Building, per kilowatt	43.75	35	per cent.
Boilers, per kilowatt	6.875	5.5	per cent.
Grates, per kilowatt	1.75	1.4	per cent.
Piping, per kilowatt	5.625	4.5	per cent.
Coal-handling apparatus per k. w.	2.30	1.84	per cent.
Balance of equipment	64.70		

The value of the building as assumed might be considered low, particularly in the case of a turbine plant; boiler cost is possibly average; grates high—a stoker valuation; piping value is about average.

Assuming as a fair value for determining fixed charges: Interest on investment, 5 per cent.; depreciation, 6 per cent.; taxes and insurance, 1 per cent., then the total fixed-charge rate would equal 12 per cent.

Upon bases of load factor and charges, a curve has been drawn showing the relative value of the fixed charges over a range of factor variation from approximately 3 per cent. to 100 per cent., in the case of the plant as assumed. (Curve A, Fig. 1.)

To determine total charges, the variation of maintenance and operation charges relative to load factor must also be considered. It is rather difficult to assume this curve, as conditions in this respect vary rather widely. However, Curve (C), Fig. 1, has been drawn through points located by comparative results obtained in actual cases of operation. The shape of the curve will practically be constant for any figure which may be assumed, and its relation to the general results will be such that the value of the principle involved will be unaffected. The sum of the ordinates between the two curves gives total charges per kilowatt-hour.

In a reconsideration of the plant design as affecting first cost, the natural method of procedure is to consider separately each item involved.

1. *Building.*—In turbo-generator plant design it is a generally accepted rule that total plant dimensions are controlled by boiler-room dimensions; that, for instance, a diminution in the actual size of the boiler room may be accompanied by a proportional diminution in the size of the turbine room, the output remaining the same. The methods of accomplishing such results are perhaps various; change in size of units, difference in type, closer grouping of units, etc.

2. *Boilers.*—The consideration of this feature is naturally interlinked with the subject of "grates," and the two can be discussed together.

Rules of boiler practice have been derived chiefly, if not entirely, by experiment and investigation; and those rules validated only by general acceptance can be quoted as bases for argument. Such a law is the following one:

"All other conditions remaining constant, capacity developed is, with slight modifications, in direct ratio to the area of the active grate surface. An increase in capacity—heating surface remaining constant—caused by an increase in grate area, is accompanied by a loss in economical evaporation, due to the increased temperature of the escaping gases."

This loss in economy is the fundamental factor which must necessarily be the object of a careful study, involving the complete investigation of the heat interchanges taking place in a boiler. The research work of such men as Newton, Péclet, Joule and Rankine, together with recent investigation, has not, as yet, produced sufficiently definite and authoritative results, which may be used as bases of rational calculation in this regard. Under normal conditions of present boiler practice, estimates of loss vary from practically zero to as much as 15 per cent. fuel economy for an increase of 100 per cent. in boiler capacity.

Lately, however, the opinion has been advanced that considerable increase in capacity can, without great sacrifice in economy, be obtained by proportional increase in grate area. This idea is based upon the possibility that combustion and heat distribution and transfer could be much improved under the new conditions, when in increasing the grate area careful attention is given to details of design most conducive to these features. Other conditions being favorable, and with a belief in the correctness of this theory, a change was made in the design of 18 of the boiler furnaces in the Fifty-ninth Street plant of the Interborough Rapid Transit Company. Such a design gave the possibility of operating within the range of the original single-stoker boiler, together with the higher range of the double stoker.

The second stoker installed, that is, the one beneath the mud-drum, has an area of 80 per cent. of that of the original stoker. Certain features in the construction of the plant prevented installation of a larger size. A detailed description of points in the design are unnecessary, save to call attention to the fact that the lower stoker is constructed practically within a so-called "Dutch oven," and

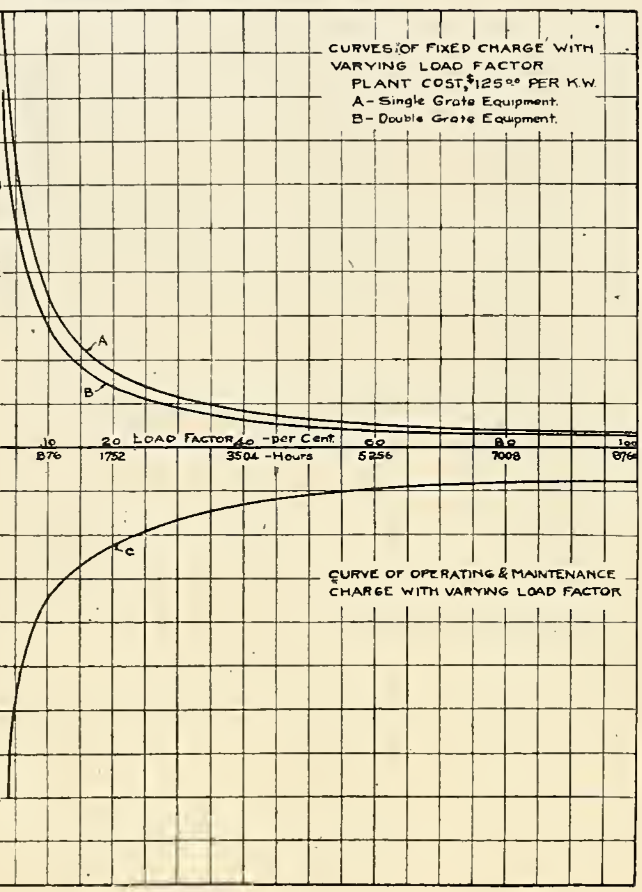


Fig. 1.

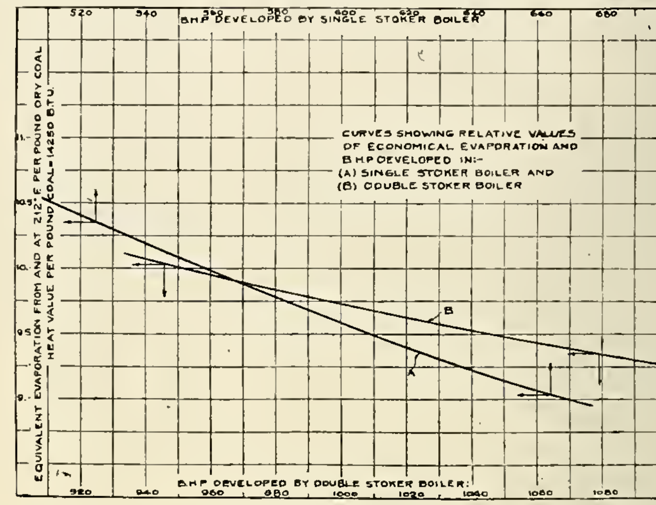


Fig. 2.

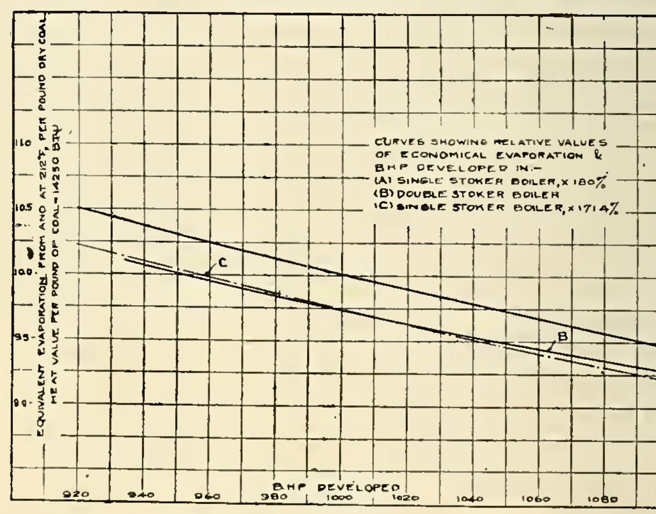


Fig. 3.

RATIO OF HEATING SURFACE TO GRATE SURFACE IN POWER-PLANT DESIGN.

1. A paper (somewhat condensed) presented at the meeting of the American Institute of Electrical Engineers, New York, December 13, 1907. The author is assistant engineer to the superintendent of motive power, Interborough Rapid Transit Company, New York city.

whatever is conducive to good combustion is provided for therein. Operation of these stokers has shown that such is practically done with but little more complication than existed in the single type.

Tests to determine the comparative economical operation of the double and single stokers show results as given graphically in Figs. 2 and 3. The curve in Fig. 2 is self-explanatory. In the curves in Fig. 3 is shown the fact that the economical loss for an increase in rating of 80 per cent., as proportioned to the increase in grate area, varied between two and three per cent.

To summarize the results of these tests: It has been made evident that in this particular case double-stoker operation covers the entire range of single-stoker operation and adds an increase of capacity proportionate to its larger grate surface with but slight loss in economy, and that the increase of 71 per cent. in capacity was accomplished with no loss in economy.

With these results as a basis, let it be assumed that boiler capacity is increased in ratio to increase in grate surface with but little loss of economy. This view might be further strengthened when consideration is taken of the possibilities of economizer practice, the increase in saving, by proper design, being high in ratio to extra cost involved.

To return to the consideration of the items under the power plant whose first cost has been assumed to be $125 per kilowatt, the next point is:

Piping.—In the case involved, the cost of steam piping between boilers and manifolds, plus boiler-feed piping, plus boiler blow-down piping, has alone been considered. With any change in number of boilers, capacity remaining the same, the cost of piping will vary in the same ratio times a factor due to change in size of pipe.

Coal-handling Apparatus.—Fixed plant capacity would seem to demand fixed cost of coal-handling apparatus, but the proportionate value of the conveying apparatus is so large that when any change is made affecting the length of carry the total system cost will be raised or lowered, although not in direct ratio to such change.

Effect of change of ratio $\dfrac{\text{heating surface}}{\text{grate surface}}$

Suppose that in a reconsideration of the plant design, it is decided to cut in half the ratio of heating surface to grate surface by the use of double grates or stokers under boilers of the same rating. Plant output is to remain the same. A tabulation of the costs as revised would be as follows:

	Per kilowatt
Building (reduced to 40 per cent.)	$ 26.25
Boilers (reduced 50 per cent.)	3.438
Stokers (remain same)	1.75
Piping (reduced 40 per cent.)	3.735
Coal-handling apparatus (reduced 15 per cent.)	1.955
Balance (remains same)	64.70
	$101.468

A curve (B), Fig. 1, is plotted upon this new basis.

Summation: Plant first cost and fixed charges, each reduced to 19.6 per cent.

The next consideration is that of the effect of such changes upon plant maintenance and operation charges. Properly to discuss this, the following tabulation, based upon the figures given by Mr. H. G. Stott in his paper on "Power Plant Economics," will furnish a means of comparison:

	Single grate (per cent.)	Double grate (per cent.)
Maintenance:		
Engine room mechanical	0.64	0.64
Boiler room	5.40—(16) =	4.54
Coal and ash-handling apparatus	0.68	0.68
Electrical apparatus	1.41	1.41
Operation:		
Coal and ash-handling labor	2.65	2.65
Removal of ashes	1.18	1.18
Dock rental	0.93	0.93
Boiler-room labor	8.38—(18.5) =	6.83
Boiler-room oil, waste, etc	0.21	0.21
Coal	71.94+(3) =	74.10
Water	0.90	0.90
Engine-room mechanical labor	1.70	1.70
Lubrication	0.44	0.44
Waste, etc	0.38	0.38
Electrical labor	3.16	3.16
Total	100.00	99.75

The saving in boiler-room maintenance and operation may be accounted for in the following itemized statement of boiler-room charges:

	Cost	
	Single grate (per cent.)	Double grate (per cent.)
Maintenance:		
Boilers	29.5	14.75
Economizers	2.78	2.78
Furnaces	17.29	17.29
Stokers and stoker engines	40.68	40.68
Boiler-feed pumps	5.42	5.42
Boiler-feed piping	2.20	1.10
Boiler blow-off piping	0.44	0.44
Water-supply piping	1.52	1.52
Total	100.00	83.98
Operation:		
Water-tenders	20.82	10.41
Stoker operators	38.09	38.09
Assistant stoker operators	15.49	15.49
Stoker oilers	2.54	2.54
Economizer oilers and cleaners	5.84	2.92
Boiler-feed pump men	5.08	5.08
Boiler cleaners	10.41	5.21
Miscellaneous labor	1.73	1.73
Total	100.00	81.47

Thus, with changes as noted, the decrease in maintenance and operation would be 0.25 per cent., the curve for same practically coinciding with Curve (C), Fig. 1.

A second set of figures based upon a plant cost of $150 per kilowatt, is shown in the table:

Plant cost per kilowatt	$1[illegible]	100%
Building	60.00	[illegible]
Boilers	[illegible]	[illegible]
Stokers	[illegible]	[illegible]
Piping	[illegible]	[illegible]
Coal-handling apparatus	[illegible]	[illegible]
Balance	70.1[illegible]	[illegible]
Same plant, double stoker		
Building (reduced 40%)		[illegible]
Boilers (reduced 50%)		4.[illegible]
Stokers (remain same)		[illegible]
Piping (reduced 40%)		4.[illegible]
Coal-handling apparatus (reduced 15%)		[illegible]
Balance		70.1[illegible]
Total		$118.79

Showing a reduction in first cost and fixed charges of 20.8 per cent.

SUMMARY.

In the case of the $125 plant, the following savings might be effected by use of double grate:

First cost, 19.6 per cent. saving.

Total plant charges varying from a saving of 5.64 per cent. at 100 per cent. load factor to 7.54 per cent. at 50 per cent. factor to 9.65 per cent. at 4.16 per cent. factor (365 days per year).

In the case of the $150 plant:

First cost, 20.8 per cent. saving.

Total plant charges vary from about 7.06 per cent. saving at 100 per cent. load factor to 9.26 per cent. at 50 per cent. factor to 11.51 at 4.16 per cent. factor.

Thus summarized, the remarkable effect that the grate area and heating-surface ratio, when furnace design is carefully considered, may have upon plant first cost and total annual costs, should certainly place this particular feature well up in the list of subjects for careful investigation, and make it a point of primary and fundamental consideration in advanced design.

DISCUSSION (IN PART).

Albert A. Cary, consulting mechanical engineer, New York city: With the handicap of too small boiler furnaces, central stations have rushed off, almost madly, to the use of machine-fired grates, thinking that with them they could find a remedy for their fundamental errors, and many of these stoker applications have been well-nigh ridiculous.

I do not wish to be understood, by these remarks, to be opposed to the use of a mechanical stoker in central stations, as, after many tests of the leading stokers, I have found them to be a most useful and desirable appliance.

There seems to be a very general idea that more coal can be burned per square foot of grate in a mechanical stoker furnace than on hand-fired grates.

This is a fallacy, as with the same thickness of fire bed and with the same difference of pressure above and below the bed of coal, the same rate of combustion will occur.

A stoker may facilitate combustion by automatically keeping its effective grate area freer of ash than the plain stationary grate, but with good firemen and a moderate percentage of ash in the coal, this difference will be very small, while with a large percentage of ash in the coal, for hand firing a good shaking grate will bring this trouble to an almost equivalent condition with the mechanical stoker.

Shaking grates and automatic stokers will, however, in most cases, largely increase the percentage of combustible matter in the ash.

More coal per furnace can, however, be burned by most mechanical stokers, owing to the fact that the depth of furnace can be rationally increased, owing to the automatic handling of the fire bed, thus giving us a larger grate area, but this increase can seldom be greater than 20 per cent., which will not be sufficient to help us out of our trouble with our 12-foot-7-inch single furnace serving the 500-horsepower boiler.

In designing boiler equipments, I do not think of allowing a boiler design to control my furnace design, but I first consider the furnace, and after designing one which will allow the proper handling of the required amount of available fuel, I then fit the boiler to this furnace, and this applied practice has always been followed with the most desirable results.

As our boilers and engines are purely heat machines, and as our electrical output depends upon the heat delivered by the furnace and the percentage of this heat utilized by the boiler and engine, it certainly seems irrational, in designing central stations, carefully to proportion generators, engines, pipe lines, etc., and then figure over some stock size of boiler to see that it contains the proper number of square feet of heating surface, without regard to how this heating surface is arranged, and finally neglect the most important consideration of all, namely, the furnace, the generator of heat—the heart of the whole plant. Yet this is the usual practice of today.

The combined furnace and boiler efficiency should be as near 80 per cent. as possible, and it certainly should not drop below 70 per cent., although in central-station practice, with badly designed furnaces, it will be understood that 52 per cent. combined efficiency is not uncommon.

After studying many carefully conducted boiler tests, I find it possible to give a rough tabulation of rates of coal combustion, which may be considered as good practice.

This table shows approximately the pounds of dry coal which should be burned per hour, per square foot of grate surface, to develop the rated horsepower of the boiler with the greatest economy:

Anthracite coal (steam sizes)	1[illegible] lbs.
Semi-anthracite coal (steam sizes)	16 lbs.
Semi-bituminous coal	18 lbs.
Eastern bituminous coal	20 lbs.
Western bituminous coal	[illegible] lbs.

There are, unfortunately, many conditions which will modify these figures, which have to be taken into account in furnace designing, such as the size of the coal, the presence of an excessive amount of ash, sulphur or moistures in the coal, etc.

I have sometimes heard the question asked, Why do we find more coal burned per square foot of grate with western coals than with those of the East?

Simply because the western coals contain more volatile matter than do the eastern coals.

The fixed carbon in the coal is burned directly upon the grate, while the volatile matter rises from the fire bed and is burned in the combustion chamber; therefore, the greater the percentage of volatile matter in the coal, the larger the combustion chamber should be.

The double-furnace arrangement presented in this paper is a most natural expedient toward securing the desired results with these narrow boilers, but I believe that some modification in the design can be made which will lead to more economical results.

There is a large field of work which has been but slightly entered, which will lead to a considerable change in the present view of ratio of grate surface to heating surface. Locomotive practice has, for example, put our stationary-boiler practice to shame by operating to good economy with a ratio of heating surface to grate area of 80 to 1. While stationary-boiler furnaces are burning from 15 to 30 pounds of coal per square foot of grate per hour, locomotives are burning from 50 to 100 pounds of coal per square foot of grate per hour, and while stationary boilers are evaporating from three to six pounds of water per square foot of heating surface per hour, locomotives are evaporating from six to 15 pounds.

John P. Sparrow, chief engineer, New York Edison Company: It seems to me that undue prominence is given to the question of grate area. If the question were what is the proper relation of boiler heating surface to maximum station output as affecting station design and operating costs, then the question of grate surface becomes one of securing the necessary capacity at the maximum efficiency.

On the ratio of heating surface to kilowatt capacity, there is quite a wide variance of practice, variations of from 5:1 to 10:1. There is also similar variation in the evaporation per square foot of heating surface, everyday practice showing examples of from 2.5 to 8 pounds for land service and as high as 10 to 12 pounds for marine work.

In ratio of grate area to heating surface we find common practice to be between the limits of 75 to 1 to 35 to 1.

In central-station service, where variable loads are the rule, these variations in heating surface and grate area have bearing on two points, the economical evaporation per square foot of heating surface and the economical rate of combustion per square foot of grate.

Large grate areas have been advocated many years, nearly always, however, from a standpoint of capacity. The New York Edison Company uses grates with ratio of 1 to 40, burning the fine sizes of anthracite coal.

The question of capacity is always associated with amount of coal burned, and here, it seems to me, that Mr. Finlay has drawn his conclusions from test results which show a fair performance of the double stoker and a poor performance of the single stoker.

The New York Edison Company has for some time been conducting tests along the line of high rate of combustion of soft coal under forced draft and has on test burned as much as 44 pounds of coal per square foot of grate with a boiler output of 1,300 horsepower and a combined efficiency of 73 per cent.

With anthracite coal under forced draft burning 24 pounds per square foot, 1,070 horsepower was developed with combined efficiency of 69 per cent.

What we should strive for in station design is a proper proportioning of heating surface to maximum output. That being established, we should design our furnaces and grates so as to utilize that heating surface to the best advantage.

In electric-lighting stations, where the storm peak demands may be from 60 to 100 per cent. above normal, it is most convenient, and I believe most economical, to operate boilers with the commonly accepted ratios of heating surface to grate surface at about 15 per cent. above rating, relying on our ability to force our evaporation to meet the sudden load demands.

If this operating routine is correct, then increased grate areas are opposed to good economies; it is practically impossible to burn fuel at low rates of combustion on large grate areas with reasonable economies. We all know the difficulties experienced in checking excess air when operating with ratios of grate to seating surface of 1 to 60. How much more difficult it will be to operate with ratio of 1 to 32 at the same boiler output.

A very large number of tests conducted by the New York Edison Company with boilers designed with ratios of 10 square feet of heating surface to 1 boiler horsepower have shown conclusively that, while there is a falling off of combined efficiency at high rates of evaporation, this decrease of efficiency is not at all serious if the higher rate is maintained only at time of peak load.

The keynote of the situation lies in an increase in our rates of combustion, this bearing the same relation to construction costs and fixed charges as Mr. Finlay's increase of grate surface.

I. E. Moultrop, mechanical engineer, Edison Electric Illuminating Company, Boston: It does not follow that it was necessary to build a second furnace under the same boiler to obtain the improvements, because the original furnace could be redesigned on similar lines, and, if necessary, a considerably larger grate could be placed in one furnace.

The Edison Electric Illuminating Company of Boston has just installed some additional boilers on these lines, and it is unfortunate that no data on performance are available, as they have only just been put into service. These boilers are of the water-tube type, having 5,118 square feet heating surface, equipped with stokers having 110 square feet grate area. The boiler is raised 15 inches higher than usual, and the stoker is dropped 9 inches and brought forward 3 feet 4 inches more than usual practice. This gives an ignition arch 5 feet 4 inches long, and a combustion chamber of 613 square feet, the latter being about 60 per cent. greater than those of the previous installation.

The older equipment just noted has given good service except that smoke has been produced at powers much above rating, showing that the combustion chamber is not large enough. However, with 12 boilers in operation, a load of 16,200 kilowatts is carried on the peak, or 12.7 kilowatts per square foot of grate surface.

The ordinary boiler plant is run at such moderate rates of combustion and the initial temperature of the gases is so low that the heating surface must be large in proportion to the grate surface to permit the former to absorb the heat and give the plant a reasonable efficiency. It is very difficult to train firemen to burn coal rapidly and not allow his fire to get uneven and full of holes.

If the above is true, the right direction is not toward more grate area, but toward more combustion chamber and less grate surface.

The proposition to reduce the size and cost of the boiler plant is a step in the right direction, but in so doing the utmost simplicity should be maintained, especially in the large stations of today. Possibly the scheme adopted at the Interborough station was the best that could be devised in an existing plant for a reasonable cost, but it does not follow that this design is a good one to adopt in laying out a new station.

W. F. Wells, Edison Electric Illuminating Company, Brooklyn: The ratio of heating surface to grate surface, although a question of primary importance, is, to my mind, a matter of secondary consideration.

In order to design the most suitable boiler plant for a power house that can be constructed at a minimum cost per kilowatt installed, consideration should first be given to the evaporation possible per square foot of heating surface consistent with commercial economy; and this in turn depends upon the maximum practical rate of combustion of the various fuels available in the local market, their relative costs per ton, cost of handling and thermal values.

Having determined the pounds of water that can be evaporated per pound of coal at various rates of combustion, a simple calculation shows the pounds of water that can be evaporated per square foot of grate, and from this, in connection with the load curve, can be determined the ratio of heating to grate surface most suitable for maximum capacity when fires are forced, or maximum economy for average load when forcing is not necessary.

In the Sixty-sixth Street station of the Brooklyn Edison Company the grates were originally installed with a ratio of 1:68, but last summer the fronts on these furnaces were extended and grates enlarged, giving a ratio of 1:53. This increase in grate area was utilized, not so much for increased capacity, as to give increased economy by burning a cheaper fuel. The economy actually effected by this increase in grate area amounted to 14 per cent. in cost of evaporating 1,000 pounds of water.

At our Gold Street station, the grates as originally contracted for three years ago were at a ratio of 1:76, but before installing the furnace, fronts were extended, thereby reducing the ratio 1:59, and under the boilers installed in 1907 by moving back the bridge wall, this ratio was still further decreased to 1:52; under boilers proposed for 1908, this ratio has been reduced to 43.

With this ratio of 1:43, almost double boiler rating can be obtained, or seven pounds of water per square foot of heating surface can be evaporated by burning No. 3 buckwheat, and double rating probably exceeded by burning No. 1 buckwheat, or a mixture. This ratio would have been made less but for the physical impossibility of handling a deeper firebox.

Walter T. Ray and Henry Kreisinger of the Technologic Branch, United States Geological Survey (jointly): We wish it distinctly understood that the United States Geological Survey is in no way officially committed to any of the opinions advanced hereafter.

The intensive working of boilers, as described in this paper, is one of the first results of rational study of furnace and boiler separately. The next few years will bring to light dozens of increases in capacity as great and greater.

But before long it will be realized that there are very few boilers on the market in which the water circulation is not much hindered. It will also be realized that grates and furnaces must be scientifically studied in detail and rationally improved.

When the high-speed tool steels came out a few years ago manufacturers at first stiffened up old patterns; finally they redesigned them.

We venture the prediction that in 10 years there will be in successful operation boilers, and maybe furnaces, doing several times as much work as at present per cubic foot of space occupied and per dollar invested, and all this perhaps simultaneously with a much higher efficiency from coal to steam. The prediction may prove wrong, but so far we know nothing fundamentally against it and many things in favor of it.

The velocity of the gases over (or past or along) the heating surface is the active feature which determines how much heat will be imparted to the surface, all other things being equal. If the velocity of gas be doubled, the amount of steam produced per second will be nearly doubled. For a fuller discussion of this matter we refer to the Geological Survey's bulletin entitled "A Study of Four Hundred Boiler Tests." [See Western Electrician of December 14, 1907, page 465.]

W. L. Abbott, chief operating engineer, Commonwealth Edison Company, Chicago: The object of Mr. Finlay's paper is to show that the ratio

$$\frac{\text{heating surface}}{\text{grate surface}}$$

is fixed by common practice at such a value that the cost of the heat lost in the flue gases is less than the interest and depreciation on the boiler-plant investment, including the cost of the boiler house; and he argues that the sum of all the plant costs, including operating expenses and fixed charges, would be lower even on a 100 per cent. load factor if the above ratio were reduced one-half, with an admitted loss in boiler efficiency.

Mr. Finlay assumes the cost of a plant to be $125 per kilowatt, and of this the cost of the building is 35 per cent., or $43.75, and also that the size of the building is determined by the number of square feet of heating surface in the boiler. He, therefore, proposes to redesign the plant, using only half as much boiler-heating surface, but worked to double the former capacity, thereby effecting a saving of $23.58 per kilowatt in the cost of the plant, of which amount $17.50 is due to a reduction of 40 per cent. in the size of the building.

While the foregoing assumptions may have been correct a few years ago, they certainly do not apply to more recent designs for turbine plants using large generating units. In these designs the size of the building is not determined by the number of boilers any more than it is determined by the number of turbines, and the cost of the building, which is around $15 per kilowatt, is divided about equally between the boiler room and the rest of the plant. The reduction of 40 per cent. in the cost of the building incident to a reduction by one-half of the boiler-heating surface will therefore be applied only to a $7.50 boiler room and not to a $43.75 power-house building.

Again, Mr. Finlay allows an additional loss of only three per cent. of the fuel when he doubles the rating of a given boiler. This assumption is probably correct for a boiler having an ample economizer, but in the case of a boiler not so supplemented, the additional fuel loss would undoubtedly be as much as 10 per cent., and it should be stated here that the figure given above for cost of boiler room did not allow space for an economizer.

We now have the following approximate figures for power-house costs:

With boilers of standard rating..............$96.00
With boilers of double standard rating....... 93.00

Both of these prices are without economizers.

Taking these new figures, and calculating the data for curves similar to those given in Fig. 1, it appears that the total cost of current output will be practically the same in both cases, regardless of the rating at which the boilers are worked.

Rules for Signaling Systems.

The "Rules and Requirements" of the National Board of Fire Underwriters for the construction, installation and use of signaling systems have been issued in separate booklet form and may be had at the Underwriters' Laboratories, 382 Ohio Street, Chicago. These rules affect fire-alarms, watchmen's time-recording apparatus, and, in fact, wiring for all electrical signal systems affecting the fire hazard.

Exhibition Committee for National Electric-light Convention.

At the Washington convention of the National Electric Light Association last June the class "D" members (manufacturers) of the association made a most attractive exhibition of electrical apparatus and appliances. During the convention these exhibitors held a meeting and offered to relieve the association of the troubles and responsibilities connected with the organization and maintenance of such exhibits at the annual conventions.

The executive committee of the association approved a plan whereby the class "D" members were to recommend annually an "exhibition committee" of class "D" or "E" members. This committee, upon recognition by the president, would elect its own chairman and organize to conduct the work pertaining to manufacturers' exhibits at the convention.

A nominating committee was formally appointed. It consisted of George F. Porter (chairman), Atlantic Insulated Wire Company; T. G. Whaling, Westinghouse Lamp Company, and Alex Henderson, American Circular Loom Company. The ticket presented by this committee to the class "D" members has been approved by a mail ballot of class "D" members and accepted by Mr. Dudley Farrand, president of the National Electric Light Association. This committee, known as the "exhibition committee," is as follows:

F. H. Gale, General Electric Company.
J. C. McQuiston, Westinghouse Companies.
H. P. Heger, Allis-Chalmers Company.
Rodman Gilder, Crocker-Wheeler Company.
H. M. Post, Western Electric Company.
C. P. Frey, Weston Electrical Instrument Company.
Benjamin Wall, Metropolitan Engineering Company.
James I. Ayer, Simplex Electric Heating Company.
S. E. Doane, National Electric Lamp Association.

On December 6th this committee met in the association rooms in New York and elected Mr. Gale as chairman. A committee on by-laws and rules for governing the committee was appointed and preliminary plans regarding the convention of next June were discussed. The committee is of course subject to the executive committee of the association and will co-operate fully with the president and other officers in making arrangements for the convention.

Standard Symbols for Wiring Plans.

The National Electrical Contractors' Association of the United States and the American Institute of Architects have issued a chart of standard symbols showing various outlets, fixtures and other wiring devices. The General Electric Company, Schenectady, N. Y., has just issued a little booklet giving sample plans of an office or accounting room and of a kitchen and dining room in which the symbols are illustrated. The other pages of the brochure are used to illustrate and describe many of the company's specialties, indicated by the symbols in the plans. The booklet is being given a wide circulation, and it is hoped that it will aid in the general adoption of the standard symbols. Copies of the charts giving all of the approved symbols may be had by application to the secretary of either the Contractors' Association (William H. Morton, Utica, N. Y.) or American Institute of Architects.

Sarnia Tunnel Equipment.

The electric installation of the Port Huron-Sarnia tunnel of the Grand Trunk Railroad is nearly completed. The change in the atmospheric conditions is marked and the company will derive a great advantage from the speedier and easier method of handling the enormous traffic that passes through the tunnel under the St. Clair River. The installation was carried out by the Westinghouse Electric and Manufacturing Company. The formal starting of the electrical service in the tunnel will take place, it is said, on Christmas night, when there will be a brilliant illumination in celebration of the event at both the Sarnia and Port Huron ends.

Production of Zinc in 1906.

The production of spelter (crude metallic zinc) in the United States in 1906 was 224,770 short tons. This production, which includes 25,076 tons of spelter obtained from the smelting of foreign ores, shows an increase of 20,921 tons, or 10.3 per cent., over that of the preceding year, and is the largest in the history of the industry. Missouri produces considerably more than half of the zinc output of the United States. The United States produces 29 per cent. of the world's zinc and ranks second among zinc-producing countries and first among zinc-consuming countries.

ELEMENTS OF ELECTRICAL ENGINEERING.

By Geo. R. Metcalfe.

XLVII.—Storage Batteries.

Nickel-Iron Cells.

Aside from the lead-type storage batteries previously described, the nickel-iron cell is the only one which has attained much commercial importance, and the application of this type is chiefly to automobile work. The grids for both positive and negative plates in this battery are alike, and they are composed of nickel-plated steel. The openings in these grids are filled with active material made up in the form of small briquettes which extend out beyond the surface of the grid. Each pocket containing a briquette is covered with a piece of perforated nickel-steel, and after the grids are thus assembled they are subjected to enormous pressure, which forces the whole plate into a solid mass.

The principal advantage asserted for this type of cell is its extreme durability in comparison with the lead cell. It is not noticeably affected by changes in temperature, and it may be fully discharged and even recharged in the reverse direction without affecting its capacity. The average voltage per cell when discharging is about 1.1 volts, which is about one-half the figure for the lead cell. It is therefore necessary to use nearly twice as many of these cells as of the lead ones to attain any given voltage.

Storage Batteries in Service.

In electric-railway and electric-lighting work the lead type of cell is used almost exclusively, and the capacity of a cell is regulated entirely by its size, or, in other words, by the area of the active material in the plates. For plates of the same construction, one having twice the area of the other will have twice the ampere capacity, and each cell has a mean potential of about two volts on discharge.

By connecting the cells in series the voltage of the series will be about twice the number of cells, and therefore in order to light a 110-volt incandescent lamp, it will be necessary to connect 55 cells in series. This will give a 110-volt current of the ampere capacity of one cell. By connecting the same number of cells in multiple there would be 55 times the ampere capacity of the series connection, but this current would be at a pressure of about two volts. In central-station work, therefore, the number of cells required to give the operating voltage are connected in series, and the capacity of the battery is obtained by making the plates of sufficient size to give the required output in amperes.

As a lead battery discharges, its voltage gradually drops, and the discharge should be stopped when the voltage has dropped to the minimum value recommended by the makers of the battery, which will be somewhere in the vicinity of 1¾ volts per cell. The capacity of a battery is given in ampere-hours, and theoretically a 100-ampere-hour cell should be capable of giving one ampere for 100 hours, or 100 amperes for one hour, or any intermediate rate of discharge. In practice, however, it has been found that a very rapid rate of discharge is very deleterious, as it causes the plates to warp and buckle, so that they are apt to become short-circuited, and the active material is also rapidly disintegrated.

For each type of cell there is recommended by the makers a normal rate of discharge, which is usually in the neighborhood of seven or eight hours, and a maximum rate of discharge, which is perhaps three or four hours less, and which should not be exceeded. For instance, the maximum rate of discharge of a 100-ampere cell might be given as four hours, which would give a discharging current of 25 amperes. The normal rate of discharge would probably be in the neighborhood of eight hours with a discharging current of 12½ amperes. The batteries may generally be charged at a somewhat higher rate than they are discharged, but the life of the battery is greatly prolonged by charging it and discharging it at a moderate rate.

As the battery is charged, its voltage gradually rises, which tends to cut down the charging current, and the charge must be continued until the voltage reaches 2½ volts per cell. When the battery begins to discharge this initial voltage drops almost immediately to two volts, where it remains during a considerable portion of the discharge. When it is nearly discharged the voltage again drops quite rapidly, and care should be taken that it does not discharge below the minimum voltage recommended by the makers.

The efficiency of a storage battery is in the neighborhood of 75 per cent., and its rate of depreciation depends entirely upon the service to which it is put. For traction purposes and for automobile work, the depreciation is very rapid, the life of a battery in this service being sometimes less than a year. On the other hand, in central stations, where the batteries operate under advantageous conditions and are discharged and charged at about their normal rate, the depreciation may be very light. In some cases batteries have been operated for several years with practically no expense whatever for renewals and repairs, and it is the practice of many manufacturers to insure the batteries being kept in repair for a price ranging from four to six per cent. of their first cost.

Lead batteries are delicate and require care in their management. If they are operated under favorable conditions and strictly in accordance with the maker's directions, they will give good service for very long periods with but slight depreciation. If, however, they are overcharged, or over-discharged, or abused in other ways, they will go to pieces rapidly, and will also be subject to numerous troubles, some of which are explained below.

Installation.

In many cases of failure of storage batteries, the fault can be traced to the user rather than to the battery. Owing to the cost of the bttaery, there is frequently a tendency to economize by using batteries of smaller capacity than the service really requires. This leads to the battery being overworked or charged and discharged at too rapid a rate, with resulting rapid deterioration, whereas, if the capacity of the battery had been more liberally chosen, the depreciation might have been almost negligible for several years.

Storage batteries should always be installed in a room by themselves, which should be well ventilated, dry and of a fairly uniform temperature. As the battery gives off considerable gas in charging, which is also accompanied by an acid spray, the entire interior of the room should be made of some acid-proof material. The floor and walls should preferably be of brick or tile, and the floor should be provided with ample drainage. In case there is any wood or iron exposed in any part of the room, it should be thoroughly coated with some acid-proof paint, such as asphaltum paint. The battery trays are made either of glass, hard rubber or are lead-lined, and are usually supported on framework of wood or iron raised a short distance from the floor, the cells resting upon porcelain insulators carried by the framework. It is important that the cells be thus insulated from each other, so that the leakage of current is avoided.

[*To be continued.*]

Note.—This series of articles, intended to survey, briefly, the whole field of applied electricity for light, power and heat, was begun in the Western Electrician of February 2, 1907.

QUESTIONS AND ANSWERS.

Commutating-pole Motors.

D. C. M., Victor, Colo.: Explain the action of the auxiliary poles in a commutating-pole motor.

Answer.

The principles of the commutating-type motor were well explained in a paper by E. H. Anderson, read before the American Institute of Electrical Engineers and printed in the Western Electrician of August 31st last, page 169. Although the paper referred to railway motors principally, the action of the commutating poles is identical on motors of this type whether used for railway or general power purposes.

High-voltage Transmission.

G. A. E., Chicago: In speaking with a mining engineer recently I was told that there is an electric-power transmission plant in Montana operating at 400,000 volts. I have also heard of a plant in Switzerland using 350,000 volts. Are these figures reliable? Can you tell me where some of the highest voltage plants in the world are located?

Answer.

The inquirer's informants probably added an extra cipher to their figures for good measure. What is doubtless the highest transmission voltage used anywhere in the world is 75,000 volts on the lines from the Kern River plant No. 1 to Los Angeles, Cal., put in operation a few months ago. The Grand Rapids-Muskegon Power Company has operated lines for over a year from Big Rapids to Grand Rapids and Muskegon, Mich., at 72,000 volts. This company is also now completing lines from Croton Dam on which it is intended to operate at 100,000 volts. In no other country, it is believed, are these voltages exceeded or even approached.

Development of Turbo-generators.

Before a meeting of the British Institution of Electrical Engineers held in London on November 28th Dr. Robert Pohl read a paper on "The Development of Turbo-generators." The author said, according to the summary in the London Times Engineering Supplement, that, owing to the great improvements made in the construction of steam turbines, the electrical industry was confronted with the problem of designing dynamos suitable to be directly coupled to these high-speed prime movers. The difficulties might be said to have been satisfactorily overcome in the case of alternators, but there was admittedly much room for improvement in the construction of direct-current machinery. The speaker confined himself to a consideration of direct-current generators from the point of view of their electromagnetic design, in which the greatest obstacles to further improvement were encountered. His object was to show why certain outputs and speeds could not, at the present time, be safely exceeded, to define these output limits, and to indicate directions in which improvements might be expected.

With ordinary low-speed direct-current machinery the only electrical limit was that of sparking, but in high-speed machines a new factor had to be considered—namely, the flash-over limit. In this connection the maximum voltage per segment was the most important factor, and he suggested as a safe limit a voltage of 40. With regard to the commutation limit, the limiting factor here was the sparking, and, having determined upon that, it was possible to arrive at the highest possible output. For outputs above 500 kilowatts, it was not possible to construct direct-current generators running at so high a speed as the equivalent turbine demanded.

The importance of the subject was undoubted, as the successful production of direct-current turbo-generators suitable for much higher speeds would further reduce the steam consumption, and would exercise great influence on the choice of a system for central stations and power-transmission schemes. Regarding problems connected with the flash-over limit, improvements in commutator construction might prevent flashing-over, but there was no likelihood of decided improvements in the direction of increased flux unless means were found which would enable the armature to be lengthened without exceeding the flashover limit, and simultaneously without increasing the reactance voltage. This could only be accomplished, he believed, by a suitable armature winding, and he described a new winding designed with this object.

Mr. Gerald Stoney, in opening the discussion, said that a higher limit than the 40 volts mentioned by Dr. Pohl could be employed as a maximum voltage per segment with modern turbo-generators. Messrs. Parsons had made several two-pole machines for 550 volts with a maximum of about 49 volts per segment, which had been perfectly satisfactory. They had obtained much better results with two-pole machines than with four-pole. Two-pole machines were now being built with outputs of 1,000 kilowatts. He disagreed with Dr. Pohl that it was not possibile to construct direct-current generators for turbine demands for outputs above 500 kilowatts. His firm had made several, running at high speeds, including a 750-kilowatt machine running at 1,800 revolutions per minute, and a 1,000-kilowatt machine running at 1,500 revolutions per minute, and he had no doubt that limit would be raised. Mr. A. Ellis contended that if maximum economy were the deciding factor, the Curtis turbine was more suitable for continuous-current machines than the Parsons.

Mr. Miles Walker, regarding the problems from the user's point of view, said that the direct-current generator should possess certain characteristics. These included carbon brushes, the maintenance of balance, the abolition of shrunk-on rings, and the limitation of the voltage between commutator segments to 20. Prof. Gisbert Kapp said that a machine with commutating poles would not be satisfactory for commutating at overload. Mr. Stoney's method of a compensating winding worked satisfactorily, and with it a machine could be overloaded to twice its normal full load. Dr. Pohl had, however, made a successful attempt to give a broad view of the limits of output for turbo-generators.

Natural Gas vs. Electricity.[1]

By John T. Huntington.

The question of natural gas versus electricity is of as much importance to the company controlling both commodities as it is to the company controlling only one. The essentially gas man, who, in the old days, manufactured his product and sold it in the towns throughout the country, especially in Kansas, had a peculiar proposition on his hands, and where he was in competition with an electric-light plant, under the conditions existing until within a few years, it was about an even break between them. They both were charging high rates, and in many cases were both giving indifferent service. The quality and quantity of the electric light was not what it should have been. The quality and quantity of the gas was not what it should have been. The use of gas was confined almost wholly to lighting. There were some developments, of course, benefiting both alike; but the gas company was benefited by the introduction of the thorium mantle, and it also developed business by introducing gas for cooking. In this community there was not much use for artificial gas for heating, except in a small way.

Not long ago, when attention was attracted to the vast amount of natural gas available in southeastern Kansas and generally over the Indian Territory and parts of Oklahoma, new capital was attracted and came into the field and built distributing stations and systems, bringing the natural gas from where it is found to distant cities where it had not theretofore been available. The gas man in those towns was then up to the proposition of either changing his conditions and getting into line with the people who were bringing the gas to him, or going out of business. The electric men faced a serious competition. In some cases, of course, the interests were the same, but the fact remained that the electrical side of the plant faced that competition.

However, the use of natural gas changed the industry to such an extent that the lighting end is of little or no importance, and where it is followed and still used, it is of the most unfair competition. It is unfair because the price at which it is sold does not allow for just costs of production and distribution, even if it only took its proportion of the investment. It still, at the low price at which it is sold, would not return the interest and operating expenses. That I believe to be true, although I cannot say that I am fully posted as to the cost. However, the amount of gas used for illuminating is so small, and the other newer uses so great, that the importance of the lighting side of the gas business is relatively very insignificant.

I do not believe, even where the interests are separate, that the gas man cares a whole lot about the lighting end of the business. Of course, it helps to some extent, small though it may be, but it is very apparent that he could not support his business on it, because we know that in the summer months he probably does not sell enough gas for that purpose to pay the ordinary operating expenses.

The present situation with natural gas is this: The man who was going to pipe it into these various communities knew that the great use would be as fuel. He knew he could sell tremendous quantities of gas and that it would warrant a low price. He was not considering the price for lighting, he was not considering the use of it for lighting; but in many of the cities where old franchises had about expired and new ones were applied for, the people demanded that the price should be very low. The promoter of the company controlling the local situation was obliged to accede to that demand and work enough injustice in the lighting situation because of the greater amount of business he would get from the sale of gas as fuel. That is what has set the price in most of our cities at 25 cents or thereabouts.

I anticipate that the price of gas in cities where it is piped for great distances will never be less; probably will be more. Logically, it should be more. As greater quantities of gas are consumed, and it is developing at a rapid rate, the shorter will be the life of the supply. The history of all gas fields has shown that their life is comparatively short. The history of individual wells shows that they fail within a very short time.

Down in the gas fields, where they are daily seeking enough gas to keep their lines supplied, they constantly open new wells and constantly look for new territory, and they are taken farther and farther afield, and their expense constantly and gradually increases. New pipe lines must be laid. Pipe lines that have been laid for some time will deteriorate and suffer heavy depreciation, and everything tends to increase expense in operating, as well as investment, which will tend to raise the price of natural gas where it is possible to do so.

Considering natural gas as an illuminant, we know that a very large amount of brilliant light is generated with a very small consumption of gas; therefore, a very small amount of money is necessary to be expended by the consumer. However, that in itself is not sufficient. While you can light a room brilliantly with gas at a very low price, yet it has its disadvantages and disabilities which are of assistance to its electrical competitor. It is not my purpose to touch upon the particular disadvantages of gas except to show where the consumer will eventually realize them, and they will help to affect his judgment in the selection of an illuminant.

The first and most apparent disadvantage is the heat caused by large gas-light units, or even the smaller ones used in homes. In the summer time it is very objectionable. In a closed room in the summer time or in a space that cannot be ventilated, it is almost unbearable. That is universally recognized to such an extent that the electric-light companies have a certain class of customers who seek the electric service in the summer and change back to gas in the fall.

Next, there are a number of points where the use of gas produces harmful effect. I do not know the exact chemical analysis of the gas for by-products, but I know some of them and I know most of the effects. One element cast off is sulphur. That tarnishes all bright metal, especially silver. You can readily see the disadvantage in the house of having silverware blackening, and it does do so. In a jewelry store it is still worse. I do not say that no jeweler uses gas, but he very quickly realizes what he is up against when he uses gas.

Natural gas in combustion also casts off a great deal of water. That has a very marked effect on woodwork. I have seen furniture in stores where they use gas liberally, nice oak chairs that had glued joints, and other nice furniture, that had been exposed to it for a brief time, with the joints all open and the value of the furniture destroyed. That man could begin to see that natural gas is not what he should have as an illuminant.

In the case of a harness store, when talked to on the subject of using gas or electric light, the man said, "While my electric-light bill is considerably more, yet it is up to a choice of whether I will pay more for my electric light or go on oiling the harness." The effect of the fumes or by-products on leather is to deprive it of the oil remaining in it and make it brittle and harsh, so it will crack.

It also has some disadvantage in that in the winter time, when rooms are more closed than in the summer time, house plants almost generally will not thrive, and usually will die. It has been known to affect the life of a caged bird, probably because it was stationed at a fair height, where it got a greater effect from it.

Of course, we all know, there is a very considerable danger element in the use of gas, and yet that should be well guarded against, because we want to use it for cooking, etc., and the installation should be such that there will be little or no danger from it. There are other dangers, however, in that there is very little odor from the gas as it escapes and is not burned. There is another danger from the burned products that escape when gas is being used in quantities, as in a small stove. If it hasn't a good pipe connection to a flue or chimney to give it ventilation, and the room is closed up, it is absolutely certain to either make one very sick or cause insensibility.

I am only commenting on these matters. There are gas men here as well as electric-light men. I do not think any electric-light man makes it a point to shout about the dangers of natural gas. I have simply touched upon these disabilities of natural gas, to turn to the other side and point to the advantages of electric light. I almost might say that the one great advantage of natural gas is its small cost, and there is nothing else. On the other hand, I might turn to electric light and say its one great disadvantage is its cost, and nothing else. You can recite just as long a list of advantages of electricity in illumination as you can disadvantages of gas for illumination.

Generally speaking, our prosperous American people want the best they can get of anything. We know they always want a good water supply. We know they will patronize the best musicians. It is notable that the American people are always well dressed; they buy as good clothes as they can afford; and so it is with illumination. If they can possibly afford the amount, they will buy electric light. Rates in the past have been high, and the field enlarges as they are being lowered—and they have been lowered and are being lowered constantly in cities all over the country.

The people want good light, and it is almost universally conceded that the electric light is the best light. Its conveniences are almost too great and too well known to be worth while setting forth. It is clean. It generates very little heat. It casts off no by-products of any kind, and it seldom ever can escape in such a way as to be dangerous. All electric systems are so arranged, and the very character of electricity is such as to lend itself readily to safety devices. Probably a short-circuit may cause a small amount of damage just at the instant and before the rush of current can blow the fuse, but that is rare. Under good inspection of electric wiring, which is closely looked after by insurance people, the element of danger is very low indeed.

I would suggest to the gentlemen who are handling both gas and electricity that I think if they will make the rates for their electricity, particularly for the lighting, as reasonable as possible, rates that are fair alike to the company and to the consumer, and then give first-class service, the effect of the cheaper gas which they handle will very soon die away. The improvements in electric lamps that we have heard about are such that when we get the full benefit from them, we will no longer fear the competition of the cheap gas.

In Topeka, where the interests are separate, those who control the electric-light company made very large reductions in rates, and while the situation has many points which might be bettered, it is going to work itself out. In the residence field we have not lost any business whatever through the competition of natural gas; in fact, our business has increased. It is greater today than it ever was. In the commercial field there is a greater chance for loss, but in that, too, I think in a very short time we will gain in a way that will effect any loss there may have been.

The man who controls both products owes it to himself not to carry on an unfair competition, but he is almost prevented from changing the present conditions. The unfair side of the competition of natural gas, as I said before, is that it is sold at less than its cost of delivery, and in addition to that the distributor is giving away light of a very great value which cannot be produced by any other method at the cost at which he is offering it, which of course produces a very bad effect on the other classes of illuminants. You can cite many parallel cases, such as if there were a number of kinds of sweetened food, and the grocer, because of the volume of business in staple groceries, should elect to sell sugar at a quarter of a cent a pound. Nobody else dealing in sweetened products would feel that he was fair. He would be giving away a very valuable thing for less than its cost.

I have said a great deal more than I intended. I am not sure that you appreciate my point of view. We are not worrying at all in Topeka about natural-gas competition. In the first place, we have to put up with it anyhow, and in the second place, it really seems to me that, having had the electric light first at high prices and with a certain class of service—I will not say it was good or bad, because I do not know; I think it was good; my predecessors were reasonably successful in administering the business, and I presume they gave good results—the people will be satisfied and pleased with conditions as they exist now. When the gas came these other conditions were all fixed, and the gas itself was a new thing. People took hold of it eagerly and saw nothing but the advantage of the price. Now, after two years of experience, we find that they are getting better and better educated and begin to realize that it is not alone price which is to be considered. Therefore, I think the electric-lighting field is fully as promising as it has been, and that the changes that are going on, in business methods as well as in the technical side of the business, are such that electricity will more and more monopolize the field of illumination.

[1] A paper read before the Kansas Gas, Water and Electric Association at Topeka on October 10, 1907. The author is manager of the Topeka Edison Company.

Prices of Electricity and Gas in Rio de Janeiro.

Deputy Consul-general Joseph J. Slechta writes that the completion of the large power plant which is being constructed some 40 miles from the city of Rio de Janeiro will greatly facilitate the development and extension of the electric-railway system of the Brazilian capital, and it is expected that it will also bring about an immediate reduction in the price of electric lighting, both public and private. The present cost would be regarded as high in the United States. The charge for gas is about 8.45 cents per cubic meter. Electricity for ordinary private consumption costs for lighting purposes a little more than 21 cents per kilowatt-hour, and for power purposes the small consumer pays as high as 11½ cents per kilowatt-hour, the charge diminishing to a minimum of perhaps five cents. The city pays about two-thirds of a cent per lamp per hour for its gas illumination and approximately 15 cents per hour for its electric arc lamps. Inasmuch as the gas supply of the city is controlled by the same corporation which furnishes electricity, and is soon to have the advantage of an economically operated power plant, there is considerable interest as to how favorable the new price schedules will be.

The Great Northern Railroad has placed orders for four 100-ton electric locomotives to be used in handling its trains through the Cascade tunnel. This tunnel is bored through the Cascade Mountains east of Seattle, Wash. The tunnel is three miles in length and on a two per cent. grade. It is partly to obviate the nuisance and danger from high temperatures and locomotive gases that the electric service is being installed.

SELLING ELECTRICITY.

Under this heading will appear, from time to time, articles, suggestions and examples which will be of assistance in the constant effort to increase the existing demand for electric current and to create new demands.

Illinois Has a "House Without a Chimney."

Mr. F. M. Sinsabaugh, manager of the Carrollton (Ill.) Heat, Light and Power Company, has built for himself a house without a chimney, said to be the first in the state. The house, which is not quite completed, is to be heated by steam from the near-by central-station plant, while the cooking will be done by electricity.

The new residence, as the Western Electrician learns from the Carrollton Patriot, is 34 by 30 feet, two stories, with attic and basement, and has eight rooms on the two main floors. It is built of cement blocks, and its architecture is of the plain, substantial Mission style. It has a front porch 32 feet wide and eight feet deep.

In the kitchen the principal article of furniture will be one of the General Electric Company's cooking cabinets, finished in antique oak. It is fitted with two electric lights, seven switches and the following cooking utensils: Two-quart cereal cooker, four-quart teakettle, coffee percolator, 10-inch frying pan, broiler, griddle and four-quart vegetable cooker, all of aluminum ware. There is also a metal oven for baking. The cost, at Carrollton meter rates, of current for cooking for a family of five persons is estimated at $3.50 a month.

There are pressed steel steam radiators in every room. In the bathroom is a tank heated by steam pipes, and in each of the sleeping rooms upstairs is a bowl to which is conveyed both hot and cold water.

The electric-light fixtures, instead of being wrought in metal, will be fashioned in wood, in designs harmonizing with the Mission architecture of the house.

The house combines more features of the Twentieth Century home than perhaps any other in Greene County. Mr. Sinsabaugh has expressed, in a practical way, his own faith in the ability of the plant to keep his household comfortable and cook his meals. To build a chimney-less house is the strongest possible expression of confidence.

The Rate Question in Minneapolis.

Controversy has arisen over the rates to be charged in Minneapolis for electric current produced from recently developed waterpower plants. Mr. Edward P. Burch, the consulting electrical engineer of that city, proposes a compromise between the low flat rates proposed by the city and the higher rates on the maximum-demand system of charging which are offered by the Minneapolis General Electric Company. His views, which will be read with interest even by those who may disagree with them, are given below.

Any electric supply company must first make a heavy investment. Directly or indirectly, the customer must pay interest, depreciation and taxes on that investment. The electric company, secondly, must produce and deliver electricity, and receive the operating cost, plus some profit, to make the business attractive.

The investment is ordinarily from $60 to $160 per maximum kilowatt sold. For example, if the electric company's total investment in Minneapolis is $5,000,000 and for Taylor's Falls will be $3,000,000, or a total of $8,000,000, with this investment they should deliver to customers 7,500 kilowatts from the Minneapolis plants and 14,500 from the Taylors Falls plant, or 22,000 kilowatts to the customer, as a maximum, and have ample equipment in the system for reserve. This is practically the situation locally.

The replacement value may be $160 per maximum kilowatt to be delivered to customers.

The cost of producing electricity in the ordinary case, is less than one cent per kilowatt-hour sold to the customer. Another cent is required to deliver the power and conduct the business, making the total cost two cents per kilowatt-hour, delivered through the customers' meters.

Allowing eight per cent. for interest, five per cent. to reserve for the depreciation of the distributing and power plant, and two per cent. for taxes, insurance and other fixed charges, we have a total of 15 per cent. This is a fair return to the company for getting ready to handle business. This is 15 per cent. per year on the $160 invested, or $2 per month per kilowatt capacity sold.

In addition to the above $2 per month for fixed charges, we have the operating expenses—two cents per kilowatt-hour for electricity metered for light and power service.

This is the correct basis for rates. It is a simple plan. The figures used are approximate. The actual replacement value per kilowatt capacity can best be determined by a simple appraisal. Our city engineer can review the company's records.

Twenty common lamps when burning require one kilowatt capacity. A one-horsepower motor requires one kilowatt capacity. If this capacity is used for one hour, we have the unit of electric power—the kilowatt hour.

An example of the application of these rates is simple: An ordinary home has 20 lamps. The fixed charge is $24 per year per kilowatt, making a total of $2 per month. One lamp uses 50 watts, or .05 kilowatt of energy. Ten lamps burning six hours per day require three kilowatt-hours, or 90 kilowatt-hours per month, which, at the rate of two cents per kilowatt-hour, would be $1.80 per month for electricity. The total bill would be $3.80 per month.

Many residences having 20 lamps use but 10 as a maximum, even during the winter season. A reduction in the rates could be made because of this decreased maximum capacity required from the electric station.

There is a simple meter, known as the Wright meter, to register the maximum kilowatts. There is an accurate meter, known as the Thomson meter, to measure the kilowatt-hours.

There are only a few cases where the rate can be changed from the above basis without discriminating in favor or against customers. If light or power was used in large blocks or under favorable conditions of distribution, there should be discounts to compensate for the decreased cost of distribution and production, and the decreased investment per unit sold.

The company must abandon its idea to limit the general use of electricity by insisting on high prices and payments on a complicated maximum-demand rate system. The representative of the City Council must get away from the flat-rate system, which is equally wrong and discriminaing.

Day Service in Small Towns.

By F. H. Plaice.

It would seem unnecessary in the present progressive age to be called upon to defend the operation of a 24-hour service in small towns, but there are still many central-station men who cannot see that they are not only neglecting good business opportunities but are also sowing the seeds of competition and municipal ownership, and that soon after the sowing comes the reaping—a very unpleasant time indeed.

An electric company operating in a small town has an opportunity for doing good to its community and to itself that cannot be equaled by the large city company, yet the opportunity is nearly always overlooked.

The writer has had his attention called to a little city of some 5,000 inhabitants where the non-progressive company was practically forced to furnish a customer with motor power and arranged to purchase his current from a local trolley line, making no further efforts to secure additional load so as to justify its furnishing light to its customers in the daytime. Gasoline lighting has been making heavy inroads into its lighting business, yet the company cannot see that it is missing a golden opportunity to prepare for the time, a couple of years hence, when it will be compelled to ask for a new street-lighting contract. The merchants are talking about a new lighting company and the taxpayers in general are discussing a municipal plant, all because they cannot get service from the present company at necessary hours.

The manager of an operating syndicate, operating a string of northern Ohio plants, told the writer that after he had placed a copy of the new-business day papers of our Washington convention in the hands of one of its small plant managers, that manager had awakened to the possibilities of his town and had secured enough motor load (nearly 100 horsepower) to justify a day service the coming spring. This man told his employers that he had never realized the amount of power that could be developed by simply picking up the small power customers that are extant in every town and village.

Another case was in a small western city, where a company, after seeing its earnings go backward for three years, called in a new-business agent for consultation. The management assured the agent that the town was entirely without opportunities for developing power load, outside of two printing offices, and that a day service would not be maintained by the lighting customers. The company operated its plant from dark to midnight, had very profitable street-lighting and water-pumping contracts, both of which had but a short time to run, and was being literally driven from the interior-lighting work by two live gasoline-machine agents. Ten days' work in the town secured for the company 25 motor customers, totaling over 100 horsepower, one of them being a $100 per month proposition.

The writer is firmly of the opinion that any town that can justify an electric plant will supply at least 100 horsepower of motors for the electric company, unless there is some good reason (as, for instance, private waterpower) why such load cannot be secured profitably.

The fan service of a community should pay an operating company at least $200 per year per 1,000 inhabitants, and flatirons twice or three times as much.

The average lighting customer will gradually make more and more use of electricity in dark corners, with the result that his monthly bill will show an advance of often 50 per cent. over the same month on a night service.

There is also the customer with whom no night operating company can do business, for the reason that he must have day service, and not infrequently in this class come large stores that have been compelled to install their own lighting plants at much higher cost for lighting than the purchased service would amount to, who would gladly abandon their own plant did they but have the opportunity.

All in all, the question of a day service as against a night service only is one deserving of the most careful consideration, and any company that can secure contracts to cover one-half the additional cost of such operation is very conservative indeed if it does not take the risk and try the experiment.—N. E. L. A. Bulletin for December.

Electric Heating in a Grand Rapids Hotel.

Not many hotels make provision for electric heating, so that perhaps the Eagle Hotel in Grand Rapids, Mich., the proprietor of which has arranged to heat all the rooms on the second floor by luminous electric radiators, has achieved a unique distinction. Current is furnished by the Grand Rapids-Muskegon Power Company, and the wiring was done by the M. B. Wheeler Electric Company. In each of the 27 rooms of the second floor a General Electric luminous radiator has been installed. In addition to this, the house is equipped with a steam-heating system, but the electric radiators will be an auxiliary comfort for guests during the coldest months of winter and on cool days in the fall and spring, when the large heating plant may not be in operation.

MANTEL WITH LUMINOUS ELECTRIC HEATER.

Luminous electric heaters, with their simulation of the comforting glow of an open grate, are attractive as well as useful. They consist of an ornamental iron frame finished in nickel or oxidized copper, and fitted with a polished reflector, in front of which are three large cylindrical incandescent heaters or glowers. These heaters are 10 inches long and three inches in diameter, designed primarily to give heat, but also showing a pleasing amount of light. The radiators are portable, and may be moved from room to room, or they may be permanently installed in a fireplace. They may be operated from an ordinary lighting-circuit outlet, although a special heating circuit is probably preferable. One advantage is that the heat radiation is almost instantaneous with the turning of the switch; there is no waiting for the fire to burn or for the steam to come up. Another feature is that there is no waste heat; the current is turned on only when wanted.

Mr. J. K. Johnston, the proprietor of the hotel, says that he knows of no device better calculated to make guests comfortable and happy. This gentleman is over eighty years of age, but he is progressive and enterprising. He was one of the first hotel-keepers in Grand Rapids to install electric lights in his house, and now he lights his dining room with tantalum lamps. The refrigerator room in the hotel is arranged so that the lights within are turned on by the opening of a door and extinguished by closing it.

An interesting application of the luminous radiator is in the electric grate and mantel, illustrated herewith. This is manufactured by the Rathbone-Panigot Company of Grand Rapids and is a handsome piece of furniture. The grate consists of the ordinary facing with polished copper reflector, in front of which are placed three of the radiator lamps. These lamps fit into sockets placed in condulets, so that the wiring is complete and safe. Each radiator takes from 750 to 1,000 watts.

Indiana District Telephone Meeting.

The members of the Indiana Independent Telephone Association for the Sixth District, which comprises the southwest portion of the state, held their quarterly meeting at Terre Haute December 12th. J. H. G. Klinger, vice-president of the association and president of the Citizens' Telephone Company of Brazil, presided, and Jesse W. Weik of the Greencastle Telephone Company acted as secretary. Every company of the district and 10,785 telephones were represented.

Secretary Weik reported that one year ago the Independent and Bell companies had about an equal number of telephones in use in Terre Haute and Vigo County; today, he said, the Independents have 3,654 and the Bell nearly 1,900 telephones in use, a net gain of 100 per cent. for the Independents, while the Bell has 400 fewer telephones than a year ago.

Discussion of "Equitable Rates" was opened by J. H. G. Klinger, who said that the needs of the several communities where telephone service is given are not alike, and for this reason telephone managers should endeavor to provide a service that meets the requirements and comes within the ability of the people of that community to pay for. In sparsely settled districts or suburban towns, he advised the one, two and four-party-line service at a reduced rate.

W. H. Harbaugh, manager of the Sullivan Telephone Company, discussed the subject of "Limitation of Free Service." He said that the high cost of materials and labor connected with the construction and maintenance of rural lines precluded the giving of free service to patrons on such lines. All should be under a toll-line rate, and such lines should center at the county seat. The flat-rate service should be limited to the immediate territory.

It was decided to take steps toward the establishment of a toll-line clearing-house association for Indiana. The district association passed a resolution requesting the officers of the state association to open headquarters in Chicago during the meeting of the International association. J. G. H. Klinger of Brazil and W. W. Harbaugh of Sullivan were elected delegates to attend the Chicago convention. The meeting closed with a dinner at the Terre Haute House, under the hospitality of the Terre Haute Telephone Company.

GENERAL TELEPHONE NEWS

The Iowa Telephone Company will soon install a new switchboard at Oskaloosa, Iowa.

The Kensington Telephone Company of Kensington, Minn., has been incorporated with $10,000 capital stock.

The Montpelier Telephone Company of Montpelier, N. D., has been incorporated with $5,000 capital stock.

The Western Telephone Company of Sawyer, N. D., recently filed articles of incorporation with a capitalization of $50,000.

A stock company is being organized at Trezevant, Tenn., to establish a local telephone system. B. H. Hillsman is interested.

The De Kalb County (Ill.) Board of Supervisors has granted the Exchange Telephone Company a franchise to do business in the county. Work will be begun at once to establish the lines throughout the county.

The Breckenbridge (Minn.) Telephone Company has filed articles of incorporation and will install a local exchange. This is the outcome of the announcement of the Northwestern Telephone Exchange Company to raise its rates.

A telephone system has been recently installed in Hangchow, China. Tall poles, towering above all the houses, have been put up throughout the city, and telephones are being installed in the official buildings, schools, shops and residences. The charges are said to be very low.

CORRESPONDENCE.

Great Britain.

London, December 6.—Several new types of brakes have been brought out as the result of the sittings of the committee appointed by the Tramways and Light Railways Association, in conjunction with the Board of Trade. A large number of new designs have been examined by a sub-committee of the main committee, but that which gives most promise of an efficient and useful brake under almost all conditions was one tested last week at Leeds. The principle of the brake, which is a product of the Leeds tramway department, is that the drag of electromagnets or main track blocks is utilized by suitable mechanism to press auxiliary track blocks on the rails, instead of on the wheels, as hitherto. The tests referred to above were carried out in public and the results may be said to have been, first, that the brake was practically non-skidding; second, that the current and electromotive force in the motors was reduced to such an extent (about five amperes per motor to coast a 1 in 9 grade) that electromagnetic braking for service stops was permissible, even on hilly routes, and third, that by arranging to apply the pressure to the main blocks manually, a semi-power brake is obtained which renders the control of the car by manually applied track brakes possible for service purposes without the use of springs or other devices to obtain large power quickly. In the event of failure of current or trolley coming off, then recourse must be had to the manual operation of the track brake. All the tests were made on a hill having a grade of from 1 in 8.4 to 1.96.

It is now known definitely that the London County Council will not promote a bill dealing with electric power supply in the next session of Parliament, and therefore the controversy this session will resolve itself into a fight between a combination of the existing electric-lighting companies and the promoters of a new company, who will work more or less upon the lines of previous similar propositions.

The arrangements for the electrical exhibition which is to be held in Manchester next autumn are now taking definite shape and some twenty local authorities have signified their intention of supporting it. Meetings of the trade are to be held next week in Manchester and London to appoint committees, and so forth. Sir William Preece will preside at the London meeting.

A large order for electrical plant, amounting to some $150,000, has just been placed with Johnson & Phillips of London by the Hankow Waterworks and Electric Lighting Company of Hankow, China. The plant is for a complete generating station of 1,500 kilowatts capacity. This is stated to be the first case in which Chinese have formulated such a scheme and carried it through with native capital.

It is said that the Colonial Office has accepted a radio-telegraph scheme for the West Indies, put forward by the West India and Panama Telegraph Company, between Georgetown (British Guiana) and Port of Spain (Trinidad). The system will be supplementary to the existing submarine cable service.

A system of electrical signaling on the cabs of locomotives has been in use upon the North Eastern Railway for some years, but until now no particulars have been published. The system is designed to collect indications by the rubbing of metallic brushes carried on the engine, over metallic bars placed on the line. This method of collection is not essential to the system, since it is capable of being operated, equally well without contact, by causing electromagnets on the line to influence magnets on the engine. The rubbing contacts, however, have been adopted. The system is one which uses visual and audible signals on the engine. Besides these indicators, the instrument carried on the engine includes a visual "failure" indicator, with which the condition of the apparatus can be gauged. In addition to these systems of signaling between the signalman and the locomotive driver, experiments are being carried out (in order to reduce the cost) to give the signal, not on the locomotive, but at a post on the roadside. A strong feeling is also current that any system of this character to be universally adopted by the railroad companies must include a means of stopping the engine should the driver overrun his signals. G.

Dominion of Canada.

Ottawa, December 14.—The City Council of St. Thomas, Ont., has decided to submit a by-law to the ratepayers to raise $42,000 for a Niagara power-distribution plant.

A movement is on foot to run an electric railway across the St. Lawrence River on the ice this winter between Montreal and Longueuil. It is thought that by providing a motor car and trailer a satisfactory and profitable service can be given, and by keeping the ice thoroughly tested and stopping in time in the spring, any danger of accident will be avoided.

The directorate of the Montreal Light, Heat and Power Company is considered one of the strongest in the country, comprising, as it does, leaders in the financial, commercial and industrial world of Canada. The statement is made that, notwithstanding the fact that the company increased its dividend to six per cent. this year, there is every reason to believe that it will carry a larger surplus to the reserve account for the year ending April 30th, next, than that of last year. It is said that the company would be justified in increasing its dividend, next spring, to seven per cent.

Representative bodies of the towns of Cobalt, Latchford, Haileybury and New Liskeard, and of Coleman, Bucke and Dyment townships, held a convention for the purpose of deciding to whom should be granted the electric railway for New Ontario. The franchise was voted to the electric-railway company in which Judge Stone of Cleveland, Ohio, is interested. The stretch between Cobalt and Liskeard is to be started before July 1st, and completed within the year, to cost $350,000. W.

New York.

New York city, December 14.—The city's lighting bill this year will amount to nearly $4,000,000. On Tuesday bids were opened for the lighting of the city next year and they were much the same as for the present year. Arc lights will cost the city $100 each for the first 5,000 lamps and $95 for each additional lamp. When the number reaches 7,000 the price of all such lamps per year will be $95 each. Incandescent lights will cost $22.50 each all over the city; current for heat and other purposes, from 7½ to 10 cents a kilowatt-hour, and current for power, six cents. Bids were not received for supplying gas, the city will pay 75 cents a thousand feet pending the decision of the courts in the suit of the city against the gas companies. It is probable that the Welsbach company and its allied companies will get the contract for the mantle lamps and the Edison company will furnish the other lights.

Representatives of various lighting companies in and about this city and Commissioner Maltbie of the Public Service Commission held a conference on Tuesday on the question of a uniform system of accounts and a special form of annual report. Robert A. Carter, vice-president of the Consolidated Gas Company, and Henry M. Edwards, auditor of the Edison company, did most of the talking for the companies, while Adna F. Weber, chief statistician of the commission, aided Mr. Maltbie. It was unanimously urged by the representatives of the gas and electric companies that the commission permit the committees on uniform accounting of the National Electric Light Association, the American Gas Institute and the Empire State Gas and Electric Association to submit to plans for uniform accounting methods and reports to be adopted by the commission. The commission indicated a desire to co-operate heartily with the accounting committees of the several associations in the way of devising accounting systems and forms of annual reports that would be acceptable to the lighting companies, and that would be in the interests of uniformity, not only throughout the state but throughout the nation in so far as they would represent the views of both the National Electric Light Association and the American Gas Institute. The conference adjourned subject to call.

The committee on uniform accounting of the National Electric Light Association held a meeting on Monday and considerable progress was made in formulating a simplification of the system outlined in the report presented at the Washington convention for the use of the smaller companies that have not facilities or do not need to keep their accounts on so extensive a scale. This committee is doing very earnest work.

There will be an exhibit of automobiles at Madison Square Garden beginning on December 28th. The show will be restricted entirely to foreign machines represented in this country. It is expected that 20 makes of well-known European machines will be displayed, including the best automobile products of France, England, Italy, Switzerland and Austria. Carlton R. Mabley is manager of the Importers' Salon, under whose auspices the exhibit will be held.

The first official execution in New Jersey by electricity took place in the state prison at Trenton on December 11th. The execution was in charge of E. F. Davis, state electrician of New York. Eighteen hundred volts were turned on and the contact kept up for a minute and eight seconds; death, however, was instantaneous.

The Public Service Commission decided on Tuesday that when a street-surface road holding a certificate of convenience and necessity to construct a road fails to begin actual physical construction work within two years the commission may at its discretion annul the certificate. Surveys and engineering work done before the granting of the certificate are not sufficient. This decision affects about 40 roads which have not begun construction within the time limit. Steam railroads are not affected.

A penalty of $500 a minute is imposed in a contract signed Monday with the New York Edison Company if the company fails within three minutes after a fire alarm is given to furnish adequate power to operate the city's new high-pressure water mains between Chambers and Twenty-third streets. John H. O'Brien, water commissioner, has made a contract with the Edison company to supply the necessary power to operate the mains. The power will be delivered to the two pumping stations which have just been completed. The power contracted for must be sufficient to furnish a pressure of 400 pounds to the square inch—the greatest pressure used in any fire mains in the country. The 60 miles of mains have been laid at the rate of five miles a month. Though originally designed as an auxiliary service in which salt water would be used, it is doubtful if salt water will be used at all in the mains. This system has cost $2,500,000 and will furnish protection to the wholesale dry-goods district. W.

Michigan.

Detroit, December 14.—The Utica Electric and Water Company has been organized, and it is expected that Utica will be given electric-light service within 60 days.

The Detroit Public Lighting Commission has arranged with the Edison Illuminating Company for an extension of the street-lighting service in Fairview, which has been annexed to Detroit. The city will make the extensions to the company's lines, and the company will operate and maintain the additional arcs at the average cost of other city lights. The company has a contract with Fairview which has four years yet to run.

The Detroit Public Lighting Commission has appointed two new inspectors of inside wiring.

William E. Baubie, who has asked the Detroit Council for a franchise for the Detroit Traction Company, has decided to hold the matter up until the amendment before the constitutional convention limiting the term of street-railway franchises to 15 years is acted upon. He says that he and his associates will not accept a 15-year franchise.

A telephone company has been organized at Coleman. An exchange will be located at Coleman, with farmer lines radiating in all directions. There will be toll service with the Michigan State Telephone Company.

The Escanaba Common Council has accepted the proposal of the Escanaba Electric Pulp and Power Company to furnish power for the operation of the municipal lighting plant for a period of 10 years. The company will complete its plant at Flat Rock on the Escanaba River by July 1st, and furnish power until July 1, 1918. The company agrees to any expense over $4,000 that is necessary to use the new power, and will furnish current suitable for present street lights until the city is able to install an alternating-current system. D.

Indiana.

Indianapolis, December 14.—The first special or private freight car to be used on an interurban road in this state is in service on the Fort Wayne and Springfield Traction Company's line, by the Decatur Packing Company. The car was constructed by the traction company for the packing company, which has branch stations at Fort Wayne and other towns on the line.

The Terre Haute, Indianapolis and Eastern Traction Company reports a net increase in the tonnage of freight handled last month of 876,820 tons, with an increase of $1,720, and this with a reduced rate of from 27 to 18 cents.

The American Engineering Company, with offices in the Traction Terminal Building, Indianapolis, reports an unusual increase in the number of requests for information and the making of estimates for electric roads to be built next year.

Mayor Bookwalter of Indianapolis has given out the statement that the population of Indianapolis has increased from 178,000 to 235,000 during the last few years, and claims that the rapid increase is due to the building and operation of interurban roads with the city as its unit, more than to any other cause. He said that interurban statistics showed that the Indiana interurban lines carried nearly 15,000,000 more passengers in 1906 than during the previous year, and that the same lines are paying annually more than $2,500,000 in wages to employes.

The Supreme Court has passed favorably the second time upon the act of 1905 which provides that a town board may require steam and electric railroads to provide lights at crossings.

It is reported that the Gary Traction Company of Gary, Ind., has placed an order with the Danville (Ill.) Car Manufacturing Company for 60 new cars to be used on the Gary system as soon as completed.

The advocates of municipal ownership have brought an injunction suit to prevent the sale of the Washington municipal electric-light plant, which was advertised for December 16th. The complaint alleges that a sale at this time would only be made at a great sacrifice to the city's interests, and asserts that a large percentage of the voters do not want the sale made. This action will probably delay the receiving of bids and the sale of the plant temporarily. A few months ago the voters decided not to expend a given sum upon the plant for repairs and improvements and ordered the plant sold. S. S.

Northwestern States.

Minneapolis, December 14.—W. B. and D. C. Jackson, employed by the Minneapolis City Council to ascertain the value of the Minneapolis General Electric Company's plant and system in Minneapolis, reported to the special council committee that a new system could be constructed to duplicate the present system at a cost of $5,000,000. The report took no cognizance of the company's expenditures on its system, but was merely an estimate of the cost of a new system at the present time.

The new power plant on the White River near Ashland, Wis., has been placed in operation and connected with the Ashland Lighting Company's lighting system.

The Crookston (Minn.) Water, Power and Light Company has begun work on a large dam 12 miles from that city, which will furnish about 20,000 horsepower. The work will cost about $200,000.

At the same time that the proposed ordinance granting a 25-year franchise to the Minneapolis General Electric Company is introduced in the Minneapolis City Council, a similar ordinance will be presented for the Minnesota Trolley and Power Company, which has resumed activity.

Frogner Bros. & Sons' electric-light plant and planing mill at Iola, Wis., was destroyed by fire. Loss, $5,000.

The Dakota Power Company has taken over water rights in the vicinity of Rapid City, S. D. and will build a light and power plant with a capacity of 1,600 horsepower. R.

Pacific Slope.

San Francisco, December 11.—An opinion was given last week by Attorney-general U. S. Webb denying the application of John Agar for permission to maintain an action in the name of the state of California against the Home Telephone Company of San Francisco for the purpose of having the franchise, granted in 1906, declared void and canceled.

The Northern Electric Railway Company has filed a certificate of increase of bonded indebtedness to $25,000,000, the money to be used for general development and improvement purposes.

The Pacific Power Company's assessment of seven cents per share became delinquent November 30th and the sale day is set for December 21st.

M. H. Fisher is completing a 2,200-horsepower plant in Fresnal Canyon, near Alamogordo, N. M., the power to be transmitted to the surrounding country and used largely for pumping.

The Lupoyoma Development Company has acquired a controlling interest in the Lake County Electric Power Company and the Kelseyville National Gas Company and will use the gas to run the power plant. George P. Low of San Francisco has acquired the interest of A. H. Spurr in the three companies and R. T. Polk of Upper Lake, Cal., has taken over H. V. Kelling's interest. Orders have already been placed for part of the machinery and poles.

George B. Brookings of St. Louis has a plan for establishing at Venice, Cal., a factory for the manufacture of incandescent globes using a patent mechanical pump. The expenditure is estimated at $50,000.

The Visalia electric railroad of Visalia, Cal., expects to have its line in operation by the first of the year.

The Santa Rosa Telephone Company will install a telephone system at Los Tranos, Cal., to connect with the Santa Rosa exchange.

Frank H. Short of Fresno, Cal., has gone to Washington to present to the Department of Agriculture the mountain power-plant companies' side of the matter of concessions in the Sierra forest reserves, claiming that unless restricted concessions are granted covering development work all power companies now nearing completion of their plants will be compelled to abandon their projects.

C. F. Shrader of Los Angeles has been granted a 50-year franchise, and the poles and wires are already up, in the town of Needles, Cal., where he will operate a lighting system.

A franchise has been granted for the Home Gas and Electric Company of Redlands, Cal., to erect poles and wires over the county roads between Redlands and San Diego in order to connect its plant with that of the Lytle Creek Company of the latter city. A.

PERSONAL.

Mr. J. P. Jackson, professor of electrical engineering at Pennsylvania State College, has been appointed dean of the school of engineering.

The following-named gentlemen, formerly associates, have been transferred to the grade of membership in the American Institute of Electrical Engineers: James William Fraser, Charlotte, N. C.; Arthur W. Henshaw, Pittsfield, Mass.; George Eugene Wells, St. Louis; Fay Woodmansee, Chicago; William Corin, Launceston, Tasmania, and Van Rensselaer Lansingh, New York.

Mr. Charles N. Wilson announces his resignation as president, general manager and director of the American Engineering Company of Indianapolis, to take effect January 1st.

Mr. C. A. Tupper, advertising manager for Allis-Chalmers Company, Milwaukee, was in Chicago this week, attending the cement show, in which his company, as one of its many activities, is interested.

Mr. A. L. Waterbury has resigned his connection with the American Conduit Company, taking effect January 1, 1908. Mr. Waterbury has entered into business enterprises of his own which require so much of his time and attention that he finds he cannot longer neglect them, and consequently severs his connection with the company to look after his own personal business. In an announcement of the resignation the American Conduit Company acknowledges to its friends and customers its appreciation of a long and pleasant connection with Mr. Waterbury and, with all his other friends, wishes him every success in the enterprises in which he is now engaged.

On December 14th Mr. H. W. Clapp was tendered an informal luncheon at the Engineers' Club, New York, by some of his business friends. Mr. Clapp has recently accepted a position in the electrical organization of the Southern Pacific Company, and will shortly remove to San Francisco, so that his friends took this occasion to express their regret at his departure from New York and to wish him success in his new field. Among those present were W. J. Clark, manager traction department, General Electric Company; T. Beran, manager New York office, General Electric Company; J. G. Barry, manager railway department, General Electric Company; W. B. Potter, engineer railway department, General Electric Company; A. R. Whaley, general superintendent Electric Zone, New York Central and Hudson River Railroad Company; C. L. Bardo, superintendent Electric Zone, New York Central and Hudson River Railroad Company; F. V. Greene, Westinghouse Air Brake Company; A. H. Sisson, St. Louis Car Company, and several others. During the five and a half years he has spent in and about New York, Mr. Clapp has been engaged in some of the most important electric-railway propositions as special representative of the railway engineering and construction departments of the General Electric Company. He is a son of F. Boardman Clapp, managing director of the Melbourne (Australia) Tramway and Omnibus Company. Before coming to America he was for four years superintendent of motive power of the Brisbane Tramways Company, Brisbane, Australia.

ELECTRIC LIGHTING.

W. H. Price and others contemplate installing an electric power plant in Forsyth, Mo.

The city of McKinney, Tex., has voted $26,000 for extension of the electric-light and water system.

W. W. Cook & Son. of Muskogee, Okla., have the contract to construct an electric plant in Pawhuska, Okla.

The Beaver Crossing (Neb.) Electric Light and Power Company has been incorporated with a capital of $20,000.

The city of Clinton, Okla., has granted an electric-light and power franchise to F. Murch of Hennessey, Okla.

A recent election in Dadeville, Ala., resulted in favor of $10,000 electric-light improvement bonds. Only $7,500 will be floated at present.

L. S. Jenkins and associates, who have been granted a franchise for an electric-light plant in Central City, Neb., will begin work soon.

The Kanawha Water and Light Company of Charleston, W. Va., asks the public, through advertisement in the local papers, to advise it promptly of any failure to receive proper service, which, by reason of new and up-to-date equipment, it is prepared and wishes to give.

The McLeod Electric Light Company of McLeod, Alberta, will install the plant in Frank, Alberta, which was formerly in use at McLeod, where a new plant has been equipped. The Rocky Mountain Portland Cement Company has also made application for a franchise to light the town and supply power in Frank, but at a meeting of the Municipal Council it was decided to see what kind of a service the McLeod company will give before entering into arrangeemnts with any other concern.

D. A. Tate has bought the electric-light plant from the South Pittsburg (Tenn.) municipal corporation, which had been running it for several years with very indifferent success. Two competent electricians have been employed, and preparations for improving and enlarging the plant and lines are now being made. Mr. Tate will put in a large new dynamo and sufficient machinery to make the plant first class and give satisfactory service. The city will put in a number of additional street lights, and South Pittsburg will be the best lighted town in its section.

The Sunshine Valley Public Utilities Company of Willard, N. M., has been incorporated with a capital of $25,000, and will put in telephone, electric-light and waterworks systems.

ELECTRIC RAILWAYS.

It is now the intention of the New York, New Haven and Hartford Railroad to extend the electrical equipment on its main lines east of Stamford, Conn. How far east has not yet been announced, but surveyors are at work between Stamford and South Norwalk, and it is safe to say that electrical trains will soon be running to the latter point.

The Philadelphia and Western Railway, which operates an electric road running out of Philadelphia, has filed a mortgage to the Trust Company of America as trustee to cover an authorized issue of $20,000,000 of first-mortgage five per cent. bonds. Of this issue, only $4,000,000 are immediately issuable, the balance being reserved for extensions, improvements or additions. All of the stock of the Philadelphia and Western is owned by a syndicate of which George R. Sheldon and Mackay & Co. are managers.

Consul-general Thomas Sammons, responding to an inquiry, says that the American-Korean Electric Company operates at Seoul the only street railway in Korea. On this line the average number of passengers carried daily in 1904 was 11,442; in 1905, 12,963, and in 1906, 13,714. The car mileage was 145,110 miles in 1904 (five months), 326,793 in 1905, and 398,616 in 1906. The equipment included 37 passenger and 18 freight cars. The company operates 12 miles of tracks with overhead electrical equipment. The gross receipts in 1906 were $98,221 and the net earnings $25,324, the increase in net earnings in 1906 over 1905 being 48 per cent. The company announces that the operating expense has been reduced from 80 per cent. of the receipts in 1905 to 74 per cent. in 1906, but with the decrease in the cost of coal and with an increased service without addition to the expense of management it is hoped that a further material reduction will occur in 1907. The efficiency of the Korean motormen and conductors is becoming more and more apparent.

POWER TRANSMISSION.

The old Scott mill property at Faribault, Minn., which was recently purchased by a Twin City firm, is to be converted into an electric plant. A concrete dam is to be built and will furnish 400 horsepower. A power house is to be erected and equipped. It is the intention to furnish Faribault and Northfield manufacturers with cheap power.

The big hydro-electric power plant of the Boise (Idaho) and Interurban Railway Company is completed and the power is ready to be turned on. The plant is located at Swan Falls on the Snake River and is capable of developing over 3,000 horsepower. The company, besides generating current for the street railway, has 95 miles of transmission lines to various localities. The plant is to be extended later.

The Glastonbury (Conn.) Power Company has awarded to F. T. Gey & Co. of Springfield, Mass., the contract for the construction of a big power plant on Roaring Brook in Cotton Hollow in South Glastonbury. An expenditure of about $200,000 is involved in the contract. It is expected that the plant, which will be capable of generating 1,300 horsepower, will be ready for use in the fall of 1908. Electricity will be furnished for power and lighting in Glastonbury, Manchester and Rocky Hill, Conn.

A syndicate headed by Frank M. Fauvre and Paul H. White of Indianapolis is now securing rights-of-way across the country and franchises in towns and cities to place high-tension wires for the purpose of transmitting electricity from a central power plant which the syndicate proposes to construct at the mouth of a coal mine in Vigo County south of Terre Haute, Ind. The members of the syndicate say they can transmit current from the coal field more cheaply than they can haul the coal to a central plant in Indianapolis or any other city. The representatives report that the cities and towns thus far are inclined to encourage the project.

PUBLICATIONS.

The Eldredge Electric Manufacturing Company of Springfield, Mass., has issued a convenient little catalogue of battery-testing instruments. It contains good information and numerous illustrations of pocket voltmeters, ammeters, voltammeters, spark-coil current indicators, miniature switchboard instruments, etc.

The December Paistery, published by the H. T. Paiste Company of Philadelphia, shows among other specialties a new cross-over insulator. Where two lines of open wiring cross each other it takes four of these insulators to do the work. Each wire is locked in place and is held firmly. Little "knobs" of porcelain at the opening of each pocket hold the wires, and the slots being at right angles the insulator cannot be moved out of place.

An instructive 24-page booklet descriptive of Greenfield flexible steel conduit and flexible steel-armored conductors has been issued by the Sprague Electric Company of New York. Modern private and public buildings must be wired for electric service, and the Greenfield flexible steel conduit is being used by many leading contractors as a safe wiring system, easily installed. The booklet illustrates and describes the flexible steel conduit and flexible steel-armored conductors and cord. Tools and fitting are also illustrated, and there is a long list showing where the Greenfield type are used.

Permanent accuracy, the chief requirement of portable instruments, is claimed for the type P3 voltmeters, wattmeters and ammeters made by the General Electric Company, Schenectady, N. Y. In Bulletin No. 4554, just issued, these instruments are described and their details illustrated. Mechanically, the instruments are strong and light, and of small size, so that several instruments may be carried with ease. They have a light-weight moving element, not susceptible to damage in transportation, and one of the strongest recommendations of their reliability when used for laboratory or general testing purposes is their ability to give accurate indications when used in the vicinity of external magnetic field. The voltmeters and wattmeters are constructed on the direct-reading dynamometer principle and the ammeters on the well-known Thomson inclined-coil principle. The pointed fluctuations are dampened by means of Foucault currents set up in a thin aluminum segment attached to the shaft. Pivots are made from the best grade of steel, specially hardened and highly polished, and are suspended in high-grade sapphire jewels. Catalogue numbers, capacities and list prices are given in the bulletin, and full-sized sample scales of the various instruments reproduced.

SOCIETIES AND SCHOOLS.

The official ballot for officers of the Illuminating Engineering Society for 1908 as named by the nominating committee is as follows: President, Dr. Louis Bell, Boston; vice-presidents, Arthur Williams, New York, C. E. Stephens, Pittsburg; directors, W. H. Gartley, M. K. Eyre, Bassett Jones, Jr.; general secretary, V. R. Lansingh, New York; treasurer, Dr. A. H. Elliott. Ballots must reach the secretary, V. R. Lansingh, 25 West Thirty-ninth Street, New York, not later than December 26th. A member may vote the official ticket, may substitute one or more names or may substitute an entire ballot containing names of his own choice.

A meeting of the New England Section of the Illuminating Engineering Society was held in the Edison Building, 39 Boylston Street, Boston, on December 18th. A paper entitled "The Variables of Illuminating Engineering," by Prof. William L. Puffer, was read. The annual meeting of the New England Section will be held on January 14, 1908, at which meeting officers for the ensuing year will be elected. The present board of managers after careful deliberation have decided to suggest the nomination of the following ticket: Chairman, J. S. Codman; secretary, R. C. Ware; managers, W. H. Blood and T. H. Piser.

Andrew Carnegie has added the sum of $2,000,000 to the $10,000,000 endowment fund of the Carnegie Institution. Announcement of the fact was made at a dinner of the board of trustees of the institution, to which had been invited a number of scientists and men prominent in public affairs. The report of the trustees showed that much important scientific work had been done during the past year, and upon their recommendation $529,940 was allotted for the prosecution of the work of scientific inquiry next year. The trustees also decided to erect a suitable building in Washington for the accommodation of the administrative offices of the institution in place of the present rented quarters.

MISCELLANEOUS.

On the way out of Norfolk on their cruise to the Pacific an opportunity was given to the vessels of the torpedo-boat destroyer flotilla to demonstrate the usefulness of the wireless telephone, with which they are equipped. Messages, subsequently verified, were exchanged for a distance of more than 13 miles, it is said. All of the 16 battleships of the fleet have wireless telephones.

In lieu of the usual quarterly cash dividend of 1¼ per cent. the directors of the Western Union Telegraph Company have ordered the amount paid out of the unissued stock in the treasury. Shareholders of record on December 20th will receive 1¼ per cent. of their holdings in new shares. Arrangements will be made for converting the fractional allotments into full shares. The decreased earnings and the increased expenses incident to the strike are assigned as the reason for paying the dividend in stock instead of in cash.

TRADE NEWS.

The Collier-Cunningham Company of Peterborough, Ont., has been incorporated and will manufacture all kinds of electrical specialties, such as electric irons, heaters, etc. The office and plant is located at 214 Hunter Street. The company has a large number of orders on hand.

Consul Robert J. Thompson of Hanover, in a report on the receipt from manufacturers and merchants in the United States of circulars and catalogues printed in English, says an American merchant might as well circulate this class of literature among his home customers in the German language as to send it to Germany in the English language.

An American consul in the Orient advises that one of the railroad companies there is considering the project of an electric street railway in one of the cities of the region in question. He suggests that it would be well for American manufacturers of and dealers in street-railway material and supplies to communicate with the company referred to. Inquiry may be made of the Bureau of Manufactures, Washington, referring to file No. 1723.

Nearly one-half of the exports from the United States goes to British territory and nearly one-third of the imports is drawn from British territory. By this term, British territory, is meant the United Kingdom and all of its colonies and dependencies in various parts of the world. The total value of merchandise exported to British territory in the 10 months ended with October, 1907, as shown by a statement just completed by the Bureau of Statistics of the Department of Commerce and Labor, is $698,000,000, forming, in round terms, 46 per cent. of the total exports of the period under consideration. The total value of merchandise imported from British territory during the same period was $386,000,000, or 31½ per cent. of the total imports.

In accordance with the terms of the advertisement issued November 21, 1906, calling for equipment for the heating, lighting and power plant for the United States Capitol and congressional buildings, proposals will be opened at the office of the superintendent of United States Capitol building and grounds, Washington, D. C., on January 15, 1908, for boiler-feed pumps, barometric condensers, centrifugal pumps, motors, cranes and chimneys. Bids will be submitted for each item separately. Each proposal must be in duplicate and accompanied by a certified check or approved surety bond in the sum of five per cent. of the total amount of the bid. Elliott Woods is superintendent of the United States Capitol building and grounds.

BUSINESS.

"When the Clock Strikes One" of the incandescent lamps protected with a Hubbell lamp guard the clock is converted into a candidate for the repair shop, according to a leaflet from Harvey Hubbell, Inc., of Bridgeport, Conn. Another leaflet illustrates and describes the Hubbell shades and shade holders. The shades are made in many sizes and styles. They are quickly adjusted and removed and cannot tilt or become loose. Two styles of shade holders rigidly fit any shade.

ILLUSTRATED ELECTRICAL PATENT RECORD.

Issued (United States Patent Office) December 10, 1907.

873,005. Knife Switch. Henry P. Ball, New York, N. Y., assignor to the General Electric Company, Schenectady, N. Y. Application filed April 5, 1905.

Each clip is made of a foot-piece having a tongue between slots struck up from the plane of the foot-piece. A U-shaped engaging strip is bent around the tongue.

873,006. Rheostat. Henry P. Ball, New York, N. Y., assignor to the General Electric Company, Schenectady, N. Y. Application filed December 21, 1905.

This starting rheostat is provided with a contact arm having means for holding the arm in engagement during normal operation and for releasing the arm on overload or underload.

873,017. Trolley-wire Ear. William G. Carey, Schenectady, N. Y., assignor to the General Electric Company, Schenectady, N. Y. Application filed February 21, 1907.

A jaw-member has an upward extension having a vertical recess for the eye of a supporting member. Another jaw member has an extension fitting into the eye. The two extensions are clamped together.

873,020. Transparency. Paul E. Collins, Boston, Mass., assignor to the Electric Novelty Machine

Company, Boston, Mass. Application filed December 7, 1904.

A number of incandescent lamps with stripes on their globes are moved back and forth behind a translucent design.

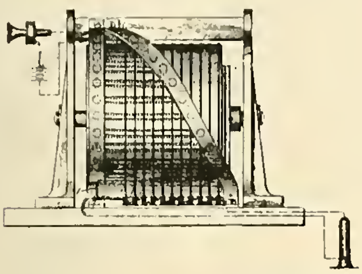
873,021. Electrotherapeutic Syringe. Harlow K. Cool, Bradford, Pa. Application filed August 2, 1907.

The nozzle has a metallic cap forming one electrode, the other being a contact plate.

873,036. Transformer. John J. Frank, Schenectady, N. Y., assignor to the General Electric Company, Schenectady, N. Y. Application filed May 1, 1907.

A number of sets of secondary coils are mounted on different parts of the core. The secondary coils are connected in series by non-inductive connections.

873,042. Apparatus for Receiving and Strengthening the Reproduction of Messages, Signals, Etc. Emil S. Hagemann, Copenhagen, Denmark, assignor to the American Telegraphone Company. Application filed June 19, 1900. Renewed May 2, 1907.



NO. 873,042—TELEGRAPHONE.

This telegraphone apparatus comprises telephone transmitting and receiving circuits, between which is an instrument for recording the message and simultaneously reproducing it in an augmented manner in the receiving circuit. (See cut.)

873,053. Electric Condenser. Frank S. Koch, Chicago, Ill., assignor to the Kellogg Switchboard and Supply Company, Chicago, Ill. Application filed June 29, 1904.

Alternate layers of plates and dielectric are folded integrally about a core which maintains the folded position of the sheets after the pressure on them has been removed.

873,061. Electrical Control Apparatus for Steam Generators. Ralph Lomax and John Tomlinson, Darwen, England. Application filed July 26, 1905.

This apparatus is designed to control the current strength of a generator by means of the rise and fall of steam pressure in the prime mover. A mercury tube affected by this pressure has a series of contact terminals for circuits electromagnetically cutting resistances into or out of the main generator circuit.

873,064. System of Motor Control. Wilbur L. Merrill, Schenectady, N. Y., assignor to the General Electric Company, Schenectady, N. Y. Application filed April 6, 1907.

Two motors are provided, one for driving the load at low speed, and the other at high speed. The voltage on the first motor is gradually raised and then it is reduced, the second motor substituted for the first, and the voltage again raised.

873,066. Magneto-electric Dumb-bell. James Moores, Manchester, England. Application filed June 12, 1906.

A spring motor in one bell drives a shaft passing through the handle. A magneto generator in the other bell has its armature directly connected to the shaft. A lever projects through the handle and operates a clutch to start and stop the shaft.

873,072. Dynamo-electric Machine. Jakob E. Noeggerath, Schenectady, N. Y., assignor to the General Electric Company, Schenectady, N. Y. Application filed September 22, 1905.

A unipolar generator has a rotor made of two superposed cylindrical members separated from each other near their centers so as to form an air chamber which has holes extending to the surface of the cylinders.

873,078. Electromagnet for Telegraphone Purposes. Peder O. Pedersen and Valdemar Poulsen, Copenhagen, Denmark, assignors to the American Telegraphone Company. Application filed April 4, 1902. Renewed May 2, 1907.

This magnet is for the recording body of a telegraphone and has its poles applied thereto in a line oblique to the direction of motion thereof.

873,083. Telegraphone. Valdemar Poulsen and Peder O. Pedersen, Copenhagen, Denmark, assignors to the American Telegraphone Company. Application filed June 12, 1902. Renewed May 2, 1907.

The magnetic record on the recording body is obliterated by uniformly magnetizing the body and then remagnetizing it in the opposite direction. It thus becomes ready to receive a new message.

873,084. Telegraphone. Valdemar Poulsen, Copenhagen, Denmark, assignor to the American Telegraphone Company. Application filed September 29, 1902. Renewed May 2, 1907.

A record-receiving body for a telegraphone consists of a sheet of magnetic material in the form of a cylinder and has means for tracing magnetic lines throughout its surface.

873,098. Meter. Ernest Schattner, Schenectady, N. Y., assignor to the General Electric Company, Schenectady, N. Y. Application filed March 24, 1905.

An alternating-current electrolytic meter has two cells in parallel, each passing current in one direction only. Each cell has a carbon and an aluminum plate immersed in a solution of Rochelle salts.

873,101. Regenerative System for Braking. Walter I. Slichter, Schenectady, N. Y., assignor to the General Electric Company, Schenectady, N. Y. Application filed June 11, 1906.

During braking all the motors are driven by the car as generators. Some have their fields excited by the line and act as field exciters for the others, which return current to the line.

873,104. Lamp Receptacle. James S. Stewart, New York, N. Y., assignor to Annie Stewart, New York, N. Y. Application filed August 17, 1906.

This receptacle is intended to be mounted directly on a molding. The base has parallel tongues projecting into the molding grooves.

873,107. System of Distribution. John B. Taylor, Schenectady, N. Y., assignor to the General Electric Company, Schenectady, N. Y. Application filed January 4, 1906.

An alternating-current railway system has a number of transformers with the middle points of their secondaries grounded, the end points being connected to adjacent insulated sections of the trolley wire.

873,108. Electric Lamp Holder. Charles E. Throop and Samuel A. Freeman, Buffalo, N. Y., assignors to the Olin Gas Engine Company, Buffalo, N. Y. Application filed September 15, 1906.

Two bars slidable lengthwise upon another are provided with a friction device to hold them relatively stationary.

873,123. Massage Implement. Henry D. Gardy, Philadelphia, Pa. Application filed April 8, 1907.

A tubular casing contains two battery cells end to end. A motor driving the applicator can be connected to the cells by slightly turning the casing.

873,132. Electric Accumulator. Quintin Marino and Edward W. Barton-Wright, London, England. Application filed December 17, 1906.

The plates are placed horizontally and separated by specially treated wood boards. The plates and boards have holes in line with each other serving as vents for the escape of gases.

873,139. Apparatus for Use in Starting and Controlling Electric Motors. Abraham Taylor, Rishton, and Thomas Eaton and Herman Schwarz, Manchester, England. Application filed July 23, 1907.

This motor starter has a liquid resistance and means for raising and lowering a contact therein. A double-pole switch can be closed only when the contact is elevated.

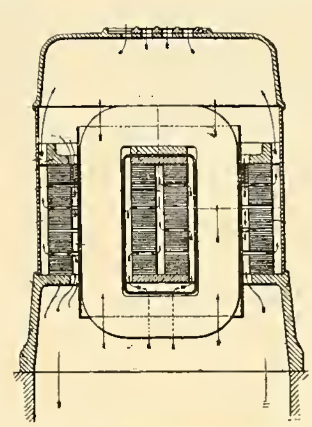
873,154. Two-male T. George A. Miller, St. Louis, Mo., assignor to the St. Louis Lightning Rod Company, St. Louis, Mo. Application filed February 4, 1907.

This is a threaded T joint for lightning rods.

873,160. Field-coil Support. Edward T. Mug, Norwood, Ohio, assignor to the Bullock Electric Manufacturing Company. Application filed September 30, 1904.

A field frame for a revolving field generator has laminæ clamped between end plates, ventilating plates and pole pieces. The coils on the latter are held in place by springs.

873,166. Transformer. Louis C. Nichols, Norwood, Ohio, assignor to the Bullock Electric Manufacturing Company. Application filed January 15, 1906.



NO. 873,166—TRANSFORMER.

An air blast transformer has its core and coils divided into sections with air passages between so as to permit a steady upward blast of air for cooling purposes. (See cut.)

873,171. Motor-control System. Walter J. Richards, Norwood, Ohio, assignor to the Allis-Chalmers Company. Application filed September 29, 1906.

A [illegible] A generator supplying the [illegible] annular winding. The controller [illegible] means for [illegible] either [illegible] variable resistance.

873,177. System of Motor Control. William F. Schneider, Norwood, Ohio, assignor to the Allis-Chalmers Company and the Bullock Electric Manufacturing Company. Application filed March 25, 1907.

The controller has two series parallel switches, one being combined with a reversing switch and the other with a resistance-varying switch independent of the position of the former.

873,178. Static Electric Machine. William C. Shinn, Lincoln, Neb. Application filed April 22, 1907.

This machine has two stationary induction plates on either side of which is a rotating circular plate. The charge is taken from the latter by combs, stored in condensers and then allowed to jump across an adjustable spark gap. The machine is housed in a glass front case.

873,215. Joint for Metal-sheathed Cables. Charles W. Davis, Edgeworth, Pa., assignor to the Standard Underground Cable Company, Pittsburg, Pa. Application filed March 31, 1906.

The joint is composed of two thimbles, each fitting over the sheath of a cable and having surface corrugations on their adjacent ends which are covered by a ring of insulation.

873,216. Electric Cable. Charles W. Davis, Edgeworth, Pa., assignor to the Standard Underground Cable Company, Pittsburg, Pa. Application filed August 29, 1906.

A stranded cable has its strands arranged in helical form of such peripheral extent that the heat radiated therefrom when carrying a heavy current will not be sufficient to damage the insulating sheath.

873,219. Feed Regulator for Grinding Machines. Thomas A. Edison, Llewellyn Park, Orange, N. J. Application filed January 13, 1903.

A separate electric motor drives the feed mechanism. If the grinding rolls are stopped, this motor is also stopped.

873,220. Reversible Galvanic Battery. Thomas A. Edison, Llewellyn Park, Orange, N. J., assignor to the Edison Storage Battery Company, Orange, N. J. Application filed November 23, 1903.

The active elements are finely divided iron in one electrode and nickel hydroxide with a small amount of bismuth hydroxide and flake graphite for the other electrode.

873,253. Coil for Electrical Apparatus. Paul MacGahan, Pittsburg, Pa., assignor to the Westinghouse Electric and Manufacturing Company. Application filed October 18, 1905.

This multiple solenoid for measuring instruments has a number of helical strap coils separated by air spaces and provided with means for connecting corresponding ends.

873,263. Electric Circuit Controller. William A. Paris, Edgewood Park, Pa., assignor to the Westinghouse Electric and Manufacturing Company. Application filed March 3, 1906.

A rotatable contact-carrying drum has a gear segment and stationary contact fingers; two electromagnets have their armatures connected to a gear segment which engages and moves the other segment.

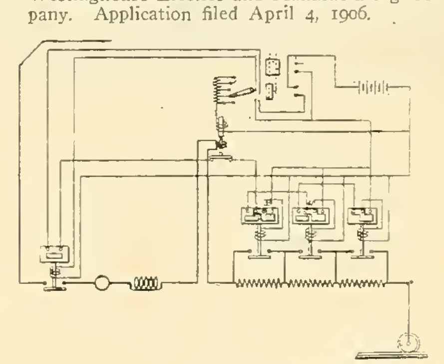
873,264. Controller for Electric Motors. William A. Paris, Edgewood Park, Pa., assignor to the Westinghouse Electric and Manufacturing Company. Application filed April 5, 1907.

In this controller the contact-bearing drum is driven by a set of two cams provided with a means for varying the ratio of forces transmitted from the driving member to the drum.

873,270. Register. Louis A. Schmidt, Chicago, Ill., assignor of one-half to James E. Plew, Chicago, Ill. Application filed February 10, 1902.

This is an electrical register for recording the number of calls. It has a number of tally wheels with contact points on their peripheries.

873,284. Control System for Electric Motors. Louis M. Aspinwall, Wilkinsburg, Pa., assignor to the Westinghouse Electric and Manufacturing Company. Application filed April 4, 1906.



NO. 873,284—MOTOR-CONTROL SYSTEM.

A master controller and limit switch operate and control the closing of a set of switches that are arranged to short-circuit the motor-starting resistances. (See cut.)

873,290. Electric Apparatus. Howard L. Beach, Wilkinsburg, Pa., assignor to the Westinghouse Electric and Manufacturing Company. Application filed March 3, 1906.

A movable contact member is arranged so it can be moved step by step into engagement with stationary contact fingers by electromagnetically actuated pawls.

873,298. Electric Motor Control. William Cooper, Wilkinsburg, Pa., assignor to the Westinghouse Electric and Manufacturing Company. Application filed March 3, 1906.

This is a combination with independently operated switches that are adapted to close in a predetermined sequence, of electromagnetic adjustable limiting devices which retard the operation of the switches.

873,307. Electrical Drop. George J. Galbraith, Boston, Mass., assignor to the Couch & Seeley Company, Boston, Mass. Application filed November 19, 1906.

This is an electromagnetically operated call indicator.

873,312. Electrically Operated Coal Hoist. Clark T. Henderson, Pittsburg, Pa., and Norman C. Bassett, Milwaukee, Wis., assignors to the Cutler-Hammer Manufacturing Company, Milwaukee, Wis. Application filed January 15, 1906.

The motor has a number of resistances in its circuit arranged in parallel. Each of these is controlled by a switch operated by a solenoid. Current is admitted to the latter through an adjustable resistance.

873,317. Electric Heater. Moise Landry, Merced, Cal. Application filed March 27, 1907.

A portable heater has resistance wire placed between two wood veneer boards covered with asbestos and hinged together.

873,328. Process of Producing Silicides. Edgar F. Price, Niagara Falls, N. Y., assignor to the Central Trust Company of New York. Application filed November 14, 1905.

Ferrosilicon is made by placing a charge of silicon compound, iron and carbon under the influence of an arc in an electric furnace.

873,351. System of Control. Frederick Darlington and Otto S. Schairer, Pittsburg, Pa., assignors to the Westinghouse Electric and Manufacturing Company. Application filed March 3, 1906.

A motor has one armature terminal connected to an intermediate point of a battery and the other terminal to a set of conducting segments so it can be connected with either the positive or negative terminal of the battery.

873,356. Prepayment Attachment for Electricity Meters. Francis J. Dowling, Montreal, Quebec, Canada. Application filed February 27, 1905.

A coin chute has a contact and a lever near its end which closes the meter switch when a coin is dropped.

873,362. Lock-out Switch for Party Telephone Lines. Oscar F. Forsberg, Chicago, Ill., assignor to the Western Electric Company, Chicago, Ill. Application filed October 5, 1906.

The switch has a ratchet advanced by an electromagnetically operated stepping lever when the latter is rocked in one direction.

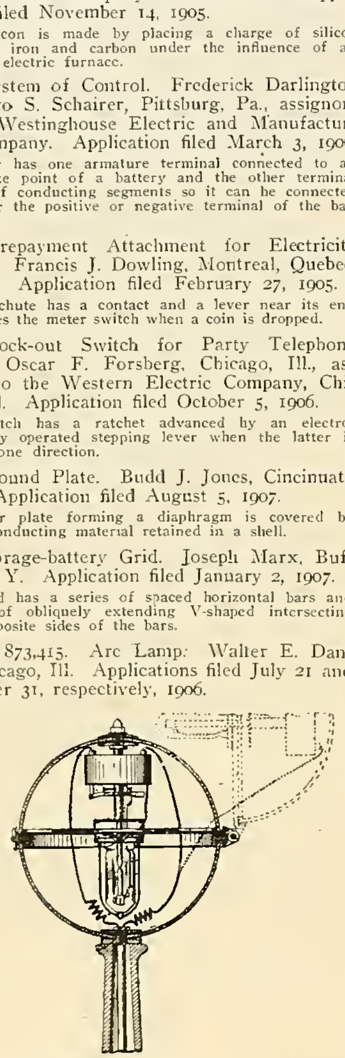
873,375. Ground Plate. Budd J. Jones, Cincinnati, Ohio. Application filed August 5, 1907.

An inner plate forming a diaphragm is covered by granular conducting material retained in a shell.

873,382. Storage-battery Grid. Joseph Marx, Buffalo, N. Y. Application filed January 2, 1907.

This grid has a series of spaced horizontal bars and two sets of obliquely extending V-shaped intersecting ribs on opposite sides of the bars.

873,414 and 873,415. Arc Lamp. Walter E. Daniels, Chicago, Ill. Applications filed July 21 and December 31, respectively, 1906.



NO. 873,414—ARC LAMP.

Each of these lamps has a spherical globe surrounding the lamp entirely. In the first the globe is divided into two parts, the upper one being hinged. In the second a single globe is used with an opening in the bottom only. (See cut.)

873,419. Trolley and Harp Therefor. Samuel F. Estell, Los Angeles, Cal., and Frederick W. G. Phillips, Wilmette, Ill. Application filed August 8, 1907.

The trolley wheel is mounted so that it can tilt in its bearings. A guide roller engages the groove of the trolley.

873,430. Means for Cutting Coil Springs. Noah S. Harter, Waukegan, Ill., assignor to the American Steel and Wire Company, Chicago, Ill. Application filed May 23, 1907.

Electromagnets control the action of the cutter, the circuit being closed by the rotating end of the coil wire.

873,442. Locomotive. Nils D. Levin, Chicago, Ill., assignor to the Goodman Manufacturing Company, Chicago, Ill. Application filed January 28, 1907.

This mining locomotive has a frame with brackets in which the axles are pivotally mounted. The motor is flexibly geared to the axles.

873,444. Trolley-wheel. Ellsworth N. Luburg, Baltimore, Md., assignor of one-third to William Wesley Varney and one-third to Albert Henry Smith, Baltimore, Md. Application filed September 18, 1905.

The wheel has a casing in its hub, a stationary member therein being arranged to convey lubricant inwardly.

873,456. Wire-carrying Cross-arm and Insulator Therefor. Edwin C. Ottinger, Newport, Pa.; Walter Scott Ottinger, Sr., administrator of said Edwin C. Ottinger, deceased, assignor of one-third to Jennie E. Ottinger and one-third to Walter S. Ottinger, Sr., Philadelphia, Pa., and one-third to Samuel H. Bair, Newport, Pa. Application filed April 12, 1906.

This is a sectional cross-arm having a continuous member into which the insulators are dovetailed.

873,468. Automatic Block-signaling System for Electric Railways. Fitzhugh Townsend, New York, N. Y.; John J. Townsend, administrator of said Fitzhugh Townsend, deceased, assignor to the General Railway Signal Company. Application filed June 29, 1906.

This system is adapted for an alternating-current railway. Thermogenerators are used to excite a direct current difference of potential between the rails of the block sections so as to affect rotary relays.

873,471. Automatic Display Sign. John A. Viger, St. Paul, Minn., assignor to James D. Lotz, Stillwater, Minn. Application filed January 19, 1907.

An electric motor drives an endless transparent canvas sign with various advertisements thereon. A shutter is operated while the "ads" are changed. Electric lights are used for illuminating the shutter and canvas alternately.

873,492. Insulated Rail Joint. James H. Brothers, Newark, N. J., assignor to the Rail Joint Company. Original application filed March 22, 1907. Divided and this application filed September 7, 1907.

Continuous splice bars and separate discontinuous filler members are used, insulating material being placed between them.

873,503. Receptacle for the Drain Water of Refrigerators and Alarm Therefor. Andrew Casale, New Haven, Conn. Application filed April 17, 1907.

A tank has a float and system of levers which closes an electric bell circuit when the water reaches a certain height.

873,508. Electrodeposition of Copper and Other Metals. Sherard O. Cowper-Coles, London, England. Application filed November 12, 1906.

This process is one wherein the solution has to be aerated to free it from impurities in suspension. After passing through an atomizer it goes through a filter bed.

873,522. Third Rail. Ralph K. Eddowes, Philadelphia, Pa. Application filed December 7, 1906.

The rail has an inverted L-shaped head enclosing all but the bottom of a conducting strip insulated from the rest of the rail.

873,531. Pneumatic Despatch Apparatus. Edmond A. Fordyce, Boston, Mass., assignor to the Lamson Consolidated Store Service Company, Newark, N. J. Application filed July 24, 1905.

An electrically operated air pump is started and stopped by the insertion and withdrawal of the carrier from the pneumatic tube. The air current in the latter is reversed for sending carriers in the opposite direction.

873,532. Dust Collector. George H. Forsythe, Chicago, Ill., assignor to Forsyth Bros. Company, Chicago, Ill. Application filed April 2, 1906.

Magnetic dust collectors are placed near abrading wheels so as to catch iron particles.

873,541. Method of Receiving and Strengthening the Reproduction of Speech, Signals, Etc. Emil S. Hagemann, Copenhagen, Denmark. Original application filed June 19, 1900. Divided and this application filed April 29, 1902. Renewed May 2, 1907.

The method of operation of the telegraphone apparatus described in No. 873,042 is here further explained.

873,587. Rail Magnetic Brake. Victor L. Ochoa, New York, N. Y., assignor of one-half to R. R. Fogel and one-fourth to Benjamin A. Jackson, New York, N. Y. Application filed February 23, 1907.

An oblong magnet core has a portion cut away for the reception of the winding. The pole head is of the width of the rail tread over which it is directly mounted.

873,588. Party-line Telephone System. Norman S. Page, New York, N. Y. Application filed January 17, 1907.

A magnet operates a lock-out when excited by direct current and independently rings the bell when excited by alternating current.

873,591. Light-projecting Attachment for Firearms. Charles R. Penfield, Chicago, Ill. Application filed September 17, 1906.

An electric light is mounted in a tube with a parabolic projector and a reflector. The tube is mounted on the firearm.

873,605. Train-controlling Means. Ernest Renaud, Montreal, Quebec, Canada, assignor to J. B. Dupuis, Montreal, Canada. Application filed February 19, 1907.

The throttle lever and emergency air-brake cock are electromagnetically operated if the train runs beyond a danger point on the track.

873,638. Burglar Alarm. Carlos Van Bergh, Winnipeg, Manitoba, Canada, assignor to the Van Bergh Electric Protection System Company, New York, N. Y. Application filed June 6, 1907.

An alarm bell and a talking machine are intermittently electrically operated when the alarm circuit is closed.

873,640. Riveting Apparatus. Benjamin Waddington, New Castle, Pa., assignor to Lee M. Raney, New Castle, Pa. Application filed November 9, 1905.

A reciprocating die head has electromagnetic means for holding the part to be riveted.

873,660. Battery Connection. George P. Blow, La Salle, Ill. Application filed April 11, 1907.

The carbon element of a dry cell has a strip connection to the side of, but insulated from, the zinc container.

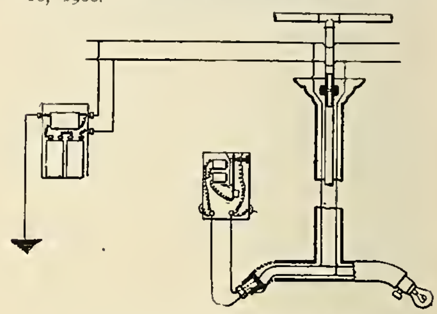
873,662. Trolley Head. Gardner P. Copp, Los Angeles, Cal., assignor of one-half to Allin L. Rhodes, Los Angeles, Cal. Application filed March 12, 1906.

This trolley head has bifurcated arms extending rearwardly which carry the wheel axle bearings and form a trolley finder.

873,668. Electric Trolley. Albert S. Janin, New York, N. Y., assignor of one-third to William J. Cole, New York, N. Y. Application filed August 14, 1905.

A form of pantagraph trolley heaving a double diamond-shaped frame carries a roller trolley on top.

873,674. Electrical Testing System. Howard E. Miller, St. Louis, Mo. Application filed April 16, 1906.



NO. 873,674—ELECTRICAL TESTING SYSTEM.

This system for testing incandescent lamp circuits comprises an induction coil whose primary terminals and one of whose secondary terminals is connected to the circuit to be tested, the other secondary terminal being grounded. (See cut.)

873,683. Apparatus for Weaving in Natural Colors Without Pattern Cards. August Regal, Banjaluka, Austria-Hungary, assignor of one-third to Franjo Harazim and one-third to Eugen Karazej, Banjaluka, Austria-Hungary. Application filed June 11, 1906.

A number of transmitter plates form each a circuit making and breaking device. Electromagnets corresponding to the plates are arranged to advance a part through different distances.

873,700. Rotating Bracket for the Suspension of Electric Wires. Charles E. Buckbee, Flushing, Mich. Application filed March 2, 1907.

An oscillating support for an insulator consists of a bracket arm with a pivoted pin for the insulator.

PATENTS THAT HAVE EXPIRED.

Following is a list of electrical patents (issued by the United States Patent Office) that expired December 16, 1907:

442,617. Electric Arc Lamp. J. E. Giles, Hazelton, Pa.
442,623. Electric Trolley Switch and Trip. R. C. Hopson, Saginaw, Mich.
442,649. Electric Heater. C. H. Talmage, Kansas City, Mo.
442,668. Regulation of Electric Motors. E. W. Rice, Jr., Lynn, Mass.
442,685. Electric-light Holder. J. B. Moore, Minneapolis, Minn.
442,705. Electric Meter. A. W. Meston, St. Louis, Mo.
442,734. System of Telegraphic and Telephonic Exchange. J. R. Smith, Neosho, Mo.
442,799. Train Telephone. R. S. Carr, Hamilton, O.
442,808. Telegraphy. A. G. Hummel, New York, and F. A. Graham, Brooklyn, N. Y.
442,843. Electrical Measuring Instrument. E. Weston, Newark, N. J.
442,856. Means for Reducing Inductive Disturbances in Telephone Circuits. J. J. Carty, New York, N. Y.
442,868. Underground Conduit and Electric Conductors. J. S. DuBois, Camden, N. J.
442,870. Dynamo-electric Machine or Motor. N. H Edgerton, Philadelphia, Pa.
442,880. System for Indicating Thermometric Records. H. J. Haight, New York, N. Y.
442,881. Means for the Transmission of Meteorological Indications. H. J. Haight, New York, N. Y.
442,882. Multiple Circuit Closer. H. J. Haight, New York, N. Y.
442,883. Combined Electric Indicating and Telephone System. H. J. Haight, New York, N. Y.
442,932. Electric Cooking Apparatus. E. Abshagen, Chicago, Ill.
442,954. Method of Welding Metals Electrically. C. L. Coffin, Detroit, Mich.
442,969. Portable Electric Lamp. D. G. FitzGerald and A. H. Hough, London, England.
443,074. Electric Signaling Device for Moving Vehicles. O. J. Depp and S. J. Munn, St. Louis, Mo.
443,081. Trolley Switch for Electric Railways. J. Jones, New York, N. Y.

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Electricity in German Churches.

By Dr. Alfred Gradenwitz.

While electric light has long been a familiar feature in churches, the advantages of electric power have not been utilized in the sacred edifices until more recently. Although this most up-to-date agent for power transmission may seem hardly in keeping with the solemn character of the place, it has adapted itself exceedingly well to the exigencies of the situation. The most important use of electric power in churches is for the operation of the organ.

As electricity is now available nearly everywhere, not only in large cities and small towns, but also in the country, even smaller congregations will be able to fit their churches with electric lighting and power plant, the cost of the current being moderate. Generally speaking, the kind of current used is of no importance; direct, polyphase or single-phase current may be used indifferently.

The connection to the central station is effected in the same manner as in the case of ordinary houses, the feeding cables being conveyed from the street to a distributing center, which is mostly situated in the cellar, comprising the main fuses and switches, whence conductors are taken to meters recording the consumption of current. According to the size and kind of plant, one or more meters of this kind should be provided. One for lighting purposes and one for power purposes will, however, in most cases, be found sufficient, while this, owing to the difference in tariffs for lighting and power current, is a minimum number. Immediately adjoining the meters are the main switchboards, on which all measuring instruments, fuses and switches for the various circuits are arranged and whence the whole current is controlled.

As the conductors starting from the switchboards should be laid out in such a way as not to interfere with the decoration and arrangement of the place, a special point should be made of inserting them in steel pipes. Those mostly used in Germany are slotted steel pipes without any insulating lining, which receive a cable made up of rubber-covered strands. These can be fitted on or below the stucco or plaster. As there is no necessity of cutting threads or tightening flanges, these pipes are very easy to fit, while being at all times accessible to the engineer. In the basement, in the loft and in all accessory rooms conductors can obviously be laid out freely.

In the accessory rooms the lighting plant can obviously be designed on more simple lines. Even the most modern types of incandescent lamp, such as the tantalum and other metal-filament lamps, which give a light of brilliant whiteness with about half the amount of consumption of ordinary lamps, have found their way into churches. Tantalum lamps are mainly designed for 25 and 50 candle-power, the working potential being 100 to 120 volts. In plants worked with a potential of 220 volts they should accordingly be arranged in series of two.

The extent of the electric-lighting plant of a church obviously depends on the size of the latter.

Fixture on Railing of Gallery.

Side Lighting in St. George's Church at Kiel.

Interior of the Dresden Church of the Cross.

ELECTRICITY IN GERMAN CHURCHES.

In order to give an idea of the extent of a plant designed for a medium-sized church, a few words relating to the plant of the Berlin Martha Church (with an aisle 27 meters in length and 23 meters in width) will be found instructive. This plant comprises:

In the main chandelier of the nave	48 lamps
In the galleries	54 lamps
In the organ choir	7 lamps
Brackets in the galleries	20 lamps
Below the galleries	32 lamps
On the pulpit	2 lamps
Total	163 lamps

There are further provided 47 lamps for lighting the entrances, vestibules and accessory rooms, basement, etc., giving an aggregate of 210 glow lamps.

The distribution and arrangement of the lamps, as well as the lamp fittings, are readily adapted to the character of each installation and any architectural style can be most perfectly suited, both in modern constructions and in old churches dating from remote centuries. In all cases electric light will allow effects well adapted to the character of the place, as may be judged by the accompanying pictures. The electric lighting fixtures installed in many churches have been designed by famous artists and are partly adapted to celebrated models of ancient ecclesiastical art.

Motors are used, not only for the operation of the organ blower, but also for bell ringing.

The shaft of the ringing gear of electrically operated bells is driven by the motor either through belt transmission or through any other intermediary gearing. The consumption of energy obviously depends on the size and extent of the bell system. In the Erlöserkirche (Church of the Redeemer) at Potsdam there is installed for this purpose a polyphase motor of six horsepower, turning at 950 revolutions per minute, equipped with a slip-ring armature and actuated by a special starter.

In the case of the organ outfit a blower is preferably operated immediately from the motor without any intermediary gearing. The motor starter should be located close to the organist's seat to enable the organist to control the motor while playing. The power consumption obviously depends on the size of the organ. At the Erlöserkirche, the organ of which comprises 42 stops, a polyphase motor of five horsepower, turning at 1,400 revolutions per minute, is used.

Whenever the bellows is used in the place of the blower, the motor can likewise be used to drive the eccentric shaft, the speed being reduced as far as possible in order to avoid any disturbing noise. The mechanism is switched in and out of gear by the organist as in the case of the blower. In order to adapt the output of the motor to the actual consumption of air, the accumulator bellows is connected with a regulator actuating the motor when the bellows is empty. When the bellows has reached its maximum expansion, the regulator stops the motor, starting it again when further air is required.

The working of the motor is thus controlled automatically according to the actual consumption of air without any necessity of supervision during the play of the organist. All that is required is to connect the starter to the motor at the beginning of the playing and to stop it at its conclusion, in order to avoid any useless consumption of energy, everything else being effected by the motor itself.

Another use for electric power is in operating the winding gear of tower clocks, in which case such a small consumption as about 0.1 horsepower will be sufficient, even this small amount of energy being drawn upon only at certain moments.

Electric motors have been found especially suitable for all these operations, as there are long quiescent intervals alternating with the periods of work in the

A GALLERY FIXTURE IN ST. GEORGE'S CHURCH, KIEL, GERMANY.

most varied and irregular manner. The safety against the risk of fire afforded by a well-fitted electric plant is another advantage in the case of places which at times may have to accommodate large throngs.

Wind-power Electric Plants in Denmark.

Windmill plants for generating electricity for lighting and power purposes in agricultural and industrial pursuits are increasing in numbers in Denmark.

Since 1897 the Danish government is said to have contributed about $28,000 for equipments and has even lately erected an experimental station at Askoc. A recent writer describes these experiments, which were made on the initiative of the Danish government, with the co-operation of Danish electrical manufacturing companies which generate electricity by means of windmills. According to his statements, windmills with four wings have given the best results, as a smaller number of wings does not fully utilize the wind power, while a larger number acts detrimentally upon the wind current between the wings.

It is said that if a medium large windmill is

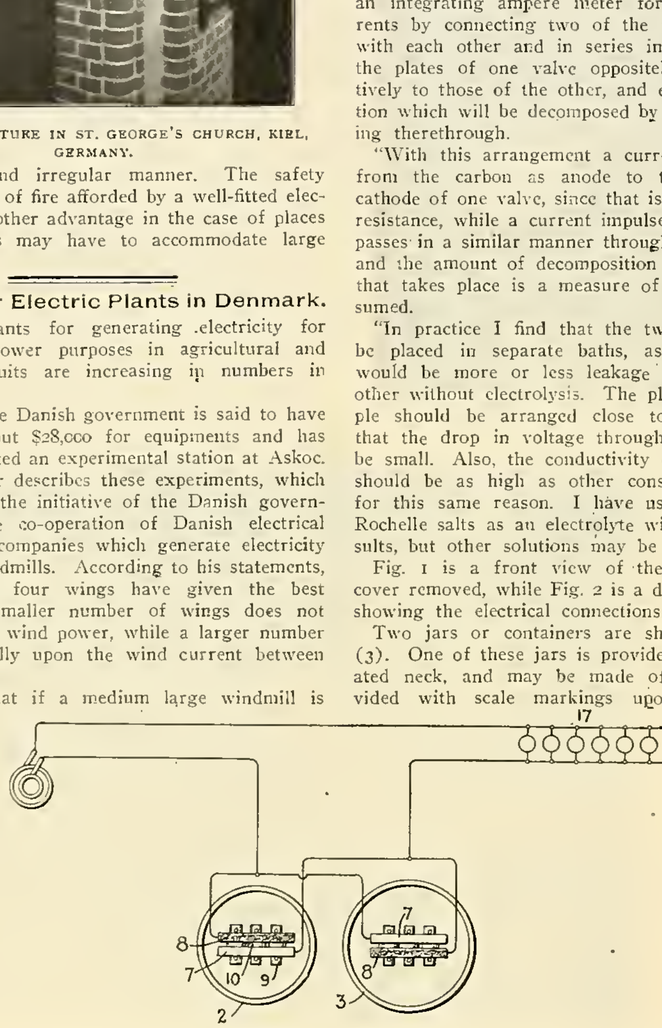


FIG. 2. CONNECTIONS FOR ELECTROLYTIC METER.

used with a wing surface of about 48 square meters (one square meter = 10.764 square feet), eight horsepower is obtained at a wind velocity of six meters per second (one meter = 3.28 feet). At a velocity of eight meters the horsepower is more than doubled. A wind with a velocity of eight meters per second is no rarity. The weather reports classify it as No. 3, while the highest wind velocity is No. 12. Since 1903 there has been in existence the Danish Electricity Company, from whose zealous agitation 30 large and small windmill electrical equipments are in operation throughout Denmark.

Utilization of Tidal Power.

It is reported that a Hamburg joint stock company has purchased a large tract of land along the mouth of the Elbe at Cuxhaven where an electric power plant is to be erected. The action of the ebb and flow of the tide is to be employed, it is said, in generating electric energy to be used in factories about to be established. The works will also furnish electric power to the town of Cuxhaven and other towns in the vicinity. The daily capacity of the plant is given as 14,000 horsepower. Tests are said to have established the feasibility of this method of generating electricity.

Electrolytic Meter for Alternating-current Circuits.

Ernest Schattner of Schenectady has invented and protected by patent a simple electrolytic integrating ammeter for use on alternating-current circuits. Electrolytic meters have been used ordinarily on direct-current circuits, so that the present invention (the patent for which has been assigned to the General Electric Company) is of considerable interest. The essential feature of the instrument is the employment of two aluminum cells or "electrolytic valves," arranged as described herewith.

"It has long been known," says the inventor, "that a couple composed of an aluminum plate and a plate of good non-oxidizing material, such as carbon, placed in a neutral conducting solution will offer a very low resistance to the passage of current therethrough in one direction, but almost entirely prevent the flow of current in the opposite direction. Such a device is commonly termed an electrolytic valve. I utilize this principle to produce an integrating ampere meter for alternating currents by connecting two of the valves in parallel with each other and in series in the circuit with the plates of one valve oppositely arranged relatively to those of the other, and employing a solution which will be decomposed by the current passing therethrough.

"With this arrangement a current impulse flows from the carbon as anode to the aluminum as cathode of one valve, since that is the path of least resistance, while a current impulse of opposite sign passes in a similar manner through the other valve, and the amount of decomposition of the electrolyte that takes place is a measure of the current consumed.

"In practice I find that the two couples should be placed in separate baths, as otherwise there would be more or less leakage from one to the other without electrolysis. The plates of each couple should be arranged close together, in order that the drop in voltage through the meter shall be small. Also, the conductivity of the electrolyte should be as high as other considerations permit for this same reason. I have used a solution of Rochelle salts as an electrolyte with very good results, but other solutions may be used if desired."

Fig. 1 is a front view of the meter with the cover removed, while Fig. 2 is a diagrammatic view showing the electrical connections.

Two jars or containers are shown at (2) and (3). One of these jars is provided with an elongated neck, and may be made of glass and provided with scale markings upon the neck, as indicated at (4). Each jar is filled almost to the top with an electrolyte which is a conductor and which will be decomposed by the passage of current. A thin film (6) of paraffin or other suitable material may be placed on top of the solution to prevent loss by evaporation, and this film may be colored so that the height of the electrolyte in the neck of the jar (2) may be more readily observed through the glass. In each of the jars immersed in the electrolyte is a pair of plates, which, with the electrolyte, form an electrolytic valve. These plates are held close together and parallel to each other by insulated bolts passing through the two plates, but actual contact between the plates is prevented by washers (10) of insulating material.

Connected to each plate is a conductor (11) extending up through the open end of the jar and insulated from the electrolyte, preferably by means of a rubber tube, fitting tightly on the conductor. In the upper part of the casing is a wooden connection block on which are two binding posts. The binding post (14) is connected to the carbon plate (8) of one element and the aluminum plate (7) of the other element by the insulated conductors (11). The other two plates are similarly connected to the binding post (15), so that the carbon of one cell is connected to the aluminum of the other. Covers rest upon the open ends of the jars and are provided with openings for the conductors and for the escape of gases. A cover plate closes the front of the meter casing with a glass-covered opening, and openings are provided in the back for the admission of the leads from the circuit to the binding posts.

When the meter is connected in series in one of

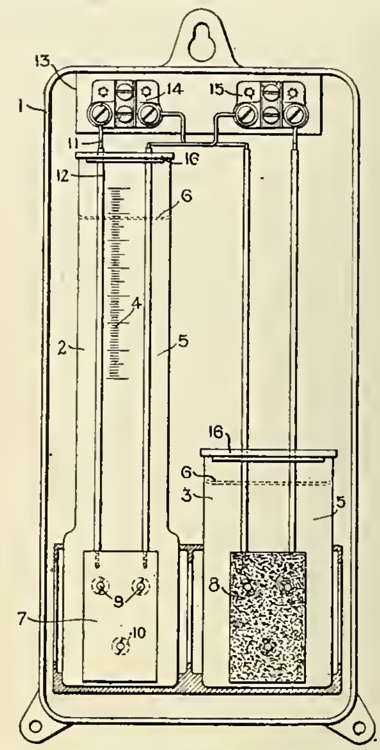


FIG. 1. ELECTROLYTIC METER FOR ALTERNATING-CURRENT CIRCUITS.

the lines of an alternating-current circuit by inserting the line terminals through the openings in the meter casing and into the binding posts (14) (15), the two electrolytic valves will be oppositely arranged relatively and connected in parallel with each other and in series in the circuit, as shown in Fig. 2. When lights (17), or other translating devices are cut into circuit, a current impulse in one direction will flow through one of the valves, as that offers a very low resistance, and as the other is practically an insulator, the current impulse in the opposite direction will flow through the other element, that being then the path of the least resistance. The current flowing between the two plates in the jar (2) is therefore always in the same direction, and the water of the electrolyte in the jar will be slowly decomposed by this current. The amount of the electrolyte decomposed, as indicated by the surface of the liquid falling on the scale, is a measure of the amount of current consumed, and this scale may be calibrated to read directly in ampere-hours.

Chicago Suburban Railways to Be Consolidated.

It is announced that the South Chicago City Railway Company and the Calumet Electric Street Railway Company are to be consolidated. New branches are to be built and the two roads, instead of running southward in parallel lines, will be united more closely so that they will mutually help each other. The Calumet Electric (of which H. M. Sloan is general manager) operates about 75 miles of track running from Sixty-third Street, Chicago, to the Indiana state line at Roby. The line is mostly double track, traversing South Chicago, Auburn Park, Manhattan Beach, Burnside, Pullman and West Pullman. The South Chicago City Railway Company operates 36 miles of track within the Chicago city limits.

A German publication is authority for the statement that about 5,000 electrical patents were taken out in various countries in 1906. The United States is credited with 2,050, United Kingdom and colonies with 750, Germany 700, France 400, Austria 200, Italy 180, Hungary 130, and Switzerland with 120.

Lord Kelvin.

After the death of Von Helmholtz in 1894 Lord Kelvin (William Thomson) was universally recognized as the foremost of living physicists. On December 17, 1907, Lord Kelvin, too, passed away, in the 84th year of his age, as mentioned in the Western Electrician last week. By his death the world is bereft of perhaps the most commanding figure in the domain of science and certainly of the most honored investigator in the wide domain of physics. Lord Kelvin was also an inventor of the first rank, and, although not a practicing engineer, he was regarded as the father of electrical engineering and was consulted in relation to electrical projects of great import to the human race, as the Atlantic cable and the electrical utilization of the waterpower of Niagara Falls. He was truly a great man.

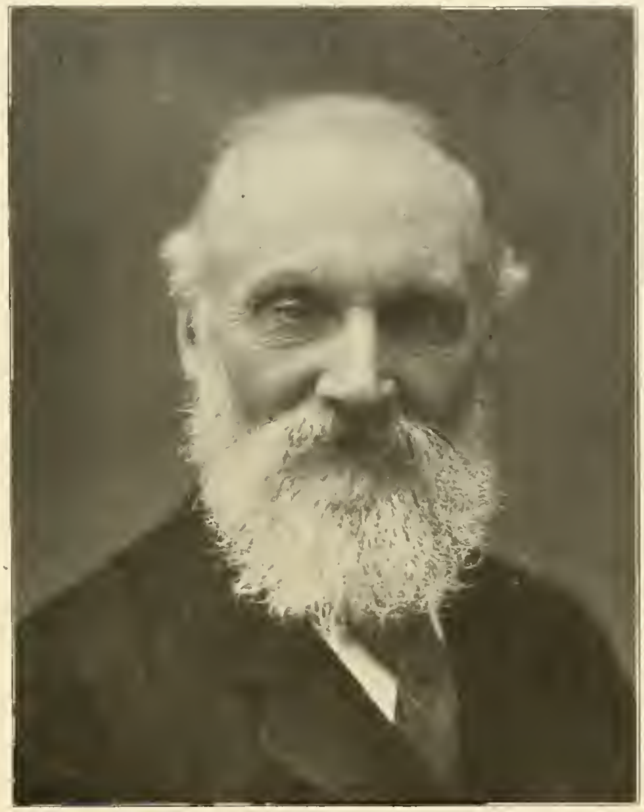
Lord Kelvin paid several visits to the United States. One was in 1902, at about the same time as the visit of Prince Henry, the brother of Emperor William of Germany, which created widespread public interest at the time. The Western Electrician, in its issue of April 26, 1902, taking advantage of the coincidence of these visits, without the slightest disparagement to the royal traveler, who was, in fact, heartily welcomed, spoke of Lord Kelvin's coming in terms which it may be of interest to recall at the present time:

"Princes' visits are made the occasion of pleasant interchanges of civilities between nations; but to the thoughtful-minded the United States is honored in a much greater degree by welcoming to its shores such a man as Kelvin, as it now does for the fourth time, or Von Helmholtz, as it did in 1893, than in entertaining the kinsman of any monarch whose title to distinction is of mere hereditary right. In science comparisons are even more odious than elsewhere, but surely no one can cavil at the assertion that the eminent Scotch-Irish professor is the greatest of living physicists. His contributions to the sum of human knowledge have been so numerous and varied that he will go down in history as one of the greatest scientists of the nineteenth century, which has been a period particularly rich in scientific investigation and achievement and characterized by many great names. And yet, at the ripe age of 78, Lord Kelvin is still a student—still striving with simplicity and earnestness to solve some of the many complex problems that natural philosophy presents to the human mind. He is a man entitled to the great honors he has received, and nowhere is the value of his work more highly appreciated than in the United States. Electrical investigators in particular look up to this living successor of Faraday and Maxwell as the 'Grand Old Man' of electrical science and venerate him for his accomplishments."

A complete biographical account of Lord Kelvin, with detailed mention of the many inventions, researches and scientific contributions that he gave to the world during the last sixty years, would fill many pages. His whole life was one of extreme usefulness, and there is hardly a branch of science that has not benefited directly through his remarkable ability and learning. Mathematics, mechanics, sound, light, heat, thermodynamics, magnetism, electricity, elasticity, electrical engineering, telegraphy, geology, astronomy, chemistry and navigation were fields in which he was a potent leader. In pure science, perhaps, he will be best remembered for the part he played in the formation of the theory of the conservation of energy, the fundamental postulate in modern physical science. Though Joule and others were associated with Lord Kelvin in working out the conception, his was a leading part. To Lord Kelvin is also due the theory of the all-pervading ether and the vortex theory of matter.

William Thomson, later Lord Kelvin, was born in Belfast, Ireland, on June 26, 1824, but from the age of eight years he had lived continuously in Glasgow, Scotland, or near that city. His father, Prof. James Thomson, earned a wide reputation as a teacher and author of text-books on mathematics, and the son was reared in an atmosphere that proved an excellent schooling for his future mathematical and scientific work. William graduated from St. Peter's College, Cambridge, as second wrangler in 1845, and the following year, at the age of 22, was appointed professor in natural philosophy in Glasgow University—a selection which shows the confidence in his future he had already inspired. At that time he was regarded as the first man of science of the rising generation in Great Britain. He continued to hold his chair at Glasgow University for 53 years, despite numerous offers to remove to Cambridge and elsewhere. In June, 1896, a jubilee celebration was held commemorative of his long and efficient service with the university. The occasion brought together a distinguished gathering of scientific men and elicited congratulatory addresses from 28 universities, 12 colleges and 51 societies and institutions.

Lord Kelvin's mind was extraordinarily prolific of investigations in all branches of physics, but especially in heat, electricity and dynamics. His treatise on natural philosophy—undertaken in collaboration with the late Prof. P. G. Tait—is a monumental one. His work in electricity, both of a theoretical and practical nature, has, perhaps, brought him into greatest prominence. He determined the law of velocity of electric signals through long submarine cables and invented the mirror-galvanometer by which these signals could be easily read, and thus was able to render the early Atlantic cable economical in working. For this improvement in submarine cabling he was knighted in 1866 with his colleagues on the first wholly successful Atlantic cable expedition.



Born June 26, 1824.—Died December 17, 1907.
LORD KELVIN (WILLIAM THOMSON).

In January, 1892, Sir William Thomson was raised to the peerage, taking the title of Baron Kelvin, as a suitable honor for his developments in electrical and engineering science. After his first researches in submarine cabling he brought out his siphon recorder, which improved on his mirror-galvanometer by writing down the message. Next followed his tidal harmonic analyzer and tide predictor, designing to calculate the height of future tides at any place; also his electric meters and standard balances for electrical measurements, and his new magnetic compass, now regarded as the best made. He introduced pianoforte wire for deep-sea sounding, and his navigational sounding machine is largely used in the British Navy and merchant marine. In his later years Lord Kelvin devoted much time and attention to the production of measuring instruments. He brought out electrostatic potential instruments, electromagnetic volt and ampere meters, a new electric supply meter, and testing instruments for measuring insulation, resistance and conductivity.

Lord Kelvin's researches in electrostatics and magnetism were collected and published in one volume in 1872. His collected mathematical and physical papers have been printed in several volumes, and his collected "Popular Lectures and Addresses" have been published in three volumes. Many honors were conferred upon him. He received the degree of LL.D. from the Universities of Glasgow, Edinburgh, Cambridge, Dublin, Yale, Montreal and Bologna; D.C.L. from Oxford and M.D. from Heidelberg. He was decorated by France, Germany, Belgium and England, and was a member of a large number of scientific associations in his own and other countries. The first award of the John Fritz medal of the United States was to him. He had been three times president of the Royal Society, London, from 1890 to 1895, and in 1871 was president of the British Association at its meeting in Edinburgh. He was thrice president of the Institution of Electrical Engineers, and in 1904 was elected chancellor of the University of Glasgow. He received a grand prize at the Paris Exposition of 1900 for his electrical instruments.

In 1890 Sir William Thomson was made president of the International Niagara Commission, established in London for the purpose of examining plans for the then proposed waterpower development at Niagara. The Niagara Falls Power Company acted upon the suggestions of the commission, but it was not until Lord Kelvin's third visit to this country, in 1897, that he had his first opportunity of seeing the great power plant with which he had been connected in its early stages.

He was married twice. His first wife was a daughter of William Crumb of Thornlibank, Glasgow. She died in 1870. Four years later he married Miss Frances Brandy. He leaves no heir.

On the occasion of their visit to this country in 1902, Lord and Lady Kelvin were given a reception at Columbia University by the faculty of the university, associated with the American Institute of Electrical Engineers and other societies. The hall was thronged by men and women eager to pay tribute to the man of science. Thomas A. Edison, Elihu Thomson, Nikola Tesla and many other prominent men were present. Speeches of welcome were delivered by Prof. F. B. Crocker and others. In his response Lord Kelvin praised the work of Cyrus W. Field in the laying of the Atlantic cable. Mr. Field's name, he said, was one the world would never forget. The speaker paid a graceful compliment to Mr. Edison, which brought forth renewed cheers and applause, which continued until that gentleman was compelled to rise from his seat at the rear of the stage and bow his acknowledgments. In closing, Lord Kelvin referred to the "harnessing" of Niagara and the wonderful possibilities developed by the electrical transmission of this great power. He said that beautiful as is that wonderful work of nature, it would be more beautiful still if those waters fell upon turbine wheels, every one of which was turning the wheels of industry.

Many anecdotes cluster about the deceased scientist. One would imply that, great as was his reputation, he was no more immune from the pranks of college lads than other teachers. It is related that when Professor Thomson was summoned to London to return as Sir William, he left his scholastic duties in charge of Mr. Day, an instructor. This gentleman was popular with the students, as may be judged by this biblical injunction, which the returned professor found written boldly on the blackboard of his room: "Work while it is yet Day, for the knight cometh, when no man can work."

Another story is to the effect that one of Lord Kelvin's theories was that the earth was a solid. To prove this he arranged two eggs, one raw, the other cooked, and spun them rapidly. The uncooked one slowed down quickly, the other maintaining its speed for a much longer time. From this the experimenter argued that, if the earth had a liquid core internal friction would have ended its rotation long ago.

In 1884 the University of Heidelberg, wishing to honor the famous man, presented him with the diploma of doctor of medicine, as the only distinction at its command which he did not already

[Continued on page 501.]

Construction and Operation of a Power-factor Indicator.

How does a power-factor indicator work? This question is frequently asked by switchboard attendants, who have occasion to use them from time to time. A description of a new form of power-factor indicator, recently invented by Mr. W. E. Sumpner of Birmingham, England, and patented in this country, should therefore be of some interest.

These instruments are designed to indicate the power factor, or phase relation between current and voltage, in an alternating electric circuit, whether the circuit be single-phase, two-phase or three-phase. In the instruments hitherto usually made for such purposes the magnetic fields set up by the currents are weak, and the forces exerted on the moving parts of the instrument are feeble. As a consequence these instruments have to be delicately constructed, and are easily affected by external magnetic fields. The object of Mr. Sumpner's invention was to provide instruments free from these defects, by applying to them the well-known principle of a strong rotating magnetic field acting across a narrow air gap between iron masses.

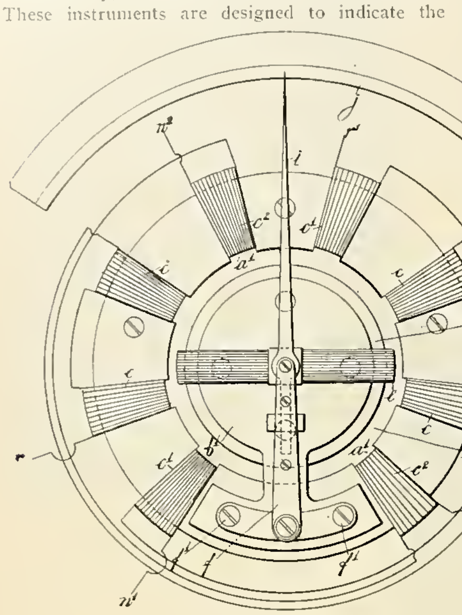


Fig. 1. Front Elevation.

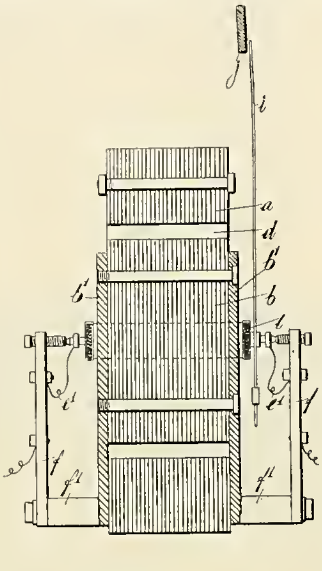


Fig. 2. Sectional Side Elevation.

CONSTRUCTION OF A NEW POWER-FACTOR INDICATOR.

Instruments constructed in accordance with this principle operate by the interaction of a rotating magnetic field whose frequency and phase depend upon one of the two quantities, and an alternating current whose frequency and phase depend upon the other of the two quantities, electromotive force and current, whose phase relation is to be indicated. For example, in an instrument constructed in accordance with this idea, a strong rotating magnetic field is produced in the manner exemplified in the well-known single-phase and polyphase induction motors. The iron parts of the instrument consist of an inner and an outer portion as in induction motors, but whereas in such motors the outer portion, or stator, is fixed, and the inner portion, or rotor, is capable of rotation, the instrument now described is constructed with both iron parts like stators fixed in position. Only one of these stators, preferably the outer one, need be wound for the purpose of producing the rotating field. The stators are well laminated, as usual, to diminish eddy currents, and are built up of thin stampings shaped as disks, and rings, respectively, the latter surrounding the former and concentric with them. The two sets of stampings are made up into cylindrical blocks and suitably fixed so as to have a common axis, while leaving between the two stators an annular air gap in which the moving parts of the instrument can turn.

The moving parts comprise one or more coils which are rectangular in shape and which form a single moving system. The axis of revolution of the moving system is the same as the common axis of the stators. The coils are so constructed that two opposite sides have the same length as the diameter of the annular air gap, while the other two sides are parallel to the axis and for the greater part of their lengths move in this air gap, which should be made as narrow as possible consistent with the necessary freedom of motion of the moving system.

The current through the moving coil or coils may be produced either by the currents through the mains or by the voltages across them, the former if the stator is wound for the voltages, and the latter if the stator is wound for the currents.

The winding of the stator is arranged to suit the circuit for which the instrument is intended, and is in connection with this circuit either directly, or through the medium of suitable transformers. The winding must consist of at least two sets of coils traversed by currents in suitable phase relation to one another. For a three-phase circuit it may consist of three similar windings symmetrically spaced as in ordinary three-phase motors, and traversed by three-phase currents produced either by the voltages across the mains of the circuit, or by the currents through these mains.

If, now, the moving system be free and one of the coils forming it be traversed by a current of the same frequency as that of the rotating field, the coil will take up a definite position, depending merely upon the phase relation of the current through it to the rotating field, and which will in the absence of extraneous disturbing forces be independent of the strength of this current, or of the strength of the rotating field in which the coil moves. A pointer attached to the moving system will indicate on a suitable calibrated scale fixed to the outer stator, the phase relation or power factor of the current tested. The moving system is balanced and quite free to move; it is not provided with a spring or other form of control tending to bring it to a definite position on the scale.

If the moving coil forms part of a circuit common to the secondary circuits of two current transformers, the primaries of which are placed in two of the mains of a three-phase system, it is advantageous to use on the secondary of these transformers a reversing switch so constructed that there is an interval of short-circuit during reversal. This makes it possible to provide the instrument conveniently with two scales, one for reading high power factors and the other for low power factors, the scale to be used depending on the position of the reversing switch. A similar device can be used when the moving coil forms part of a circuit including in series the secondaries of two voltage transformers, the primaries of which are put across two of the voltages of three-phase mains. The reversing switch on one of the secondaries of the transformers should in this case be such that there is an interval of open circuit during reversal; these devices are described hereafter.

In the accompanying drawings is shown an application of the principles described above. Figs. 1 and 2 are, respectively, front and sectional side elevations of the instrument. Figs. 3 and 4 illustrate various applications of the instruments.

An outer stator (a), Figs. 1 and 2, has holes or slots (a_1) for the windings and an inner stator (b) is left unwound. The windings are indicated at (c, c_1, c_2), and the ends of the coils are shown, respectively, at (r n, r' n', r^2 n^2). The coils may be joined up in any ordinary and suitable manner to the polyphase circuit. These windings together with the iron stators constitute a stationary polyphase electromagnet, that is to say, an iron-cored magnetic system of which all the iron appreciably affecting the total magnetic flux is fixed and magnetized by two or more windings secured to the iron. The windings are supplied with a corresponding number of currents, all differing in phase, and the iron stators together with the air gap serve to provide a distinct magnetic circuit for each winding, thus producing what is called a rotating magnetic field as in an ordinary induction motor. The stators are so dimensioned and assembled as to provide a minimum length air gap (d) for the moving coil (e). By this means is obtained all the advantage in the way of a strong field, due to the use of a practically closed iron magnetic circuit, and there is avoided the great disadvantage of having a heavy moving system, the strong force due to the strong field being exerted on a light moving system of conductors which need not carry any iron at all, and which will operate when carrying currents so small that they do not appreciably affect the field of the polyphase electromagnet. The moving coil is pivotally supported by the insulated bars (f) secured to the outer stator by bolts (f_1). Current is led into and out from the moving coil in any convenient manner, such, for example, as by fine wires (e'), exerting no appreciable control on the system. A pointer (i) serves to indicate on a scale (j) the movement of the coil (e). The mode of supporting the inner stator is clearly shown in Fig. 2. The inner stator is secured by end plates (b') to the outer stator, the plates being formed with neck portions sufficiently narrow to permit as large a range of movement as possible to the moving coil.

One mode of connecting a reversing switch to enable the same instrument to be employed for reading either high or low power factors is shown in Fig. 3. Here (g) (g) (g) represent the three mains of a three-phase circuit, while (h_1) and (h_2) are the primary coils of two current transformers (l_1 and l_2). The function of the switch (o) is to reverse the connections of one of the two secondaries. The reversal of connections affected by the switch (o) serves to change, by a definite and fixed amount, the phase of the current in moving coil (e). The connections to the coil (e) are as indicated. The same result may also be obtained when the instrument is used on a single-phase circuit by substituting through the medium of a two-way switch a condenser and a non-inductive resistance, for one another alternately, in series with the moving coil.

In Fig. 4 is shown one mode of supplying suitable currents to a multiphase electromagnet from a single-phase circuit. In this diagram wherein

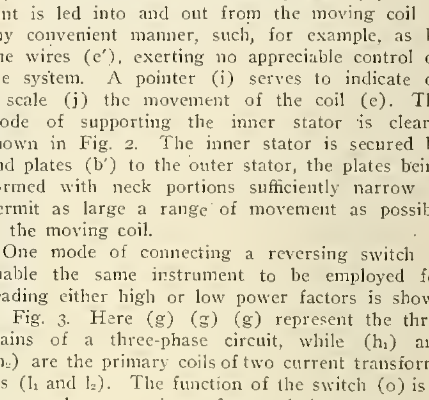


FIG 3. METHOD OF CONNECTING REVERSING SWITCH OF POWER-FACTOR INDICATOR.

only four magnet windings are shown for simplicity of illustration, (p_1) is the primary of a current transformer inserted in one of the single-phase mains (g_1). (p_2) are two secondaries in the primary (p_1), and have two ends connected together at (p_3). The other ends are connected together through a non-inductive resistance (r_1), one set of windings (c) of the multiphase electromagnet and a choking coil (s). The second set of magnet windings (c_1) is connected to the point of junction of (c and s) and to the point (p_3) of direct junction of the two secondaries (p_2). These two secondaries thus co-operate with the electromagnet to produce a rotating field, since the coil (c_1) receives a current displaced in phase relatively to that in (c). The winding (c_1) receives the difference between the currents in the two secondaries, while (c) receives the current from one secondary. The two secondaries may be formed by the two portions of a single winding having a point therein tapped for the junction (p_3), or they may be the secondaries of two distinct transformers and be each energized by its own primary. In such case the two primaries must be similarly excited, from

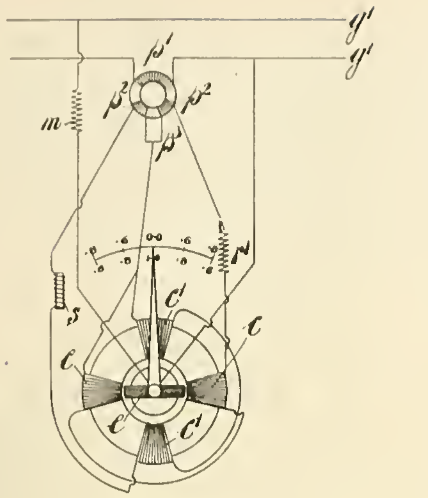
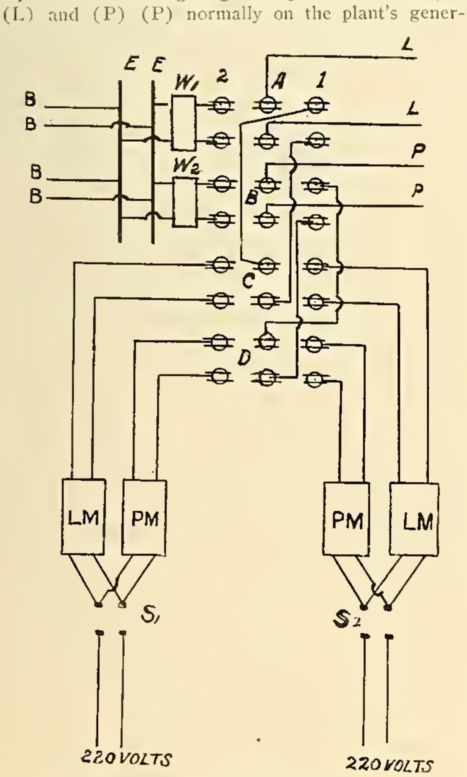


FIG. 4. POWER-FACTOR INDICATOR.—SUPPLYING POLYPHASE CURRENT FROM SINGLE-PHASE CIRCUIT.

the same source, that is, if current transformers they must carry the same current and if potential transformers the same potential or currents or potentials proportional to and in phase with one another.

Isolated-plant Emergency Connections.

One of the essential steps in the design of isolated-plant wiring, where emergency central-station service is to be supplied, is the provision of a simple and flexible scheme of switching over from the plant bus-bars to the entering lines. Many special problems arise in different conditions of this kind, one of which, with its solution, is illustrated herewith. In this case it was desired to operate separate 220-volt lighting and power circuits (L) (L) and (P) (P) normally on the plant's gener-



ISOLATED-PLANT EMERGENCY CONNECTIONS.

ator bus-bars (E) (E) and to be able to throw either circuit in case of emergency upon either of two outside supply circuits (S_1) and (S_2). It was desired to separately meter all current used, respectively, for lighting or power service.

To accomplish this, four double-pole switches of the double-throw type, (A), (B), (C) and (D), were installed and connected as shown with the lighting and power circuits, the bus-bars and the four wattmeters (LM) and (PM). The wattmeters (W_1) and (W_2) record the energy consumed in the lighting and power service when the current is generated in the plant itself. The designers did not wish to throw the working circuits in multiple to the extent of carrying part of the lighting load on the generators and part on the outside supply. The same thing applied to the power service.

By throwing the switch (A) upon position (1), the lighting circuit is carried to the center terminals of switch (C). Accordingly as switch (C) is thrown to position (1) or (2) it will draw current from the lighting wattmeter of circuit (S_1) or (S_2). Thus three sources of supply exist for the lighting circuit (L) (L), and the same conditions apply to the power circuit (P) (P) through switches (B) and (D). In each case the metering is separate, and the exact demand upon each of the supply circuits is registered. Either the lighting or the power circuit can be supplied from the plant generators, while the other power or lighting service is handled by the outside supplies. Ordinarily circuit (S_1) is reserved for emergency lighting supply and (S_2) for power.

Coil-retaining Wedge for Dynamos.

The cores of dynamo-electric machines, both of the rotary and stationary members, usually consist of laminæ which are arranged in groups, the groups being spaced apart by ventilating segments or separators. The separators are usually provided with spacing ribs, which not only hold the groups of laminæ at predetermined distances apart, but in the rotary cores act as fan vanes to create an outward flow of air to cool not only the core and coils of the rotor, but also the core and coils of the stator. If the core is provided at its periphery with open slots for the reception of conductors, the latter are held in place by so-called "sticks" or "wedges" of non-magnetic material, which engage grooves at the outer ends of the teeth.

Usually the depths of the grooves which receive the wedges are small as compared with the width of the teeth measured circumferentially, or the distance between adjacent slots. In some machines, however, the slots are very closely arranged, leaving narrow teeth. The result is that the grooves for the wedges on the opposite side of each tooth closely approach each other, and when the wedges are in place only a very narrow opening is left between the wedges. It is seen that in this construction if the ordinary coil-retaining wedges are employed the outward circulation of air is seriously interfered with.

A recent invention patented by Bernard A. Behrend, chief engineer of the Bullock Works, Allis-Chalmers Company, consists in producing a form of coil-retaining wedges in which the portions bridging the ventilating spaces are of less width than the remaining portions. The width of the wedges at the ventilating spaces is less than the width of the slots, so that the wedges do not in the slightest degree restrict the size of the ventilating openings in the periphery of the core nor interfere with the outward flow of air.

In the accompanying drawings, illustrating the application of these wedges to a rotor, Fig. 1 is a partial vertical transverse section through the core of a rotor, the section being taken through the ventilating passageway, and Fig. 2 is a plan view of a small portion of the core. Mounted on the shaft are the core laminæ (11). These laminæ are, as in the usual construction, arranged in groups, which are spaced apart by separators (12), forming circumferential ventilating passageways (13). The groups are held apart by the radial ribs (14), which act as fan blades in the rotary cores to create air currents, which pass radially outward, cooling both the rotor and the stator. The periphery of the core is provided with closely arranged open slots (15), leaving teeth (16), which are narrow measured in a circumferential direction. The ribs (14) extend outward almost to the ends of the teeth, so that the latter are well braced. Located in the slots are the coil conductors (17), which are well insulated and retained in place by non-magnetic wedges (18) of peculiar construction that engage the grooves or slots (19) near the outer ends of the teeth.

In the usual machines in which the slots are comparatively far apart the depth of the grooves which are engaged by the wedges is small as compared with the space between the slots or the width of the teeth. In those machines, however, in which the slots of the core are closely arranged, as in the core shown in the drawings, the wedge-retaining grooves on the opposite sides of each tooth closely approach each other, leaving a comparatively narrow opening between the coil wedges when the parts are assembled. If in such machines the ordinary wedges, which have a uniform width throughout their length, were employed, the ventilating openings at the periphery of the core would be very much restricted. The ventilating passageways are further restricted by the outer ends of the ribs (14) of the spacing members, which ribs, as is shown in Fig. 1, extend outward between the wedges.

In order to obtain a free flow of air through the passageways in the core, the coil-retaining wedges or sticks have notched or cut-away portions (20) at each side, which, when the wedges are in place, occur at the ventilating spaces. Thus

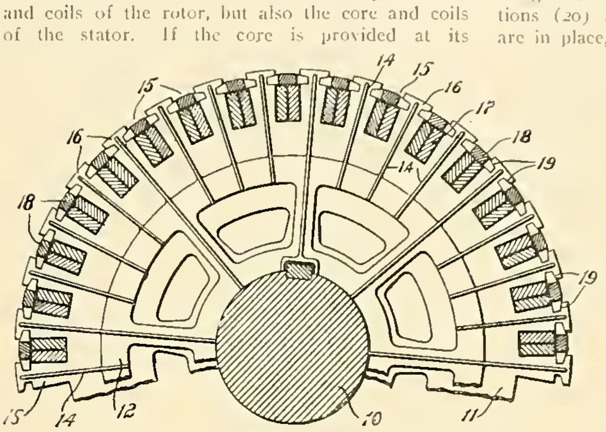


Fig. 1.

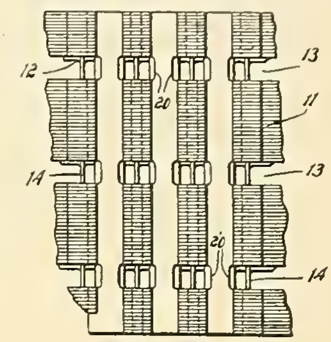


Fig. 2.

BEHREND'S COIL-RETAINING WEDGE FOR DYNAMOS.

the portions of the wedges which bridge the ventilating spaces are of less width than the remaining portions which engage the grooves. With this construction it is seen that no matter how closely the slots are arranged nor how deep the wedge-retaining slots are made, the outward flow of air through the ventilating spaces is not restricted to the slightest degree by the coil-retaining wedges. This construction is suitable for stators as well as for rotors.

Novel Use of Electric Flatirons.

It is not often that heating units from electric flatirons are put to as severe a test as in the instance given below. The problem was to replace a crankpin on the high-pressure side of a 500-horsepower cross-compound Russell engine. The new pin was six inches in diameter with a taper of one-sixty-fourth inch, and had to be fitted tightly into the disk which was five inches thick with a 12-inch shaft. To expand the disk by heating it with blow torches would have taken too long, besides making a dirty and unsatisfactory job, so several heating units from General Electric six-pound flatirons were grouped around an iron core 3¼ inches in diameter and placed in the six-inch hole in the crank disk. In four hours after the current was turned on the disk had expanded sufficiently to allow the crankpin to slip in. Although the heating units were at about white heat all of the time they were not injured except that the brass tubing on two was slightly melted in one place. The heating units were replaced in the flatirons and have been in use for the last three months, one of them being in a laundry, where their active service averages 40 hours each week.

Old Rensselaer Gets in Line.

The Rensselaer Polytechnic Institute of Troy, N. Y., announces that it has inagurated courses in mechanical engineering and in electrical engineering leading to the degrees of mechanical engineer and electrical engineer. The gift of $1,000,000 by Mrs. Russell Sage insures laboratories in mechanical and electrical engineering of great value. Rensselaer has the reputation of a solid, conservative school. For many years it has been well known for the high character of its course in civil engineering.

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DEPARTMENTS.

DATES AHEAD.

[illegible] Electrical Show, Coliseum, January 13th to 25th.

Northwestern Electrical Association (annual convention), [illegible], Milwaukee, January 15th and 16th.

[illegible] Independent Telephone Association (annual [illegible]), [illegible], January 21st to 23d.

WHILE PERHAPS Mr. T. H. Reardon, in his article in this issue on "Electric Power for Artificial Refrigeration," takes an over-sanguine view of the possible use of electricity in the production of refrigeration (not artificial ice, it is to be observed, which is a different matter), his arguments are nevertheless worthy of attention. Electric motors are now used for this purpose to some extent, and there is no doubt that this application can be and will be extended. It may be doubted, perhaps, whether electrically operated refrigerating plants would be sufficiently economical in small-sized units for domestic use, but in hotels, meat markets and similar establishments it would seem that the possibility is worthy of careful consideration.

THIS is the concluding number of Volume XLI. of the Western Electrician, and the next issue will be the New Years issue for 1908. Following our annual custom, the New Years number will appear in a handsome colored cover, especially designed by a well-known artist. It will contain the Western Electrician's estimates of the value of electrical and allied manufactures produced in the United States in the year, reviews of the electrical progress of the year in the United States, Great Britain and the Continent of Europe, from the pens of qualified writers, a Business Review of the year, and a number of other articles of timely interest, with many illustrations.

The Index for Volume XLI. will be distributed to all subscribers gratuitously with the issue of January 11, 1908, immediately following the New Years number.

Taking advantage of the holiday season, we express to all our readers the sincere hope that they may enjoy a happy and prosperous New Year.

LORD KELVIN was generally regarded as the leading physicist of the world after the death of Von Helmholtz in 1894, and by many he would have been so recognized even before the passing of the great German scientist who made Berlin a world center for the study of physics. The comparison of these two great men is of no importance, however, and is not attempted here. But attention may be directed to the fact that Lord Kelvin was not only a great physicist, but he was also a great inventor and so prominent in the application of electrical principles to the accomplishment of useful work that he was affectionately styled the father of electrical engineering. He was a man whose work was of great helpfulness to the world—a truly great man in the best sense, and endowed, like nearly all men of science of the first rank, with great simplicity of character and enduring patience. Well did he deserve the honors which the world heaped upon him, and worthily is he buried in Westminster Abbey. He leaves a record of a life's work which will serve as an inspiration to future generations.

"JAPANESE CHINA" is a new geographical designation which appears in the official reports of the Bureau of Statistics of the Department of Commerce and Labor. The territory in question, which was in 1898 leased by the Chinese government to Russia and transferred from Russian control to that of the Japanese government by the treaty which terminated the war between Japan and Russia, includes Port Arthur and the adjacent port of Talienwan, now known as Dalny, with certain adjacent territory, and is the terminus of that branch of the railway which connects the Russian Trans-Siberian line through Manchuria with Port Arthur and Dalny. To this geographical area the exports from the United States have rapidly increased during the current year until they now exceed $1,500,000 a month, and seem likely to show for the year about to end a total of approximately $9,000,000 against less than $250,000 last year. It is to be remarked that during the period in which this region was under Russian control the direct exports of the United States to that territory never reached as much as $1,000,000 in any calendar year. The principal items of export from the United States to "Japanese China" for the ten months ended October 31, 1907, were railroad cars, steel rails and steam locomotives. It is interesting to note that the value of electrical machinery so exported was $11,740. This is not very large, but it is something, and it is to be hoped that this item will be materially increased in the future.

As a close neighbor, if not a part, of the vast Chinese Empire, that part of China under Japanese control will afford a constant object lesson to the Chinese; hence the importance of this market to the American exporter is greater than the mere local demand would indicate.

A CONSIDERABLE extension of telephone service is to be witnessed in Western Canada at the present time, principally due, it must be confessed, to the activity of government officials. In the province of Alberta there are already over 500 miles of long-distance lines, 44 toll stations and 16 exchanges in operation under government ownership, which is the record of but a little over a year's work and is spoken of as but a beginning. The Hon. W. H. Cushing, minister of public works for Alberta, is reported to have predicted recently that within five years at the latest every town, village and hamlet in the province will have a municipal or government-owned telephone system connected with the rest of the province by the government's long-distance lines. In Saskatchewan a similar system is planned. The Bell company is strong in Manitoba, but here, also, government-ownership sentiment is rife. In British Columbia the provincial government has built several lines, and a programme of government-owned telephones will be discussed at the coming session of the Legislature.

Western Canada is a new country, and sociologists will observe with interest the enthusiasm with which the principle of public ownership has been taken up. Elsewhere municipally operated telephone systems have not worked well; the example of Glasgow is well known. But at any rate the use of the telephone is being rapidly extended, which is certainly commendable.

VLADIMIR POULSEN, inventor of the wireless system which bears his name, is reported to have declared that he will establish wireless-telephone service between Europe and America, via Ireland, in February. Already, it is asserted, wireless-telephone connection has been maintained between Berlin and Copenhagen, a distance of 240 miles. This, in itself, will prove to be an extraordinary accomplishment, if verified; but if we are to talk across the Atlantic by "wireless" in 1908, the feat will be no less than stupendous, for hitherto no means has been found to transmit articulate speech by submarine cable for anything like that distance. It is thus proposed to accomplish by the etheric system what has hitherto been impossible by cable.

But perhaps Poulsen never made the prediction credited to him; if he did, he is probably over-confident. In relation to the proposal, Prof. M. I. Pupin of Columbia University, who is familiar with the limitations of long-distance telephony by wire, is quoted as follows: "Professor Poulsen's invention of the continuous oscillator makes wireless telephony possible beyond a doubt. But the distance over which communication can be established will always be limited, and he will never be able to telephone across the Atlantic or over any other area of the same size. In telegraphy the whole of the power is available for signaling, while in telephony this only holds true for a small fraction of the power. So it does not seem likely that wireless telephony will ever cover nearly the distance that wireless telegraphy can. To do the same work, telephony would require a hundred times the power needed for telegraphy. I should therefore consider an announcement of this kind with a great deal of suspicion."

Until further information is received, technical men will be apt to agree with Professor Pupin, hoping, but hardly believing, that Poulsen may have devised means to accomplish what has been suggested.

[illegible] Power for Artificial Refrigeration.

By T. H. Reardon.

The problem of heating by electrical energy has received much attention in electrical journals, and a great variety of apparatus for such purposes, many of which are reliable, economical and extremely convenient, are to be found on the market at the present time. Electrical heating, regarded from the viewpoint of desirability, healthfulness and cleanliness, the entire absence of smoke, soot and ashes, stands without any formidable competitor in its appeal to those who wish the best.

The artificial production of cold, while it is not as extensively employed as the production of heat, still it is an enterprise that has assumed large proportions, and it finds no difficulty in enlisting capital where local conditions and climatic influences are favorable to such a project.

Artificial refrigeration and the artificial production of ice are so different in character that frequently the first is a pronounced success, while the latter turns out to be a complete failure, and an unfortunate investment.

The refrigerating machine, like the dynamo, has several expressions for its efficiency.

Manufacturers adopt a theoretical rating, in order that machines of different types and embodying different principles, may be compared with one another on this basis.

Usually a 100-ton machine is rated in such a way that it is understood that it is capable of converting 100 tons of water at a temperature of 32° Fahr. into 100 tons of ice at the same temperature.

In practical operation a machine never works under such conditions; the water instead of being at a temperature of 32° Fahr. often in summer time will be at 70° or at 80°, necessitating the abstraction of 38 or 48 heat units from the water before it is brought to the temperature of 32° Fahr., the point at which the formation of ice commences.

Further, in the manufacture of ice, the temperature of the calcium chloride bath in which the cans containing the water to be frozen are immersed, is usually carried as low as 10° Fahr.

Thus it is seen that in the artificial production of ice, instead of the machine working under ideal conditions, the water that is used is far above the freezing point at the commencement, and, after the ice is formed, it is frequently cooled 20° below the freezing point, and as the ice regains this heat from the surroundings in a very short time after it is removed from the freezing bath, the abstraction of so much heat from the ice in the freezing process represents so much energy thrown away.

The machine with the theoretical rating of 100 tons ice production in 24 hours might not actually produce more than 50 or 60 tons of ice in this time.

It will also appear that the commercial efficiency of an ice-making machine will vary greatly, according to the climatic conditions under which it does its work.

In regard to the artificial cooling of rooms, without actually manufacturing ice, the conditions are entirely different; it is simply a matter of lowering the temperature in such rooms a certain number of degrees. We are dealing with air, a medium that has a specific heat of about 0.24, instead of water that has a specific heat of 1.

When the difference in density between air and water are taken into account, it is found that the amount of energy that will lower the temperature of 1 pound of water 1° Fahrenheit will lower the temperature of 56 cubic feet of air 1° Fahr.

In the science of thermo-dynamics, it is immaterial whether one heat unit is added or whether it is abstracted. Precisely the same amount of energy must be expended for the attainment of the one or the other.

It is the purpose of this article to show that the field of artificial cooling is an inviting one to the electrical engineer.

A pound of high-grade coal may evolve something like 14,500 heat units when burned under favorable conditions. A pound of ice in liquefying can only abstract 143.5 heat units from the surroundings. The work done in each case, while opposite in character, is directly comparable, and has the ratio 14,500:143.5.

Conversely, if electricity is to compete with coal for purposes of general heating, the 29,000,000 heat units in the ton of coal, if obtained from electricity, will require the expenditure of 849.7 kilowatt-hours.

At the price of three cents per kilowatt-hour, which has been quoted in electrical journals during the current year, the cost of this quantity of heat obtained electrically would be $25.49.

The ton of ice in melting abstracts 287,000 heat units from the surroundings, and the kilowatt hour equivalent to this number of heat units is 8.430, which, figured at three cents per kilowatt-hour, gives $0.253 as the cost of the electrical energy equivalent to the number of heat units that are absorbed in the melting of one ton of ice.

It is well understood that one ton of ice or its equivalent in cooling effect cannot be produced by the expenditure of 8.430 kilowatt hours, for the discussion only considers ideal conditions. The subject of heating and the subject of cooling are treated, however, from similar points of view, and, while in the case of electrical heating, every watt expended gives practically full value in the form of heat, in refrigerating, large losses incident to practical operation will have to be considered.

The ton of ice and the ton of coal cost practically the same, and if the electrical engineer can furnish the heat units evolved in the combustion of a ton of coal for a price that will enable electricity to compete with coal, there does not seem to be any valid reason why artificial refrigeration employing electric power should not find wide application, where the use of ice in considerable quantities, with its incident waste and inconvenience, would render the installation of a proper-sized refrigerating unit both desirable and economical.

Artificial refrigeration is beyond the experimental stage; it is in use in many of the leading hotels and cold-storage establishments, and it is the only correct and scientific method of regulating temperature and keeping each particular room at a temperature determined by its contents.

The use of ice is unsatisfactory; it is impossible to keep any desired temperature range by means of its use, and the result is a sort of compromise, in which one article is cooled too much and another is not cooled enough.

The installation of a medium-sized refrigerating unit for hotel or domestic service, where the operation is by steam power, necessitates the employment of an engineer, and this constitutes a great drawback, as the labor item of expense may be three or four times as large as the cost of power actually used in operating the plant.

In connection with such a unit operated by steam power on the premises, there remains to be considered the greatly increased cost of installation, which, in many small installations, would require putting in a steam boiler as a part of the refrigerating unit.

The combined efficiency of a small steam boiler and a small steam engine for such work would of necessity be very low, and when it is further considered that the demands on a refrigerating unit will vary between wide limits, it will be readily apparent that steam power for the operation of small units of this kind is far from being satisfactory.

With electric power, economically generated in a large station, and metered for four or five cents per kilowatt-hour, the cost for power will be far less than the cost of the coal burned in the case of operation by steam power.

The compression system of refrigeration should of course be used, and automatic regulation and simplicity should be dominant features in the design of such a unit.

Both the electrical power of the motor and the refrigerating capacity of the compressor and cooling coils should be ample to take care of any ordinary overload that might be induced by attendant conditions. The fact that ample power is always available, and that all waste of energy ceases as soon as the switch is thrown, should have much to do with placing the electric motor in the foreground as the most desirable prime mover for this class of service.

By giving proper regard to the features of automatic regulation and simplicity of and accessibility to working parts, the attention required by the apparatus can be made so slight in many instances that it will require even less attention than do the steam radiators in a hotel office, and such attention could be given the apparatus by someone employed in another capacity without interfering with his regular work only to very slight extent.

The small-size electric refrigerating unit will of necessity be more expensive and more complicated than the electric heater which has no moving parts, but it does seem that inventive genius should be able to come forward with small practical units of the kind that would at all times be reliable and require but a minimum of attention.

The field seems to be an inviting one, and if such a scheme can be widely carried to successful realization, it will bring comfort and luxury to the home and patronage to the central station.

Lord Kelvin.

[*Continued from page 587.*]

possess. Upon the day when it arrived, Sir William noticed that his lecture room assistant was indisposed, and wrote out his first prescription. "Vis medicatrix naturæ; septem dies"—in other words, a vacation of a week.

One of Lord Kelvin's warm friends was King Edward. For many years as the Prince of Wales his majesty and Kelvin were well acquainted and the friendship continued after the prince received the crown.

Another man who rejoiced in the friendship of the deceased scientist was George Westinghouse. At a dinner in London in 1903, Lord Kelvin proposed Mr. Westinghouse's health in a laudatory speech, in which, among other things, he said: "The present development of the electrical industry in the United Kingdom owes its growth largely to him. 'Largely' is a small word to express how much we owe to him. I do not wish to enter into any comparisons or superlatives, but I do not think any man in the world of engineering could be named to whom more is due than to Mr. Westinghouse for his work in electrical engineering."

While at Cambridge young William Thomson was no mere bookworm. He took an active part in field sports and athletics. He was a skilled oarsman and won the Colquhoun silver sculls.

Lord Kelvin was an advocate of the metric system, and during his visit to this country in 1902 he appeared before a congressional committee at Washington and urged the passage of a bill for the substitution of the metric system of measures for the standards now in use.

Christian believers hailed Lord Kelvin as their champion, for he was not an agnostic, like many men of science. When he was installed as chancellor at the University of Glasgow the vice-convener associated the new chancellor with Bacon and Newton as the leading exponents of Christian philosophy.

For 67 years Lord Kelvin lived within the gates of his beloved university. He was the first, it is said, to introduce laboratory work as a part of the student's course. His first laboratory was in a deserted wine cellar of an old professorial residence. It was as chanceller of the university that he welcomed visiting delegates from European and American electrical engineering societies to Glasgow in July of 1906.

In March, 1905, when almost 81 years of age, Lord Kelvin underwent a severe surgical operation, but he made an excellent recovery—a fact that well attested the vigor of his constitution.

Lord Kelvin was not without a tincture of Scottish thrift, and he accumulated a comfortable fortune from his inventions. But with all his years, honors and wealth, he remained a simple, kindly seeker after knowledge. A recent biographer spoke of him as one "whose life of unwearied industry, of universal honor, has left him with a lovable nature that charms all with whom he comes in contact."

Lord Kelvin was buried on December 23d in Westminster Abber, near the monument to Sir Isaac Newton. There was a large gathering of scientists representing American and Continental as well as British societies. Many of those present were clad in their academic robes and wore their decorations. King Edward and the prince of Wales and other members of the royal family sent representatives, while among the twelve pallbearers were men eminent in various walks in life, as John Morley, Lord Rayleigh, Admiral Sir Edward Hobart Seymour, Lord Strathcona and others. Almost all the foreign embassies in London were represented, Secretary Carter attending on behalf of the American embassy. The scene at the Abbey was solemn and impressive. No fewer than twelve clergymen were associated in reading the service, which was of the simplest character. The request for burial at Westminster was made by the Royal Society. Charles Darwin, buried in 1882, was the last preceding scientist to be so honored.

Lumber Cut of the United States in 1906.

Annual statistics of the forest products of the United States in 1906 were prepared by co-operation of the Bureau of the Census and the Forest Service. The Forest Service of the Department of Agriculture has just issued a circular of 42 pages relating to the lumber cut of 1906. Mr. Gifford Pinchot is forester.

A close approximation of the lumber production of the United States in 1906 was 37,550,736,000 feet, with a mill value of $621,151,388, the largest quantity ever reported for a single year, and by far the greatest value. In addition there were produced 11,858,260,000 shingles, valued at $24,154,555, and 3,812,807,000 lath, valued at $11,490,570. The total value of the lumber, lath and shingle production reported in 1906 was thus $656,796,513. Making a fair allowance for incomplete reports, it is safe to say that at present the annual lumber cut of the United States approximates 40,000,000,000 feet, and that the total mill value of the lumber, lath and shingles annually produced is not less than $700,000,000.

In the circular are given details of the production of lumber, lath and shingles by states and by species, and comparisons with Census statistics for 1899 and 1904 (based upon the censuses of 1900 and 1905). No detailed reports were received from Alaska. It is known, however, that the cut of Alaskan mills in 1906 approximated 16,000,000 feet, of which some 15,000,000 was spruce and the rest mainly cedar.

The total cut of softwood lumber in 1899 was 26,153,063,000 feet, and of hardwood 8,634,021,000 feet. In 1906 the softwood cut was 30,235,245,000 feet, and the hardwood cut, 7,315,491,000 feet. Over 31 per cent. of the total cut was furnished by yellow pine, while white pine and Douglas fir compete closely for second place, with an advantage of one per cent. in favor of fir. The seven woods of which the annual cut is more than 1,000,000 feet each are yellow pine, Douglas fir, white pine, hemlock, oak, spruce and western pine, which, together, furnish over four-fifths of the total production.

Scientists Will Meet in Chicago.

Beginning on December 30th and closing on January 4th next, there will be held in Chicago what is anticipated as one of the largest and most important gatherings of scientific men that has ever taken place in this country. This will be the occasion of the fifty-eighth annual meeting of the American Association for the Advancement of Science, which will this time be held at the University of Chicago. An attendance of 3,000 to 4,000 is expected. Aside from the meeting of the parent body the following sections will hold sessions: A—Methematics and Astronomy, B—Physics, C—Chemistry, D—Mechanical Science and Engineering, E—Geology and Geography, F—Zoölogy, G—Botany, H—Anthropology, I—Social and Economic Science, K—Physiology and Experimental Medicine, L—Education. A large number of affiliated scientific associations also hold meetings at the same time.

The membership of the association is now nearly 5,000 and includes almost all the leading American scientists, professors of scientific studies at the universities and colleges, and those educators, philanthropists and others who, though not themselves scientists, are in harmony with and actively assisting the advancement of science and scientific methods. The president of the association is Prof. E. L. Nichols of Cornell University, Ithaca, N. Y. The chairman of Section B is Prof. D. C. Miller, Case School of Applied Science, Cleveland, and of Section D, Prof. O. H. Landreth, Union College, Schenectady, N. Y.

COMMUNICATION.

Electrical Conditions in Peoria.

To the Editor of the Western Electrician:

In this week's issue of the Western Electrician I notice an article "Electrical Conditions in Peoria," in which it is said that the Code is being rigidly enforced with the exception that iron wall frames are permitted for flush switches instead of boxes. In relation to this, allow me to say that such was the condition until the 1st of October. Some time before that all the wiring concerns received notice from the city electrician that after that time iron wall-boxes would be required, and to the best of my knowledge these boxes have been used since that time. L. B. V.

Peoria, December 21, 1907.

Affairs of the Westinghouse Companies.

At a meeting of the creditors and stockholders of the Westinghouse Electric and Manufacturing Company in New York on December 20th the organization of a committee of creditors was announced. Plans for raising new capital and restoring the company to its stockholders have been under consideration for some time. The following statement was given out by J. N. Jarvie, who was named as chairman of the committee of creditors:

"At a conference between the receivers and a number of important creditors of the Westinghouse Electric and Manufacturing Company, held yesterday [December 20th] the following gentlemen were appointed a committee to act for the creditors of all classes in formulating and executing a plan for the readjustment of the company's debt and the prompt termination of the receivership:

"Richard Delafield, president of the National Park Bank; James N. Jarvie, representing the National Bank of Commerce and other financial institutions; Albert H. Wiggin, vice-president Chase National Bank; F. H. Skelding, president of the First National Bank of Pittsburg; Charles A. Moore of Manning, Maxwell & Moore; Neal Rantoul of F. S. Moseley & Co. of Boston. A seventh member residing in Chicago is to be added.

"The committee organized by electing Mr. Jarvie chairman, and is now at work upon a plan of readjustment which has been under informal discussion for several days.

"The committee is acting in harmony with Kuhn, Loeb & Co., who represent the interests of the holders of convertible bonds and the six per cent. collateral notes. The committee is also acting in full accord with Mr. Westinghouse, who is giving the committee his earnest co-operation."

Power Required to Drive Machine Tools.

In the new shops of the Wabash Railroad Company at Decatur, Ill., there is an interesting installation of Wagner three-phase 440-volt motors used to drive the varied machines used in car building and locomotive repairing. The Wagner Electric Manufacturing Company of St. Louis has just issued a pamphlet entitled "The Polyphase Motor in the Shop," illustrating this installation, and included in this book is a valuable table showing the power to drive certain machines, made from actual tests on the machines while working under normal conditions. This table, somewhat condensed, is reproduced herewith:

Description of Machine.	Name of Maker.	Capacity of Machine.	Method of Drive.	Motor Size and Speed	Average Load in H. P.
Planer and Matcher, 15x6......	Berlin Machine Tool Co.	15x6; 4 sides; 100 ft. per minute.	Direct Connected	40 H. P. 850 R. P. M.	25 to 50 H. P.
24x16 Car-sill Planer...........	S. A. Woods.	24x16; 4 sides; heavy oak.	Direct Connected	50 H. P. 850 R. P. M.	25 to 75 H. P.
Double Surfacer, 12x20........	Berlin Machine Tool Co.	30x12; 2 sides.	Direct Connected	30 H. P. 850 R. P. M.	15 to 40 H. P.
14x6 Outside Moulder..........	American W. W. Co.	14" wide, 6" thick.	Direct Connected	20 H. P. 850 R. P. M.	15 to 25 H. P.
36" Single Surfacer............	S. A. Woods.	36" stock.	Belted	10 H. P. 1,200 R. P. M.	5 to 13 H. P.
No. 4 Automatic 36" Cut-off Saw	Greenlee Bros.	13" timbers.	Belted	15 H. P. 1,200 R. P. M.	10 to 25 H. P.
40" Cut-off Saw................	Greenlee Bros.	18" timbers.	Belted	15 H. P. 850 R. P. M.	10 to 20 H. P.
Combination Band, Rip and Re-saw, No. 282.............	Berlin Machine Tool Co.	16" timbers.	Belted	15 H. P. 1,200 R. P. M.	7½ to 20 H. P.
Vertical Car-boring Machine..	Greenlee Bros.	4 vertical, 1 radial bit; ½ to 3", in timbers 14" thick.	Belted	15 H. P.	10 to 15 H. P.
Four-spindle Horizontal Boring Machine, No. 306........	Greenlee Bros.	4 bits, ½ to 3", in 16" timber.	Belted	10 H. P.	5 to 10 H. P.
Heavy Car-gaining Machine, No. 3......................	Greenlee Bros.	Gainer head 16" diameter, 6" wide; stock 24x20.	Direct Connected	15 H. P. 850 R. P. M.	10 to 25 H. P.
Vertical Hollow Chisel, No. 300	S. A. Woods.	Chisels, ½ to 2½"; 14x14 timbers.	Belted	15 H. P.	10 to 20 H. P.
Horizontal Car Tenoner.......	Greenlee Bros.	12x12 timbers, 10 and 6" wide.	Belted	15 H. P. 850 R. P. M.	10 to 20 H. P.
Heavy Car-sill Tenoner, No. 4.	Greenlee Bros.	16" cutting heads; stock 14x14.	Direct Connected	15 H. P. 850 R. P. M.	10 to 15 H. P.
20" Rip Saw...................	Greenlee Bros.	Rip material 6" thick, 17" wide.	Belted	10 H. P. 1,120 R. P. M.	5 to 15 H. P.
Double-spindle Shaper........	Berlin Machine Tool Co.	....	Direct Connected	10 H. P. 1,120 R. P. M.	5 to 10 H. P.
No. 7 Bulldozer................	Williams & W. Machine Co.	Crosshead 70", 14" wide; stroke 20".	Rawhide Pinions	30 H. P. 850 R. P. M.	10 to 40 H. P.
2½" Ajax Upsetting Machine..	....	2½" diameter round stock, 5x1" flat stock.	Belted	10 H. P. 1,120 R. P. M.	5 to 10 H. P.
Vertical Drill..................	Barnes.	Operating 2" drill.	Belted	3 H. P.	1½ to 3 H. P.
5½x10 Double Axle Lathe.....	Putnam Machine Tool Co.	27 axles in 10 hours.	D. C. with Gears	20 H. P. 900 R. P. M.	....
42" Car Wheel Borer..........	Putnam Machine Tool Co.	100 to 120 wheels in 10 hours.	Direct Connected	20 H. P. 1,120 R. P. M.	....
48" 200-ton Wheel Press.......	Niles Tool Co.	42" wheels at 200 tons pressure.	Geared	7½ H. P. 1,120 R. P. M.	....
Six-spindle Arch-bar Drill....	Foote-Burte Co.	Six 1⅛" holes	Geared	10 H. P. 1,120 R. P. M.	12 H. P.
Four-spindle, No. 2 Independent Feed Drill..	Foote-Burte Co.	Four 1⅜" drills.	Geared	7½ H. P. 1,120 R. P. M.	....
Taper Roll Machine...........	Williams & W. Machine Co	Rolling brake shoe keys and brake levers.	Geared	15 H. P. 1,120 R. P. M.	10 to 15 H. P.
Bolt Shears....................	Williams & W. Machine Co	Round iron, ½ to 2"; bar iron, 1¼ to 4", has architectural jaw for cutting angle channels.	Geared	7½ H. P. 1,120 R. P. M.	....
Combination Punch and Shears	Hillis & Jones.	Punching 1½" holes in 2" iron; shearing 8x1⅛" bars and 2¼" round iron.	Belted	7½ H. P. 1,120 R. P. M.	5 to 10 H. P.
80" High-pressure Blower.....	Buffalo Forge Co.	....	Direct Connected	50 H. P. 850 R. P. M.	30 to 40 H. P.
24" Jointer.....................	Greenlee Bros.	....	Belted	5 H. P. 1,800 R. P. M.	2 to 5¼ H. P.
24" Cut-off Saw................	Greenlee Bros.	....	Belted	7½ H. P. 1,200 R. P. M.	3¼ to 5 H. P.
Automatic Car brace Machine.	Greenlee Bros.	....	Belted	10 H. P. 1,200 R. P. M.	4½ to 6½ H. P.
Single Spindle, Horizontal and Radial Car-boring Machine..	Greenlee Bros.	....	Belted	3 H. P. 1,800 R. P. M.	1 to 2½ H. P.
No. 70 Tenoner................	Fay & Egan.	....	Belted	5 H. P. 1,800 R. P. M.	4 to 5½ H. P.
No. 281 Band Rip Saw.........	Berlin Machine Co.	....	Belted	15 H. P. 1,200 R. P. M.	8 to 15½ H. P.
Panel Carving Machine........	Fay & Egan.	....	Belted	5 H. P. 1,800 R. P. M.	1½ to 2½ H. P.
16" Universal Woodworker....	Greenlee Bros.	....	Belted	7½ H. P. 1,200 R. P. M.	4 to 7 H. P.
Combina'n Rip and Cut-off Saw	Amer. Woodworking Co.	....	Belted	5 H. P. 1,800 R. P. M.	2⅓ to 3 H. P.
Four-sided Sash Sticker.......	Amer. Woodworking Co.	....	Belted	5 H. P. 1,800 R. P. M.	5 to 6½ H. P.
Ajax Bolt Forging Machine....	....	....	Belted	10 H. P. 1,200 R. P. M.	2 to 2½ H. P.
Double-head Axle Lathe	Putnam.	....	Direct Connected	20 H. P. 900 R. P. M.	7 to 20 H. P.
200-ton Wheel Press...........	Putnam.	....	Geared	7½ H. P. 1,200 R. P. M.	1 to 5 H. P.
Shaving Exhauster Fan........	American Blower Co.	....	Belted	75 H. P. 900 R. P. M.	85 to 90 H. P.
Steel tired Wheel Lathe	Putnam.	....	Direct Connected	30 H. P. 900 R. P. M.	4 to 30 H. P.

ELEMENTS OF ELECTRICAL ENGINEERING.

By Geo. R. Metcalfe.

XLVIII. Storage Batteries.

Troubles.

The most common troubles to which storage batteries are subject are disintegration of the active material, buckling and short-circuiting of the plates, and sulphating.

Disintegration of the active material may be due to various causes, the effect of which is to loosen up and break off small pieces of the active material, which either fall to the bottom of the cell or, if large enough, may lodge between two adjacent plates and short-circuit them. This disintegration of the active material gradually reduces the amount and consequently the capacity of the cell. Excessive charging and discharging rates and buckling of the plates are among the principal causes leading to disintegration.

As disintegration always takes place to a certain extent, and the sediment collects in the bottom of the cell, it is apparent that all the plates would soon be short-circuited if they rested in the bottom of the cell where the sediment collects. In order to avoid short-circuiting from this cause, it is customary to suspend the plates in the cell at some distance from the bottom, varying from one inch to five or six inches according to the size of the cell.

As long as the sediment which collects in the bottom of the cell does not reach the plates, no harm is done, and the cells should be carefully watched to avoid trouble from this source. When a certain amount of sediment has collected in the trays, the electrolyte should be carefully siphoned or pumped out of the cell after removing the plates. The tanks can then be thoroughly flushed out until the sediment is entirely removed.

What is known as sulphating consists in the formation of a white coating of sulphate on the surface of the plate. This is not to be confounded with the formation of ordinary lead sulphate, which is the natural accompaniment of discharging the battery. The white scale which forms on the surface of the plates under certain conditions is a non-conducting material and the portion of the plate on which it forms becomes entirely inactive, as the part under the scale is incapable of being charged.

Among the causes which lead to sulphating may be too strong an electrolyte, too high temperature of the battery, being left discharged for a long time, or being discharged below the limits of voltage specified by the makers. Where only a slight amount of sulphating has taken place it can be removed by fully charging and only partly discharging the cells for several times in succession. If considerable sulphating has taken place, however, it can only be removed by taking the plates out of the cells and scraping off the deposit.

Buckling of the plates may be caused by an excessive rate of charging and discharging, or may be due to sulphating. The immediate cause of the warping of a plate is the uneven chemical action on the two surfaces. The expansion and contraction of active material is normally the same on both sides of the plate when the latter is in good condition. If one side of a plate, however, is partly sulphated, no chemical action takes place at this point, and the expansion on the opposite side causes the plate to warp. This buckling in turn also tends to disintegrate the plates.

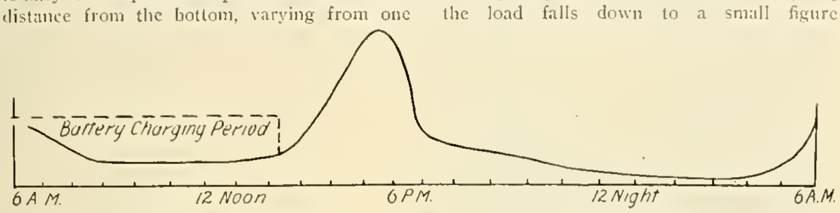
If a plate has not become too badly warped, it may be strengthened by subjecting it to pressure, or, in some cases, it may be necessary to hammer the plate to straighten it. This is a dangerous remedy, as it is apt to loosen or crack the active material, but if necessary, the plate may be laid between flat boards and carefully hammered straight with a wooden mallet.

If a plate is considerably warped, it is liable to short circuit by touching the plates on either side of it at some point. In some cases perforated hard rubber or other non-conducting material in thin sheets has been placed between the plates in order to prevent short-circuiting, but this practice has practically disappeared, as the separators introduced considerable internal resistance which greatly reduced the discharge rate of the cell.

Applications.

As storage batteries are now very widely used in isolated plants, central-station work and electric-railway work, a brief description of their more general uses in these classes of service will be given.

Storage batteries when used in connection with isolated plants are employed almost entirely for furnishing power during certain hours when the plant is not running. Consider the condition of the load, for example, in a large office building during the winter season: Starting about five o'clock in the morning the lighting load begins to pick up, and the maximum morning load exists from perhaps six to eight o'clock. By 8:30 a. m. the load falls down to a small figure which remains fairly constant until two or three o'clock in the afternoon. This part of the load represents the lamps that burn all day in dark offices, etc., and is only a very small fraction of the capacity of the generating plant. Nevertheless, it is necessary to keep the plant in operation, even though very few lamps are in use.



CURVE SHOWING APPROXIMATE LIGHTING LOAD OF OFFICE BUILDING.

About three o'clock in the afternoon the load begins to rise rapidly until it reaches its maximum between five and six o'clock at night. It then falls rapidly at about seven o'clock and then more gradually until 10 or 11 o'clock, after which there is but little load on the plant until the early morning lighting. The early morning lighting begins about four or five o'clock in the morning.

The general appearance of the load line is shown in the accompanying diagram, and it will be seen that the peak load about six o'clock determines the capacity of the plant, because the plant must have sufficient capacity to carry this load, even if it is only required to carry 10 or 15 per cent of it during the balance of the 24 hours.

This load also represents a very uneconomical way of running, because it involves the installation of a great deal more machinery than would be necessary if the load could be more evenly distributed over the whole 24 hours. Moreover, it is still further uneconomical because the boilers and generators work at their maximum efficiency at or near their full load, which corresponds to the peak on the load diagram, and during 18 or 20 hours of the day while operating on light loads their efficiency is very much reduced. This matter, however, may be partially compensated for by dividing the generating plant into two or three units of different sizes which may be used separately or in combination according to the conditions of the load. Even this, however, means that the item of labor continues through the whole 24 hours, and considerable more coal than necessary must be burned, as the boilers must be kept so that steam can be gotten up quickly when required.

If a storage battery be added to such a plant it not only reduces the capacity of the installation of boilers and engines, but it also does away with the necessity of requiring attendance during part of the day. It also enables the load line to be flattened out, so to speak, or in other words enables the boilers and generators to run at a fairly constant load during the time of day when they are required to operate.

If the storage battery is thrown on the line to be charged about seven o'clock, the load line, instead of dropping down to the usual day load, would continue at about the early morning amount, and would run approximately even until two or three o'clock in the afternoon, as represented by the dotted line.

Just before the peak load commences to rise, the battery can be thrown in parallel with the generator, so that the generator will carry, say, one-half of the maximum load and the battery will carry the other half. After the peak load falls down in the evening the entire generating plant can be shut down and the balance of the night load will be carried by the storage battery. This means that the generators have worked 12 or 14 hours a day at a nearly constant load, and the battery carries part of the peak load and all of the night load. This enables the fires to be banked at night, and the cost of attendance is reduced one-third, or possibly nearly one half.

The use of a storage battery also is extremely convenient in bridging any gap of the service which may be occasioned by breakdown or derangement of the machinery which requires the plant to be shut down for a short period while repairs are being made. If the batteries are of sufficient capacity so that the service does not require them to be charged or discharged faster than their normal rate, they should last for several years with but slight depreciation, and frequent inspection and intelligent care would make their life almost indefinite in this class of service.

[*To be continued.*]

Note.—This series of articles, intended to survey, briefly, the whole field of applied electricity for light, power and heat, was begun in the Western Electrician of February 2, 1907.

Identification of Underground Circuits.

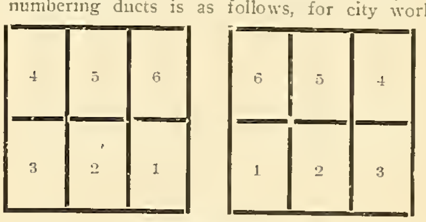
In answer to several questions, the editor of the Question Box of the N. E. L. A. Bulletin, from information furnished by W. E. McCoy, Guy K. Mitchell, G. A. Fuller and Parker H. Kemble, has prepared the following in relation to the identification of underground cables:

Tag all cables and keep careful records of the same, open at all times to employes of the company. A very satisfactory material for tags is one-eighth-inch sheet lead secured to the cable with wire solder. The cable number, voltage, etc., are stamped on the lead tags. Detailed drawings should show duct numbers, cable lengths and sizes, etc. One way is to tag all cables at least every block. Tag them all consecutively as they are drawn in on each street. If a cable is ever drawn out, this number disappears. This means there are no two kinds or makes of cable numbered the same on the same street. When feeders are cut up, destroy old records and make new ones.

In addition to tagging, safeguard by using a small transformer connected to a telephone receiver, and laid on the cable. If the cable is alive, a noise due to the frequency will be heard. In another case, on 13,000-volt, three-phase cables, a telephone receiver in circuit with about 300 turns of No. 24 wire, wound on a wood core, is used. If voltage is on the conductors of the cable, a hum will be heard in the receiver when the coil is laid on the lead sheath of the cable. A compass is misleading on a direct-current cable, because of the ground currents in the sheath.

Another way is to strip off the lead carefully and saw the copper in two, using care by standing on dry boards and wearing gloves. The action of the spark when cutting the copper will show whether the cable is alive or dead. Block switches at station. A block of wood painted red and stenciled "Wireman on lines," placed in the slot of the switchboard and held in place with a rubber band, is suggested. Also, short-circuit cable ends and ground them.

The Baltimore Electrical Commission's system of numbering ducts is as follows, for city work:



Power Development at Rapid City.

The Dakota Power Company is building a hydro-electric plant on Rapid Creek, west of Rapid City, S. D., to develop 1,500 horsepower. The company now has 2⅝ miles of ditch and flume completed, and has still 1¾ miles of flume to build. The entire cost of the plant when completed will be about $200,000, it is said. The same company can generate, if necessary, an additional 1,500 horsepower. The plant will be installed in two 500-horsepower units and two 250-horsepower units. The power is to be used for light and power in Rapid City. The plant will be completed and in operation next fall. The Business Men's Club of Rapid City, of which W. W. Soulé is one of the directors, is interested in the project.

Direct-current Integrating Watt-hour Meters.

By W. R. Pinckard and H. W. Young.

Perhaps the best known form of direct-current integrating watt-hour meter is the "commutating" type, and many different forms have been developed to meet the various conditions. The usual form of commutating meter contains the three necessary elements—a motor producing a driving torque; a generator providing a load or drag varying with the speed, and a registering mechanism so arranged as to integrate the instantaneous values of the electrical energy passing through the measuring coils.

The motor element usually consists of two stationary coils wound with wire of sufficient capacity to carry the entire load and located so as to surround a rotable armature wound with several coils of fine wire and suitably connected to a commutator on which bears a set of brushes. In series with the armature is a high resistance and a small fine wire coil located in proximity to the armature. The stationary coils are connected in series with the load and the shunt circuit consisting of the armature, resistance and light load coil is connected across the line.

The construction employed gives a driving torque proportional to the energy flowing in the circuit, and to secure correct registration it is necessary for a retarding torque to be provided which will be proportional to the driving torque. A controlling force varying directly with the speed is obtained by mounting an aluminum disk on the same shaft causing it to pass between the poles of permanent magnets whose fields induce foucault or eddy currents in the disk. The inter-action between the fields of these eddy currents and the field of the permanent magnets produces a retarding torque varying directly with the disk speed. With such an arrangement of driving and retarding torques a rotation is produced which is proportional in speed to the driving torque and, therefore, to the energy passing through the measuring coils. As the measuring elements do not employ iron and are practically non-conductive, the meters can be used on either alternating current or direct current circuits.

Figures 1 and 2 illustrate a form of commutating-type meter which is interesting in that it embodies several features new to this type of meter, such as the roller type of ball bearing, dissimilar alloy commutator and brushes, solid pressed dustproof cover, porcelain terminal blocks, etc.

Commercial Requirements.—In order that an integrating meter may meet commercial requirements it is essential that it be highly accurate, owing to the fact that any errors which may be present are cumulative, and even a small percentage error will, after a lapse of time, become relatively important from a pecuniary standpoint. The accuracy must be especially high at the lower end of the curve, owing to the fact that for the larger part of the time the actual load is but a small percentage of the meter's capacity, and a meter which shows inaccuracy at this point cannot be a profitable investment for the central station for the reason that the tendency is to under-register rather than over-register.

In commutating-type meters the accuracy obtainable depends upon a number of different factors, such as design of the measuring coils, amount of friction caused by the commutator and brushes, amount of friction caused by the lower bearing, permanency of the drag magnets and the ratio of torque to friction. Assuming that a correct electrical design has been secured and the initial accuracy is within the recognized limits, the most important quality of a meter is its ability to maintain the initial accuracy for long periods of service with minimum attention and expense for maintenance.

In the commutating type of meter the factors determining this most important requirement are refinements entering into design of bearings, weight of moving elements, alloy employed in the commutator and brushes, dustproof features, ability to withstand heavy overloads on short-circuits without damage.

In general the type of lower bearing and type of commutator and brush construction employed give a good idea of the meter's ability to maintain initial accuracy under operating conditions, for it is at these points that friction first asserts itself. The commutator friction can be reduced by employing small diameters and gravity-controlled multiple-contact brushes, thus equalizing the tension and contact friction. By employing proper metal in the commutators and brushes the inevitable oxidization, with its attendant variable nature, can be reduced to a minimum so that errors due to this feature can practically be eliminated. Care should be exercised, however, in designing commutators not to overstep the well-recognized limits and by striving to secure an excessively small diameter run into the more serious trouble caused by a weak mechanical or electrical construction.

Lower Bearing.—The lower bearing, however, is largely the cause of inaccuracy, and much thought has been devoted to this subject. The earlier forms of lower bearings consisted of a polished steel pivot resting on a highly polished sapphire jewel bearing, and with some modifications, such as having the pivot removable, thus facilitating replacement, is still employed.

Probably the chief objection to these earlier bearings was the fact that the entire weight of the rotating element was concentrated on a very small bearing surface and the attendant rubbing naturally caused wear. The amount of wear was variable, depending largely upon the material employed, but under some conditions it would be sufficient to even drill a hole through the jewel or wear the pivot end absolutely flat.

The natural wear of the bearing surfaces was also aided by the dust or small particles of sapphire thrown off from the jewel surfaces, and these particles, being harder than the pivot, would embed themselves in the steel, thus practically forming a cutting tool, tending rapidly to break down the jewel surface, with the resulting impairment of light-load accuracy.

In commutating-type meters having rotating type of elements considerably heavier than those employed in induction meters, the jewel wear takes place at a much more rapid rate than in the latter type, and therefore the proper design of lower bearing is of the highest importance. The roller or ball bearing, which has been successful in the induction type of meter, was therefore decided upon for use in the commutating type of meter herein described and has worked out in a satisfactory manner. Owing to the increased weight of the revolving parts over those employed in the induction type meters, it was deemed advisable to mount the lower jewel on a spring support, which would obviate any undue vibration or shock which might be transmitted to the moving element from the meter support. The arrangement of the various elements of the roller form of bearing is detailed in Fig. 3, and, as will be noted, it is very similar to that adopted for induction type of meters.

As will be seen the bearing consists of a steel ball resting between two cupped sapphire jewels, one of which is mounted on a spring-supported plug and the other on a removable sleeve attached to the end of the disk shaft. The steel ball is hardened and highly polished, the sapphire jewels being ground to the proper radius to fit the ball and then carefully polished. By this combination of a movable jewel, movable ball and fixed jewel, a rolling action is obtained as contrasted to the rubbing action of the older form of pivot bearings. This changing point of contact between the bearing surfaces insures a lower friction value and a longer jewel life with minimum wear than can be secured by the pivot construction.

Another feature of this form of bearing is that the wear is distributed over the entire surface of the ball rather than being confined to a relatively small surface as offered by the end of a pivot.

Registering Mechanism.—A source of friction and consequent inaccuracy in integrating meters is traceable to the inevitable corrosion of the brass plates and gears of the registering mechanism. This corrosion, which is common to all ordinary brass, is not apparent when the meter is new, but appears after the meter has been in service and is objectionable in that it introduces friction due to the gumming or clogging action which ensues. This corrosive action of meter registers can be entirely eliminated by gold plating the various surfaces, and with this treatment the registers will be unaffected even after years of service.

FIG 1. COMMUTATING TYPE DIRECT-CURRENT METER.

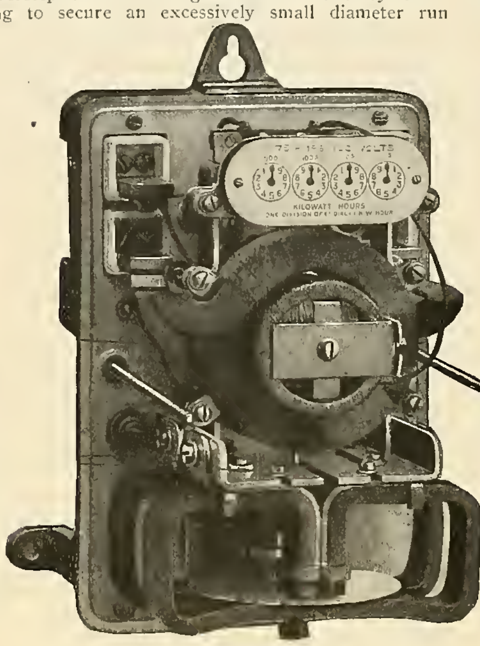


FIG. 2. COMMUTATING-TYPE DIRECT-CURRENT METER (COVER REMOVED).

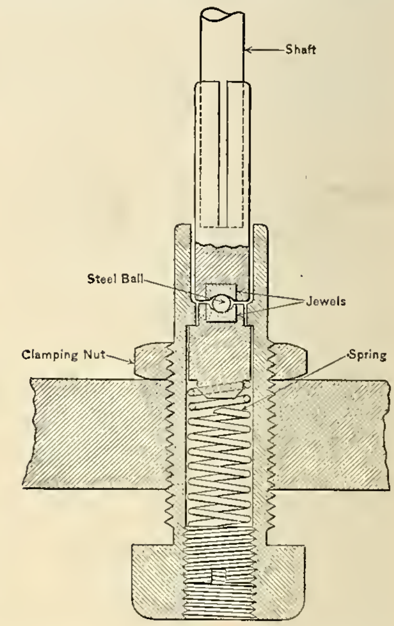


FIG. 3. SPRING-SUPPORTED ROLLER TYPE OF BALL BEARING.

Another method of securing a light running register is to make the shafts of polished steel rather than of brass as ordinarily employed. It is a well-known fact that bearings composed of like metals are not so efficient as those employing unlike metals, and therefore the use of "steel to brass" necessarily gives a better operating construction than in the older form of meters employing "brass to brass."

In all integrating meters it is necessary to have a worm transmission in the register and the usual position for this worm is on the disk shaft. In the meter illustrated above the worm on the first shaft is replaced by a pinion so located as to mesh into a suitable wheel and the worm itself is placed back in the gearing or removable bracket, as shown in Fig. 4.

Light-load Adjustment.—To overcome the initial friction which is unavoidable in any meter's construction and to compensate for any increase which may occur after a period of service, commercial meters are provided with some form of compensation which is invariably adjustable. In the meter illustrated, this compensation is affected by means of an adjustable coil connected in series with the armature, which, when connected to circuit, energizes a constant auxiliary field. This field, in conjunction with the field generated by the armature coils, tends to produce a sufficient torque to overcome the static friction of the rotable element, which is thus poised or held in a position ready instantly to respond to any magnetic field generated by current passing through the series coils. By varying the distance between the armature and compensating coil, the effect on the armature may be increased or decreased as desired.

Effect of Short-circuits.—A trouble which is more or less common to commutating type of meters is that of errors in the registration caused by the heavy magnetic field projected from the series coils causing severe short-circuit conditions which cause the meter to carry abnormally heavy currents. These projected or stray fields tend to demagnetize the permanent magnets, thus causing the meter to run fast, although under certain conditions the opposite may take place.

These detrimental effects of short-circuits may be largely minimized by locating the magnets at a considerable distance from the series coils and arranging their poles so that the fields will be at right angles to that generated by the series coils. The magnets can be further protected by use of an iron shield which may be interposed in the path of the magnetic flux.

In analyzing the merits of the integrating watt-

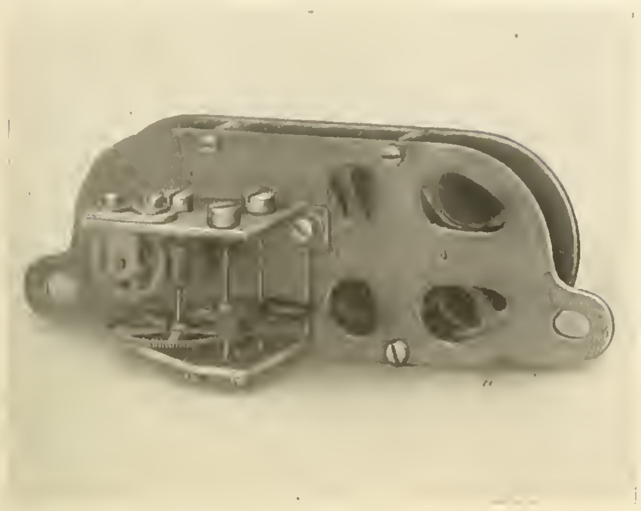


FIG. 4. REGISTERING MECHANISM OF DIRECT-CURRENT METER.

meter with a view of deciding upon its ability to give or maintain accuracy, the importance of having a high "ratio of torque to friction" can be better understood by considering the action and operation of an integrating meter as analogous to that of a small direct-connected motor-generator set in which the current and potential coils are considered as the motor element and the disk and the permanent magnets as a magneto-generator with a short-circuited disk armature. The work expended by the motor is absorbed in driving the short-circuited generator and overcoming friction in the bearings and registering mechanism. In a perfect meter (or motor-generator) all the work would be expended in driving the disk or generator (friction being absent), in which case a direct ratio would exist between the speed and the energy passing through the motor system, thus giving a meter absolutely accurate throughout its entire range.

It is, however, impossible entirely to eliminate friction, but it will be seen that the more perfect the meter is, the greater will be the ratio between the work expended usefully in driving the disk or armature of the generator and that expended in overcoming friction; in other words, the "ratio of torque to friction" in the meter will be high. Meter manufacturers recognize this essential feature and endeavor to make this ratio of torque to friction very high by efficient design of the measuring elements and reduction of friction in the bearings and registering mechanism.

Proportion of Coal for Starting and Banking Fires.

[From the Question Box of the National Electric Light Association.]

In a central-station plant of 2,000-kilowatt capacity, using water-tube boilers at 160 pounds pressure, what should be the proper and reasonable proportion of coal used for banking and starting boiler fires to total coal burned?

ANSWERS.

C. E. Elliott: In our plant of three water-tube boilers of 650-horsepower units, fitted with Roney stokers, the percentage of coal used for banking to total coal burned averages seven per cent.

James Link: Two or three per cent. of the total coal burned should take care of banking and starting fires. Do not favor banking fires for period of over five or six hours.

C. H. Parker: A 2,000-kilowatt plant manufacturing 24,000 kilowatt-hours per day would use about 20 per cent. of the coal for cleaning, banking and lighting fires.

G. R. Wood: Will depend upon conditions, size of boilers, peak load, etc., and will run from 4 to 12 per cent. of the coal burned.

The first test of the 5,000-horsepower gas engine on December 13th by the Carnegie Steel Company at the Edgar Thompson plant was satisfactory. The engine was designed by Carnegie and Westinghouse engineers to take advantage of the waste gas of the blast furnaces as fuel. It is said the new engine will save half the fuel bill at the plant.

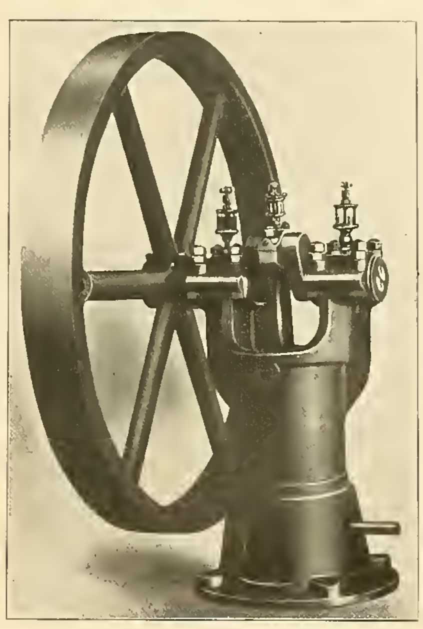
A New Westinghouse Air Compressor.

The Westinghouse Air Brake Company has been for some years supplying various industries using compressed air with standard steam and motor driven air compressors. In a large number of plants, however, there is a demand for a compressor of smaller capacity. The company has therefore developed a small belt driven compressor, which has now been thoroughly tried out.

The new compressor, which is a belt driven unit, is characterized by the same excellence of design and construction as the larger apparatus now standard in railway and traction practice and also used in commercial work. The weight of the complete unit is 218 pounds, and its base is 12 inches in diameter. Its compact build enables it to be located in limited space where power from shafting or small motor drive is available. It is particularly adapted to gas-engine starting, automobile-garage use, charging storage tanks for small pneumatic tools, general machinery cleaning and in a great variety of cases where compressed air at high or low pressures, but in small quantities, is required.

The compressor is of the vertical single-cylinder, single-acting, water-jacketed type, operated by power delivered to a 30-inch flywheel attached to a crank-shaft, the rotation of which drives the piston in the cylinder by means of a connecting rod. The diameter of the cylinder is three inches, the stroke of the piston is four inches, and the rated capacity of the pump is four cubic feet of free air at 250 revolutions per minute. It will operate satisfactorily against any air pressure up to 250 pounds. At 250 revolutions per minute (its speed of maximum efficiency) and against 200 pounds air pressure, approximately one brake horsepower is required to operate the pump.

Since the act of compressing air always raises the temperature, the cylinder is surrounded by a



A NEW WESTINGHOUSE AIR COMPRESSOR.

water jacket, through which a constant circulation of water is maintained, thus lowering the temperature of the discharged air and increasing the efficiency of the compressor, and at the same time greatly reducing the effects of overheating, due to prolonged operation.

A detailed description of the new compressor is to be found in a booklet just issued by the Westinghouse Air Brake Company.

Articles of incorporation have been filed for the Chicago, Joliet and Eastern Illinois Railway Company. The new line is to be electric, and will run in a southwesterly direction from Chicago, and is likely to touch at points in Cook, DuPage, Will, Bureau, Peoria, Kendall, Grundy, La Salle, Livingston, Putnam, Marshall, McLean and Woodford counties. The first incorporation was for $2,500, but it is said that this amount will be increased to $1,000,000. The incorporators are: Josiah Burnham, Hugo D. Loeb, George L. Turnbull, Gerald Turnbull and L. H. Stricker.

The Technically Trained Man and the Electric-railway Profession.

By Prof. Henry H. Norris.[1]

The manufacturers were the first, and have been foremost in utilizing the product of the technical schools. They have carried this to such an extent that apprentice courses are offered by all of the large companies, and the young men are given every possible opportunity to develop normally and quickly. They are taken through all departments of the works, learning in each enough of the detail to enable them to appreciate the reasons for the development of existing forms of apparatus, and for the employment of present methods of construction. They test the finished product, and so learn what to expect of the various classes of machines.

The operating companies are now taking this matter actively in hand, and a few lighting companies have developed courses similar in purposes but necessarily different in plan from those of the manufacturers. The Denver Gas and Electric Company was a pioneer in this direction, and its example is being followed by other companies.

The purpose of the present paper is to inquire of the members of this association whether it is practicable for them to institute something corresponding to the apprentice courses of the manufacturing and lighting companies. Some years ago, at the request of the New York State Street Railway Association, the writer conducted an investigation to determine the attitude of the members of that association toward the technical school. The result of this inquiry was to find that technical graduates are favorably regarded by the officers of the railway companies. At that time technical graduates were found mostly in the engineering departments, although some had risen to managerships and superintendencies. In response to an inquiry as to how young men should go about entering the electric-railway field, the replies were not entirely satisfactory. The general advice was to begin at the bottom and to work up, it being a matter of small consequence what the first position is. There was, however, no systematic way by which a young man fresh from college could learn the electric-railway business nor, as far as the writer is aware, is there any at the present time. While it is natural that the graduates should find their way first into the engineering departments, it is the firm conviction of the writer that if their training is a success, the young man should be equally well adapted to the other departments, provided, of course, that they have the necessary personal qualities for superintending and managing.

The men who are now controlling the electric-railway companies have largely grown up with the industry. The experience of many dates back before the early '90's, when the horse was supplanted by the electric motor. These officials are now training young men to take their places when they retire, and they naturally desire to find for this purpose individuals with the necessary characteristics and training. For many reasons they have the right to expect the technical schools to supply the class of men required. The first of these is that the technical schools should, and probably do, attract a large proportion of industrious, active and capable students. A young man who has the nerve and ability to conquer the difficulties of a technical training, especially if he is financially handicapped, ought to be one who is needed in business. In the second place, the mental and physical discipline tends to bring out his good qualities and make him self-reliant and original. It increases his initiative power, the most important business qualification which he can possess.

It is surprising that such a comparatively small number of the technical graduates find their way into the electric-railway business. Of the more than 2,000 graduates of Sibley College, probably not more than 50 are directly or indirectly engaged in this line. Of these, quite a proportion are in the supply business, and only a small number are actually in the field. This is probably not because railway work is not attractive, but other lines have been so much easier to enter that they have attracted the bulk of the graduates. Some kind of an apprentice course would be welcomed by technical students. They enjoy any work in this direction that is given in the schools, and they show great aptitude for it.

To make the matter entirely practical the following arrangement is suggested for such a 1½ years' course:

(1) *Three months in master mechanic's department.*—This time should be largely spent in the car barns and repair shops. The apprentice can serve as helper on car inspections and repairs, construction of special parts, tests, etc.

(2) *One month in purchasing agent's department*, partly as assistant to the storekeeper, and partly as general assistant to the purchasing agent.

(3) *Three months in motive-power department.*

1. A paper (condensed) read before the American Street and Interurban Railway Association at Atlantic City on October 16, 1907. The author is professor of electrical engineering at Cornell University.

—This time should be spent as general helper, oiler, or in any other capacity in which the apprentice could be made useful. He could also assist on tests, designs for repairs and inspections. He could also act as emergency supply for substation attendance. A short time in the superintendent's office would familiarize him with the details of administration.

(4) *Two months in transportation department.*—The apprentice could be given miscellaneous work in connection with the preparation of time tables, familiarizing himself with the train-dispatching system, and, in general, making himself useful to the superintendent. In many ways he could assist in this department as emergency supply in ticket offices, on express cars, etc.

(5) *Two months on outside line work.*—The apprentice could be employed as assistant with the repair gang, and he could also make himself useful in construction of new work, testing, repairs to instruments, etc.

(6) *Three months in way department.*—This time should be spent in office work, laying out details of new construction of track, bridges, etc. The apprentice should also assist in surveying and other field work.

(7) *Two months in comptroller's department.*—This time should be spent as general office assistant, and in conducting special investigations for the financial officers of the company. A technically trained man would be well equipped by this time to be of great assistance in compiling statistics. These cover not only the operation of the company itself, but of other companies. The apprentice would thus become familiar with the methods of accounting used, and of the relation of this department to the others.

(8) *Two months in general manager's office.*—The apprentice should now be in a position to be of practical use to the manager, and could be detailed to special duties which happened to demand attention.

One and a half years have thus been scheduled and subdivided among various departments with a view to preparing the apprentice for any line of work in the railway field which may happen to be open to him. He has had the opportunity to demonstrate his peculiar abilities and disabilities, and if he has "stood by" for the full period, he has shown his appreciation of the opportunity. It is obvious that a very large company could handle a number of such apprentices without serious difficulty if the officers in charge of them were in hearty sympathy with the idea.

The plan requires the co-operation of the heads of all departments, and there are numerous objections which appear as soon as the scheme is suggested. The young men are in the various departments such a short time that they are not able to work at maximum efficiency. Further, it requires a little effort on the part of the superintendents of the various departments to lay out the work for the apprentices. The young men are apt to leave, and thus the company loses the benefit of the effort expended. On the other hand, opportunities are constantly arising in every company demanding loyal, well-trained employes. These are difficult to obtain, and could be picked out instantly from the apprentice corps. Smaller companies, by slight modifications, could use the same general plan, and with the same results.

The matter of pay for the apprentices is one of practical importance. It is not to be expected that they will be able to earn as much as men regularly employed in the departments. On the other hand, they should be expected to earn for the company as much as possible. Their wages should be based more upon a reasonable living expense than upon their earning capacity. This will depend upon the cost of living in various communities. Probably from $10 to $12 a week at the start, with a reasonable increase at the end of each six months' period, would be reasonable and satisfactory to all concerned.

This paper is not intended to recommend that companies go into the apprentice business on a wholesale scale. If each year one or two men could be employed by the smaller companies, and half a dozen or so by the large companies, there would be a sufficient supply of new material always in process of development. Of the men hired probably one-half would drop out before the end of the period, and those who remain would naturally be the ones best fitted for the work. From the writer's personal experience he is aware in a general way of what the companies need in this line, because he has the frequent privilege of recommending young men for various positions in electric-railway work. In every such case if the apprentice corps were in existence, the needs of the company could have been met better within their own organization.

Discussion (in Abstract).

Henry W. Blake, New York: Professor Norris' paper suggests a concrete plan by which the results secured by other companies in utilizing the college graduate may be carried out by street-railway companies. His apprentice course of some months should form an excellent method for learning the practical application of the principles acquired at the university, and the establishment of a trained corps of men in the way suggested by him should be of great future assistance to the railway companies.

Prof. A. S. Richey, Worcester (Mass.) Polytechnic Institute: I think the apprenticeship course that Professor Norris suggests is a very good one. The technical schools are taking an interest in electric-railway work. Worcester Polytechnic Institute, which is a small institution compared to many others throughout the country, has just completed a laboratory which, with its equipment, represents an investment of about a quarter of a million of dollars, and between one-third and one-fourth of that investment represents equipment which is devoted exclusively to electric-railway work. No one course was elected by more than three-fourths of the men in the senior class in electrical engineering except the electric-railway course, and that course was elected by every man in the senior class. Three men taking post-graduate work in electrical engineering have been interested enough in your association to come to this convention from Worcester at their own expense—and that expense to a student in an institution of that kind means more than it does to a great many of you men. But the technical schools can only give a foundation in electric-railway engineering. That is the reason why this suggestion has been made for a sort of apprenticeship course which will round out that work of the technical schools more quickly and in better shape than simply beginning at the bottom and working up.

There is another way in which the technical schools and the electric-railway association might co-operate. The institutions have put a great deal of money, some of them, into equipment which is suited to testing and experimental work. Purdue University, with its splendid laboratory for steam-railroad experimental work, is an example. Some such working arrangement as that might be gone into by this association and the various technical schools which are taking up the electric-railway work.

Just one thing comes to my mind now, in the report of the committee on maintenance of electrical equipment. There is a great divergence of opinion as to the best quality of brushes to use on railway motors. It cannot be possible that the very hardest brush is the best brush, and at the same time the very softest brush is the best brush, under the same conditions. Nobody seems to know what those conditions are, nor where to bring that wide divergence of opinion down to a point, and who is better fitted to take that up than these institutions, which are equipped for this experimental work and have the time and inclination to go into and find out the "why" of these things. That is another way in which we can co-operate.

C. S. Sergeant, Boston: I have been interested for many years in utilizing technical graduates, so long as they could be prevailed upon to remain with us, but they are birds of passage. They have done a great deal of good work for us for little or no compensation, and to a considerable extent in different departments, and I would say that other graduates, even the graduates of our regular college, have, some of them, sufficient sand to put on a blue uniform and go on the cars for a few months, and it is rather a hard thing for a Harvard graduate to do, but they have done it, a number of them.

Now, it seemed to me that in listening to this paper, Mr. President, that if one were to criticize at all it would be as to the brevity of the course in each department. I do not believe in a smattering. I think that this business becomes more specialized all the time, and that there is a good deal of danger that the young man who flits about from a couple of months in one department to a month and a half in another will think he knows it all in a year or two. That is the worst thing that happens to a young man. I would like very much to induce the student to spend more time in each department. But I do believe in the rotation from one department to another, and possibly my criticism is not a fair one. I do think that we cannot have too many educated men in the business.

C. D. Wyman, Stone & Webster, Boston: We have been fortunate enough to secure, for what we call our school, from 10 to 20 graduates from Cornell, from Massachusetts Institute of Technology and from a number of other technical institutions, and in our school we endeavor to give them first some practical education along the line of investigating actual statistics derived from the operation of our various companies. After having, if possible, a year's study, they then are very willing and anxious to undertake practical results with some of the different companies that we control. Every year there go to these companies, as I said before, from 10 to 20 young men, who get right down to business. They follow various lines. There is nothing too good in the way of mental and technical equipment that a man can have who is to direct the work of those public-utility corporations. I hope that the members of this association will assist and encourage work of this kind.

W. H. Evans, Buffalo: It occurs to me that this scheme would fail entirely, or at least in part, if we had but one apprentice at a time. If the road were sufficiently large to have several, I think very much better results would be attained. If you simply appointed a man who was to be railroaded through this course to the general manager's office, he might reserve his best efforts until he reached the general manager's office. It also occurs to me that those apprentices will fail in the first step unless they get down to the level of those with whom they associate. They must disabuse their mind of the fact that they are there to gain all and to give nothing, because Jack and Bill and Mike and Tom are not going to unbosom themselves to a fellow who impresses them with the idea of his great superiority.

John I. Beggs, Milwaukee: I wish to indorse every word that Mr. Evans has said, from my experience with a lot of these apprentices. They thought they were so above the men that they were thrown in to work with that they wouldn't put on the overalls, and they were a little bit careful of their hands and garments getting greased. As soon as they feel like that they had better be transferred to some other department. That is one of the things that these professors in the colleges should impress upon these apprentices when they go out. Let them start as not superior to the men from whom they must gather the information to make them valuable.

J. W. Corning, Boston: I second the remarks of Mr. Evans. Some of the students seem to think that they are not to accept responsibility; that this course is something which is mapped out for them, and that by passing through it, by some hocus pocus, they will come out on top and be ready to accept responsible positions when they are through. A fairly large number of men seem to have that idea and have failed to measure up to what is expected of them.

W. Caryl Ely, Buffalo: I just want to say one word in regard to the overalls, dirty hands and dinner pails. There is an idea prevalent, I think, among the men who are practical in the street-railway business, and especially the older ones of us, that men who are technically educated have to be taken down a peg in some way in order to make them accustomed to the things that they would come in touch with in the shop or in the practical department. I want to say that there could not be a more erroneous idea, based upon the things that one sees at Cornell and the different institutions where men receive instructions in mechanical arts, engineering, etc. Why, they work hours and hours. I have known men to do 16 hours of laboratory work at Cornell, when I was a student there; and the overalls and grime and dirt and dinner pails are their regular daily companions throughout the four years of their course. It is a mistake to think that a man has to be born with a red flannel shirt on him in order to enable him, if he has been through a course of instruction, to get down to good hard common work that greases his hands and smuts his face.

C. L. S. Tingley, Philadelphia: It appears to me that too small a period of time was allotted by Professor Norris to the man in my department, namely, the accounting end. One of the greatest difficulties that the accounting department has is the inability of some of our technical men to grasp the importance of giving us any account of what they are doing, and unless a man has a turn of mind which lends itself to the grasping of accounts and accounting methods, two months is entirely too short a time to give him an insight into the details and working of a very important part of our business. Therefore it will greatly facilitate the man's education, and also his efficiency, when he passes out into the larger field, if he is allotted a little longer time.

There is one other thought, and that is that a man in this apprenticeship should not be passed on from one department to another until the head of the department in which he is working has certified that he is competent or that he has done the allotted work, the same as you would not pass him in a school until he had done satisfactorily the allotted work of his course.

The Independent Telephone Movement.

There will be no coalition, co-operation or connection between the Independent and Bell telephone companies, according to President Theodore Gary of the International Independent Telephone Association, which has just established permanent headquarters in Chicago. Mr. Gary made this statement speaking of rumored negotiations for peace and unification of interests at the annual convention of the Independent association in Chicago, January 21st, 22d and 23d next. The Independent telephone business is said to be thriving, and officials of the association say that in 15 years the number of Independent telephones in use has grown to over 3,000,000. During the approaching convention many subjects important to the Independent movement in the United States, Canada and Mexico will be discussed by the leading men in the industry.

Indiana District Telephone Meeting.

The Indiana Independent Telephone Association held an important meeting in the Eighth District at New Castle on December 20th. A. C. Lindemuth of Richmond presided. Upon roll call it was found that every company in the district was represented. Mr. Lindemuth read a paper on "Organization," which resulted in steps being taken to further a plan for a change in the relation of the national and state telephone bodies. This was followed by the reading of an able paper on "County Service" by Mr. R. R. Faulkner, president of the New Castle Telephone Company, who advocated compact organization for the county with a reasonable toll charge between all exchanges in the county.

The meeting passed a resolution opposing any direct or indirect connection with the Bell company unless it was a universal connection for all companies which guaranteed the Independents their right of territory for all time to come.

A. Boyd, manager of the Citizens' Telephone Company of Cambridge City, suggested how rates may be raised without giving offense to the patrons. As he had just successfully raised the rates in the several exchanges operated by his company, the number of practical suggestions he made were received with considerable interest and profit by those present.

C. A. Phelps, manager of the New Castle Telephone Company, and K. B. Davis, manager and secretary of the Middletown Telephone Company, were selected as delegates to the international convention in Chicago January 21st to 23d.

The delegates and visitors were entertained at dinner as the guests of R. R. Faulkner, president of the New Castle Telephone Company.

Indiana Telephone Items.

The directors of the Goshen Home Telephone Company have decided to expend about $25,000 in improvements and extensions.

It is reported that Theodore Thorward, president of the South Bend Telephone Company, has completed arrangements for connection with the company at Cassopolis and Grand Rapids, Mich. As a result the Indiana company secures connection with 88 cities and towns in Michigan, including Detroit.

The pastor of the Presbyterian Church of Muncie has for some time past placed a desk telephone on the pulpit so that the sick and disabled of his flock could enjoy the sermon and music at their homes. The stay-at-homes became so numerous and the congregation decreased so rapidly that the minister has concluded to discontinue the telephone service from the pulpit.

The Cumberland Telephone Company of Evansville has asked for an extension of time to May 1st for installing the new equipment provided in the new franchise granted the company some months ago. The City Council has granted the request.

The Bloomington Home Telephone Company has announced that it will raise the rates on its patrons beginning January 1st. Residence telephones heretofore $1.25 a month will be increased to $1.50. Business and office telephones will be raised from $2 to $2.50 a month. The company gives as its reason for this increase that all materials used in the service have increased in price almost 60 per cent. above what they were three years ago and that labor is much higher and that the state tax board raised the company's assessed valuation over $2,000. S. S.

Telephone News from the Northwest.

Lincoln Eves of Meckling, S. D., has bought the local exchange at Fulton, S. D., and will install a new switchboard.

The Independent telephone companies of Wisconsin propose to construct a toll line from La Crosse to Milwaukee next season.

Work will be started at once on the new telephone system at Breckenridge, Minn., by the Breckenridge Telephone Company, which has recently incorporated with a capital of $50,000.

The Providence Township Mutual Telephone Company has been incorporated at Iowa Falls, Iowa, with a capital of $10,000.

George N. Bandy of Des Moines, president and general manager of the Hawkeye Telephone Company, has disposed of his half interest in the company to the Brenton brothers of Dallas Center, and they now own the entire property.

A telephone franchise has been voted at Casey, Iowa.

The Western Telephone Company has been organized and it will build a rural line southwest of Fergus Falls, Minn.

The Shickley (Neb.) Telephone Company has been organized with a capital of $2,000. M. L. Schelkopf is president and A. Nelson, secretary. R.

Bids will be received at the office of the deputy postmaster-general, Sydney, New South Wales, for the supply and delivery, at the Central Exchange, General Postoffice, Sydney, Australia, of 1,000 telephones, wall, common battery, and 100 telephones, table, common battery.

CORRESPONDENCE.

Continental Europe.

Paris, December 10.—Among the large electric furnace plants which are now building on the Continent I may cite the plant of Kalscheuron, not far from Cologne. It is intended for the manufacture of carbide on a large scale. In France there are also several large electrochemical works in course of construction. One of these lies in the Pyrenees region in the south of France and has undertaken an important piece of hydraulic work upon the lake and the basin of the Bassies River. The present plant is to be used for aluminum production and will commence work with 2,000 horsepower. A much larger installation, however, will be erected upon the Durance River at Largentan, also for aluminum, and it is expected to use about 40,000 horsepower in this case.

At St. Petersburg there has been erected a steam-turbine plant which is designed to furnish current for the more recent sections of the electric railway. Its capacity at present is about 10,000 horsepower, and it is expected to increase this in the near future by adding other turbine groups. At present there are installed three main groups consisting of Westinghouse-Parsons steam turbines of 3,200 horsepower each. The steam pressure is 180 pounds and the superheating about 300° C. The alternators are three-phase machines, delivering 6,600 volts.

In order to compete with electric motors, especially with the small units, the Gas Industries Society of France decided at its recent congress to open a competition for small gas engines from 10 to 50 horsepower. These must be presented before the end of this year.

There are but few electric lines on the Continent on which accumulator trains are used, but I may mention one electric interurban system of this kind which has been started in Germany within the last few months. There are in fact three separate lines which start from the city of Mayence, running to the towns of Oppenheim at 12 miles distance; Ingelheim, 11 miles, and Rüsselheim, eight miles. It is said that the accumulator cars are giving good satisfaction.

Among the new electric railroads is to be noted a narrow-gauge line in Switzerland, for which the concession has been lately obtained. It lies in the southern part of the country and is to run between Chiasso and Riva St. Vitale. In France the concession is secured for a short line of electric road which connects the city of Belfort with the suburban localities of Etueffont and Chatenois, passing through a number of communes.

Berlin is now able to communicate with Vienna by radio-telegraphy. During the first week of December there were made some experiments between the large station of Nauen, near Berlin, and the Austrian post at Kornenburg, not far from Vienna, this latter being established as a military post. After securing a good syntonization of the apparatus in the two stations the Kornenburg post was able to receive very clear messages from Berlin. In this case the distance is about 330 miles.

The Municipal Council of Paris is soon to discuss the matter of the new sections of the Metropolitan subway, according to the report upon this subject which is presented by Felix Roussel and adopted by the subway commission. The original network contains eight different lines, some of which are now finished and the others partly so. The north-south line, which I referred to recently, is operated by another company. When the projected lines are completed, Paris will no doubt have the best subway facilities in Europe. One of the most interesting of the new lines will differ somewhat from the others, as it makes a circular path around the central part of town and on both sides of the Seine, crossing the river at two points and passing under the Grands Boulevards, while on the left bank it runs near the Invalides. This line will no doubt have the heaviest traffic of the series.

According to recent reports as to the waterpower which is available in Sweden for turbine plants, it is noted that there are 17 falls in the series which give a total of 763,000 horsepower. The largest fall is located at Lule and is estimated at 170,000 horsepower alone, while the Wener Gota fall will afford 165,000 horsepower. In Sweden the largest falls are situated in the northern part of the country and in a region which is far from the industrial centers.

At Malaga, Spain, there is in course of erection a large sub-station which receives current from the Chorro turbine plant, located at some distance from the city. The pole-line operates at 25,000 volts, and this is converted to 550 volts direct current. There is also to be constructed a new line of tramway which runs to the suburb of San Sebastian. It will be designed on the trolley system, according to the plans of Engineer Quevedo. At Madrid there is to be installed a new system of electric omnibus which is under the control of the Arosa company. Another new project is an electric railroad line which is to run from Barcelona to the locality of Tarrassa. It will be undertaken by the Tibidabo company and will pass through a number of localities. A. [illegible]

Great Britain.

London, December 14.—Good progress has now been made with the preliminary arrangements for the electrical exhibition which it is proposed to hold next year at Manchester. As the result of meetings in Manchester and London a general committee has been formed, consisting of representatives of manufacturing firms, corporations and electric power companies. Unlike that at Olympia in 1905, the exhibition will be promoted practically by the exhibitors, and all profits will be partly returned to standholders and partly allocated to the benevolent funds which exist in connection with the electrical industry. A large number of firms have promised to exhibit, and many corporations and supply authorities have likewise promised support.

The electrical industry is caught between two stools, in a way next year in the matter of exhibitions, for there is a very strong electrical section to the Franco British Exhibition, which is also soliciting support. This exhibition will be more of a bazaar, and will run from May till November. The Electrical Exhibition, on the other hand, will be a purely trade affair and will be open for a month, probably the whole of October. Nevertheless, the two will clash to the extent that not many firms will be inclined to go to the expense of being represented in both places. A further point is that the industry has been circularized by the Institution of Electrical Engineers to support the Franco-British. I think it will be found that the bulk of firms will prefer Manchester. A feature of the Franco-British Exhibition is to be a collective exhibit representing the gas industry, with the object of demonstrating the utmost that can be accomplished.

A company has been formed, consisting of the chairmen of all the electric supply companies in London, for promoting an electric power bill for London. This is the syndicate to see the bill through Parliament (and to provide the necessary funds) which will, if passed, create a joint committee created from among the existing electric-lighting companies, and such local authorities as care to join.

The question of fares in London, which has for a long time past been occupying the earnest attention of the proprietors of electric railways and omnibuses, has at least reached a crisis, and a general increase of fares is announced. Throughout the routes covered by the London County Council tramways, however, and the two routes served by the electric omnibuses of the Electrobus Company no increases are announced, because these two authorities have refused to come into line. For some reason, hitherto unfathomed, the advent of electric traction on the London railways and of mechanical traction upon the omnibuses has coincided with most remarkable losses. Of course, these are to be attributed, really, to the gradual lowering of fares which was taking place prior to the adoption of electricity. Working arrangements have now been made between the railways and the omnibuses over a large proportion of routes which will eliminate the losses due to excessive competition, and at the same time permit of a gradual return to the old order of things so far as fares are concerned. The deleterious effect of constantly decreasing the fares to meet the outcry of the socialist party on the local town councils is mainly the cause of the extreme weakness of late in British Electric Traction Company's stock.

An interesting point has arisen between the Board of Trade and the Metropolitan Electric Tramways Company, which latter owns a considerable network of tramways in the outer London district. An extension of the system, involving an expenditure of $300,000, has been completed, and in order to avoid expensive road widenings interlacing lines were adopted. When the Board of Trade inspector arrived on the scene he refused to sanction the lines on the ground that there should be two separate tracks. No reasons appear to have been vouchsafed, which is surprising, for in Bournemouth a similar method of construction has been in satisfactory use for a very considerable time, and there may be other places.

The utilization of peat as a fuel for use in generating stations instead of coal is receiving a great deal of attention just now. Several years ago an electrical system was evolved for treating peat and making it into "coal" blocks, or something akin to them, but it was never put into commercial use. There are many people who still believe that peat is capable of treatment which would render it valuable as a fuel in addition to giving off its contents of notrogen, as ammonium sulphate, but the difficulty is to find capitalists who will put money into the business.

A short while ago a company was registered in London for the purpose of erecting a factory here to manufacture wolfram metal-filament lamps. It is now said that the shareholders in the German Incandescent Lamp Company have sanctioned an increase in capital in order to invest in the new English company.

The recent action by Dr. Alexander Muirhead for the revocation of the patent of the well-known Brown submarine telegraph relay was taken into the Appeal Court this week. The result was again in favor of Mr. Brown. G.

New England.

Boston, December 19.—The Boston Elevated Railway is about to install 100 easy-access, semi-convertible surface cars. These cars are 45 feet in length, seat 52 passengers and weigh 28 tons. They are equipped with four motors, with General Electric automatic control, Westinghouse air brakes and improved heating, lighting and ventilating apparatus. The seats and floors are especially designed for sanitation, and the floors are fireproof. The cars have pneumatic sliding doors and folding lower steps that are closed and raised respectively when the car is in motion, so that passengers may not get on or off until the car has come to a stop, the door has been opened and the step dropped.

The management of the Pawtucket Electric Company of Pawtucket, R. I., has been turned over to the Stone & Webster company of Boston. The principal reason for the change is said to be that the holders of the common stock have not been satisfied with their dividends.

A new telephone exchange has been erected in Wellesley, Mass. The switchboard has a present equipment to give service to about 1,100 subscribers and an ultimate capacity for 1,500 subscribers.

The Massachusetts Board of Railroad Commissioners has granted the petition of the Old Colony Street Railway Company for authority to act as a common carrier of baggage and freight in West Bridgewater and in the city of Fall River. B.

New York.

New York city, December 21.—As the result of the trial of A. H. Smith, general manager of the New York Central Railroad, charged with manslaughter in connection with the wreck of the Brewster electric train at the Woodlawn curve in which 23 persons were killed, Mr. Smith was freed on Wednesday. The trial took about a week and much interesting evidence was heard. Supreme Court Justice Kellogg, without hearing the defense, directed the jury to acquit Mr. Smith. The justice told the jury that it was dealing with a general manager who controlled 50,000 men and 7,000 miles of track who had to delegate part of his power, and that it was humanely impossible for Mr. Smith to have oversight over every bit of the track. The evidence, the justice said, showed the wreck to be due to excessive speed on a curve, due to the inexperience of the motorman, for which the blame rested with the department which put the man to work.

The efforts of Attorney-general Jackson to begin anti-trust action against the Western Union and Postal telegraph companies were checked by Supreme Court Justice Hendrick yesterday when he vacated an order directing Clarence H. Mackay and other directors of both companies to appear before a referee and testify concerning alleged contracts and agreements between the two companies. The court said that telegraph companies are not included under the Donnelly anti-trust act and held that the transmitting of messages from one point to another does not make the messages so transmitted a commodity within the meaning of the act.

Having decided practically that the upper East Side and the lower West Side of Manhattan are entitled to the benefit of the next subway, now that Brooklyn is assured of the Fourth Avenue tube, the Public Service Commission, within the next three weeks, it is expected, will take preliminary steps toward providing such a rapid-transit route. Informally, decision has been reached that the subway shall run down Lexington Avenue to or a short distance below Forty-second Street, then swing across to the West Side and go downtown beneath Seventh Avenue.

Representatives of the leading electrical repair concerns met on December 12th in the rooms of the Modern Science Club, Brooklyn, N. Y., for the purpose of organizing a trade association. Mr. James F. Hughes of the Charles A. Borne Company, New York, was elected temporary chairman, while Mr. Leopold F. Luedecke of the Thompson-Bonney Company, Brooklyn, was elected temporary secretary. Mr. Hughes stated why such an association should be called into existence. He touched upon the abuses and impositions the repair man has become more and more exposed to by irresponsible persons, and said that the time was ripe that they should rise in self-defense. This sentiment was enthusiastically received and a general debate ensued, in which the most salient points of the repair business were discussed. It was decided to name the new organization "The Metropolitan Electric Repair Protective Association." The chairman appointed a committee to prepare a constitution and by-laws consisting of John P. Bonney, Eugene E. Higgins and Leopold F. Luedecke. Mr. Hughes read letters from the electrical repair concerns not represented at the meeting, who promised their hearty co-operation. The next meeting will be held January 16th.

At the meeting of the New York section of the Illuminating Engineering Society on December 12th the æsthetic treatment of the illuminating problem for buildings was discussed. The paper of the evening was by Bassett Jones, Jr., and was entitled, "The Relation of Architectural Principles to Illuminating Engineering Practice." Failure was predicted by Mr. Jones for the illuminating engineer who considers only the scientifically practical side of his problems, for he will not get the recognition that the importance of his work deserves. Among those who discussed the paper were L. B. Marks, L. H. Hopton, V. R. Lansingh, S. W. Jones, W. S. Kellogg, G. H. Stickney and E. L. Elliott. The last-named speaker made the point that much difficulty was due to the fact that illuminating engineers and architects are working in fields which overlap.

Public Service Commissioner John E. Eustis admitted that at the joint conference of the city and the up-state bodies of the Public Service Commission with Governor Hughes in Albany on Wednesday night the question of giving the two commissions jurisdiction over telephone and telegraph companies was discussed, and also the advisability of having the Elsberg bill amended.

Within the last three months the street cars, elevated, steam and subway trains in the city of New York have killed 155 persons and have seriously injured 500 more. These figures are compiled from the reports filed with the Public Service Commission by the traction and railroad companies themselves, and are particularly significant in view of the fact that there has not been any railroad accident of great magnitude within the time specified. W.

Michigan.

Detroit, December 21.—The dam of the East Jordon Light and Power Company in Deer Creek broke on December 16th, releasing the water in their storage basin, which extends a mile up the river and which is 28 feet deep. The plant and machinery were not damaged and the company is giving service from its steam plant. The tracks of the East Jordon and Southern Railroad Company and the Detroit and Charlevoix Railroad which cross the valley were washed out. The dam will be repaired as soon as possible.

The Kalamazoo Power Company has been incorporated to furnish power and heat to manufacturing plants in Kalamazoo. It is proposed to install gas engines and producers, two engines being connected to each 1,100-kilowatt generator. The franchise limits the maximum rate to eight cents per kilowatt-hour. The ultimate size of the plant is to be 7,700 kilowatts.

The Utica Electric Company has been incorporated with a capital of $22,000.

The new railroad commission held a conference with the managers of interurban railroads on Tuesday in relation to rates, signals, accidents and depot facilities, nearly every interurban road being represented. The committee cautioned against reducing services during the winter and advised uniform rules for stopping cars in cities, and stated that the law requiring depot facilities would be enforced. D.

Dominion of Canada.

Winnipeg, December 19.—The British Columbia Electric Street Railroad Company is said to be applying for a charter to build an electric railway from Vancouver to Midway, B. C., a distance of about 210 miles. Such a line would traverse a country absolutely without railway facilities of any kind. R. H. Sperling of Vancouver, B. C., is general superintendent of this company.

The settlers along the Peace River trail between Athabasca Landing, Alberta, and the Lesser Slave Lake are pressing their claims strongly for an extension of the government telegraph line along this trail as far as Lesser Slave Lake. A petition was sent to Ottawa this week. The settlers say that if the line is built the same poles will do for a rural telephone system, which they will build.

A unit of 10,000 horsepower, almost the total capacity of the present plant, is being installed by the Vancouver Power Company at its plant on Lake Buntzen, near Vancouver, B. C. This unit will cost $300,000 and will be completed by the beginning of January. As soon as this unit is completed construction will be commenced on two more units of 10,000 horsepower each. It is the intention of the company to utilize the full electrical development at its sites on Lake Buntzen and Lake Coquitlam.

The Brantford Electric Street Railway Company, Brantford, Ont., has been granted a 45-year franchise in that town, and during the last 25 years of this franchise it will pay the town $2,500 per annum. Within two years from the present time the company must lay and have in operation between six and seven miles of track.

During the year the Canadian Pacific Railway Telegraph Company has built 4,000 miles of new wire, 50 per cent. of which was copper, and rebuilt 1,000 miles of pole line. Fifty new offices were also opened up. B. S. Jenkins of Winnipeg is general superintendent.

Among the government estimates recently made public from Ottawa appear the following items regarding telephone construction in British Columbia: Salt Springs Island telephone extension to Pender and Mayne islands, $3,000; Victoria and Cape Beale telephone line improvements, $6,000; improvements on the line between Vernon and Penticon, $3,500, and the Vernon to Lumby line improvements, $1,700. Fred Gelinas, secretary to the Department of Public Works, Ottawa, Ont., may be addressed in relation to these projects.

The talk of a commission to investigate the contract given by the City Council, Calgary, Alberta, to the Calgary Power and Transimission Company has resulted in the aldermen reconsidering the matter. At the last session of the Council a motion was passed giving the Alberta Portland Cement Company 10 days in which to sign the agreement to supply power at $25 per horsepower, providing a deposit of $10,000 is made by the company. It will be remembered that the cement company put in a lower bid than the transmission company. It is understood that the Alberta Portland Cement Company will at once close the contract with the city.

Within the next few days the city electrician's department of Winnipeg will install 45 new fire-alarm boxes, 15 of which will be placed in city schools. R.

Pacific Slope.

San Francisco, December 18.—The Shasta Power Company, which was first promoted by H. L. Shannon of San Francisco nearly seven years ago, is at last ready for commercial business. The project, which was backed largely by the small contributions of Italians of moderate means on the advice of Secretary Scalimanini, has experienced many vicissitudes and has had various obstructions thrown in it way by rival concerns. The order for two 1,500-kilowatt, three-phase generators was placed several years ago with the Bullock company. The San Francisco fire caused a further delay, but a modern high-tension transmission plant, with direct-connected waterwheels operating under a head of about 1,500 feet, was rushed to completion this fall. A test run was commenced a short time ago and commercial lights are now being supplied at Redding, Cal. Several other towns in Northern California will also be supplied. The furnishing of power in large blocks to smelters in the copper belt was expected to be a large source of revenue when the plant was first projected, but at present several prominent smelting plants are shut down, owing to the depression in copper. H. L. Shannon, who engineered the new enterprise to a successful completion, was formerly connected with the Northern California Power Company. The plant utilizes the waters of Hat Creek and its tributaries, which are connected by a system of short ditches. The natural topography of the country enabled this company to secure ample water storage and a high-working head without the construction of very large and lofty dams and expensive canals.

The Great Western Power Company of San Francisco is preparing to install at its Feather River plant in California three very large transformers built for it by the General Electric Company. The total weight of each of these will be 128,000 pounds, of which 40,000 pounds is due to 5,000 gallons of oil to be used in each transformer for cooling and insulating purposes. Each transformer stands 20 feet high and measures 9 by 18 feet. Each is expected to transform 14,000 horsepower of electric energy from a low to a high voltage at an efficiency of 98.6 per cent. The new power house of the Great Western Power Company is located on the Feather River near the Big Bend, above Oroville. The ultimate head of water developed will be 626 feet. It is planned to transmit 40,000 horsepower at 100,000 volts a distance of 165 miles. A force of surveyors has just surveyed the right-of-way for the company's pole line between Oroville and Island Bar.

E. V. N. Lebe of Dixon, Cal., is planning to build a transmission line to supply the Suisun valley with power from the main line of the Bay Counties Power Company.

The Sultan Mining Company of Grass Valley, Cal., is preparing to put in an electric power plant to furnish light and power for its property. Plans are now being drawn for a plant and distributing system to cost about $20,000.

The Oro Water, Light and Power Company has completed eight miles of the ditch which will convey water to its proposed power plant at Humbug Valley in the Sierra Nevada Mountains. The ditch is expected to carry 3,000 miner's inches of water to the power-plant site, where it will have a fall of 2,000 feet. The company's hydro-electric plant near Magalia is supplying Oroville and the surrounding territory at present.

It is reported that the Southern Pacific Railroad Company, which recently announced plans for transforming its suburban steam line in Alameda, Cal., into electric lines, will make application for permission to transform its Berkeley steam lines into electric lines.

A. Welsh and the Willamette Valley Company, owners of various electric properties in Oregon, are planning to incorporate the Portland, Eugene and Eastern Railway Company, with an authorized capital stock of $1,000,000. The purpose of the new company will be the construction of an electric road from Portland to Salem, Eugene, Princeville, Yaquina and Ontario, with branches to other towns.

The Bismarck Mill Company of Bismarck, Wash., will shortly begin work on a steam electric power plant to supply the suburbs of Tacoma with power.

Work has been begun on the electric railway for which a franchise was granted to W. H. Keller and C. H. Kerckhoff in Los Angeles some time ago. The line will run from Date and Atlantic streets, San Diego, to Delmar, 18 miles up the coast. It is understood that this road will form a part of an extension of the Pacific Electric system from Los Angeles along the coast to San Diego. A.

PERSONAL.

Mr. F. E. Fitzpatrick has resigned his position as superintendent at Sacramento, Cal., of the California Gas and Electric Corporation. His time is now entirely occupied with his work as general manager of the John Martin interests.

Mr. Edward Satterfield of Pittsburg has been appointed director of the engineering department of the Winona Technical Institute, the new technical school in Indianapolis. Mr. Satterfield was graduated from Purdue University in 1904 and comes to the Winona institute highly recommended by the faculty of Purdue. Mr. Satterfield has had the advantage of successful industrial experience as superintendent of a plant in Pittsburg.

Mr. J. W. Ager, electrical aide in the Bureau of Yards and Docks, United States Navy Department, has resigned his government position to enter the employ of Muralt & Co., engineers, of New York, as manager of their southern office in Birmingham, Ala. Mr. Ager is a graduate of Columbia, where he took the degree of M. E. in 1903 and of the Massachusetts Institute of Technology, where he obtained the E. E. degree in 1904. He then was engineer with the Western Electric Company, New York, during 1905 and 1906 and was in the service of the United States Navy Department from 1906 until now.

Mr. Thomas F. Bechtel, general auditor for the Grand Rapids-Muskegon Power Company since the amalgamation of that enterprise with the Grand Rapids Edison Company last summer, has resigned his position. He will make no plans for the future until after his return from a trip to Florida and Cuba in search of rest and recreation. His relations with the company and with his associates have been pleasant and he leaves its service with the best of wishes for its growth. Mr. Bechtel has been connected with the electric-light and power business in Grand Rapids, Mich., since the organization of the Grand Rapids Edison Company about 20 years ago.

In celebration of an honor conferred on Mr. Arthur Williams, chief inspector of the New York Edison Company, by the French Republic, a luncheon was given for him on December 17th at the Engineers' Club, New York city, by his colleagues on the board of the American Museum of Safety Devices. The honor was the decoration "Officer of Public Instruction." It was sent to Mr. Williams in recognition of his work in behalf of public welfare. A representative of the French Consul-general delivered the decoration to its owner in the course of the luncheon. Addresses were made by T. C. Martin, John W. Lieb, Jr., and others. Among those present were Walter C. Kerr, H. G. Stott, N. F. Brady, Dudley Farrand and Prof. F. R. Hutton.

Mr. A. W. Zahm, whose voluntary resignation as manager of the Fort Dodge (Iowa) Light and Power Company was received with regret by the owners of the property, will make a trip to New Mexico in January. Primarily, the journey will be for rest and recreation, but Mr. Zahm will also make an investigation of the possibilities of a hydro-electric proposition in Northwestern New Mexico. His father is there now, and friends are interested in a company which is seeking to develop a valuable waterpower property there. It is proposed to transmit the power to Albuquerque, many miles away. Mr. Zahm is a former president of the Iowa Electrical Association and is well known to electrical men throughout the West. His friends will follow his future movements with interest. As previously stated in the Western Electrician, Mr. W. B. Foshay will succeed to the management of the Fort Dodge company.

ELECTRIC LIGHTING.

The City Council of Madison, S. D., is considering the enlargement of the electric-light plant.

The Griswold Light and Power Company of Griswold, Iowa, has decided to enlarge its plant.

The Shattuck (Okla.) Electric Light Company has increased its capital stock from $3,000 to $15,000.

C. S. Bacon of Pine Bluff, Ark., is interested in the installation of an electric light plant at Russellville, Ark.

The Flandreau (S. D.) Water Power Company may install an electric-light plant to be operated by waterpower.

H. Rice has sold his electric-light plant in Albion, Neb., to L. L. Brown. F. E. Brown will be the local manager.

The Tulsa (Okla.) Corporation has decided to expend from $75,000 to $100,000 in improving its electric-light plant and system.

The Northwest Light and Water Company has been incorporated at Wallace, Idaho, but the principal place of business is Carson City, Nev. The capital is $1,000,000.

The Narragansett Electric Lighting Company of Providence, R. I., has declared a quarterly dividend of $1 per share, payable January 2d to stockholders of record December 14th.

The city of Streator, Ill., has made a five year contract with the Illinois Light and Traction Company to light the streets, the arc-lamp rate being $65 a year for each of about 140 lights.

The city of Humboldt, Kan., is considering installing an electric-light system. An expert electrician from Chicago is conferring with the City Council with a view toward constructing a plant.

The grand jury has been investigating the municipal lighting plant in St. Joseph, Mo. The News-Press of that city says that "the inquiry is surrounded by mystery that is more than ordinarily impenetrable."

The proposed contract between the city of Covington, Ky., and the Union Light, Heat and Power Company, whereby the company is to furnish electric lights for the city, provides for a price of $65 per lamp for arc light with a rebate of $10 if more than 450 lamps are used, the rebate to be given the city upon a renewal of the contract from year to year. It also provides for a reduction in the price of commercial lighting of from 10 to 40 per cent., according to the amount of the bills.

In dealing with representatives of the Cuyahoga Heat and Light Company, which seeks a franchise, Mayor Johnson of Cleveland has manifested a desire for a central power plant. The company wishes to install several power plants in the city. Mayor Johnson insists that one big central plant will be more efficient and economical. The company is now supplying a limited district. A 400-kilowatt unit was installed recently and another is to be installed. Action will be taken on the franchise ordinance when the new councilmen have taken office.

The Winthrop (Iowa) News says that the city of Winthrop wants electric lights and that the field is a good one for somebody. It says: "A poorly lighted town, a dimly lighted home, is a cheerless home, a cheerless, unprogressive town. Why waste time on smoky old lamps on a street corner when clean, up-to-date electric lights can be placed there instead? Hardly a home in Winthrop but could and would be wired. Churches, homes, halls, barns, basements—hundreds of places are waiting the call and the presence of the electric-light man."

ELECTRIC RAILWAYS.

The regular guaranteed semi-annual dividend of $2 per share on the preferred stock of the West End Street Railway will be paid on January 1st by the Boston Elevated Street Railway Company.

The Mexican "Diario Oficial" recently printed a copy of a decree authorizing the Empresa del Ferrocarril Industrial de Puebla to import into Mexico free of duty all necessary material for converting the line into electric traction.

The Lake Shore Electric Railway is testing a trolley finder invented by Dr. Husted of Oberlin. The finder may be used to supply power to the car when the trolley leaves the wire and is also used in locating the wire and making it easy for the conductor to replace the wheel.

With the completion of the Akron and Youngstown interurban railroad there will be a continuous and unbroken network of trolley lines from Toledo to Newcastle, Pa. It will then be possible to make a continuous trip by trolley from Port Huron to Newcastle, a distance of 550 miles.

The steam railroad of the Compania Minera Las Dos Estrellas, connecting the mining properties of this company with El Oro, Mexico, is to be converted to electric traction, said to be the first steam road in Mexico to be electrified. Electric locomotives will be used, to be built, it is said, by the Baldwin Locomotive Works, the Westinghouse company furnishing the electrical equipment.

Judge Craig of the Circuit Court at Mattoon, Ill., has issued an order to the grand jury to reconvene January 6th. It is said this action was taken at the request of the state's attorney to modify the indictments issued against Federal Judge Grosscup and the directors of the Central Illinois Traction Company, on account of the wreck near Charleston, Ill., and that the new indictment will read "criminal negligence" instead of "manslaughter."

The United States Steel Corporation was defeated in mandamus proceedings in the Lake County Circuit Court on December 19th, in which it sought to compel the Gary (Ind.) Board of Trustees to call a referendum election on the Gary street railway franchise, granted by the board last summer to the Gavit syndicate for the New York-Chicago Air Line Company. The steel corporation was an applicant for the franchise. The victory of the Gavit syndicate is said to mean a three-cent fare for Gary.

The Eastern Wisconsin Railway and Light Company of Fond du Lac, Wis., reports for the year ended November 30th, gross receipts amounting to $164,360.77, of which $95,387.80 was from the railway system, and $68,972.97 from electric light and power. The total receipts for the year ended November 30, 1906, were $146,561.95, which would make the increase for this year $17,799.82. The receipts from the railway department were $95,387.80, an increase of $6,750.59 over last year; and the receipts from the light and power department were $68,972.97, an increase of $11,048.23.

Men, women and children of East Troy, Wis., with bands, banners and bugles, turned out on December 13th to greet the arrival of the first interurban car connecting East Troy directly with Milwaukee. The special car contained President John I. Beggs and several officials of the road, as well as the officials of East Troy and of neighboring towns. Business was suspended for the afternoon in East Troy, to give the citizens the opportunity of celebrating the event, and cheer upon cheer greeted the arrival of Mr. Beggs. In his address Mr. Beggs said that the new line furnished the means of connections with the metropolis of Wisconsin, and eliminated the former necessity of the people of East Troy going seven miles by wagons, to a station which connected with the metropolis of Illinois, instead of Wisconsin. When the financial condition clears up, connections will be made with Elkhorn and Delavan in the near future.

POWER TRANSMISSION

The Fremont Power Canal Company, which also controls mining interests near Sumpter, Ore., has placed the power and mining divisions under separate management. Frank Harmon of Fremont, Neb., was chosen manager of the power company and John Thompson will manage the mines.

Montreal shipping men are opposed to the damming of the St. Lawrence River, and opposition to the project of the St. Lawrence Power Company and the Long Sault Development Company to construct a number of dams across the St. Lawrence River adjacent to Long Sault Rapids has been raised by the Shipping Federation, which has forwarded to the Canadian section of the International Waterways Commission a request for rejection.

SOCIETIES AND SCHOOLS.

In the engineering department of the University of Michigan there are 1,324 students enrolled. This is nearly 30 per cent. of the total registration for the whole university.

The next monthly meeting of the American Society of Mechanical Engineers will be held Tuesday evening, January 14th, in Assembly Room No. 1, of the Engineering Societies Building at 29 West Thirty-ninth Street, New York. The subject will be "Car Lighting," the presentation being made by Mr. R. M. Dixon, president of the Safety Car Heating and Lighting Company, and will treat of the general subject of lighting of trains, showing relative economies in the several systems, electric and gas. There will be in operation exhibits of different methods, such as the Pintsch mantle, the vapor mantle system, a new acetylene system, and several varieties of axle lighting by electricity, with their regulating and governing mechanism. Each member may bring one friend.

PUBLICATIONS.

The Glower, published by the Nernst Lamp Company of Pittsburg, has an attractive holiday cover for December. It proclaims that the Nernst wave is "still sweeping everything before it."

"Specifications for Splicing Hargis Joints in Telephone Cables" is the title of a booklet of vest-pocket size issued by W. N. Matthews & Bro. of St. Louis. The reader is given practical, useful information relating to the making of a moisture-proof joint in lead-encased, paper-insulated telephone cables by the Hargis method.

"Der Ingenieur" is the title of a new technical semi-monthly journal that has just made its appearance in Germany. It is published in Berlin. The aim of "Der Ingenieur" is to be an international review of the entire engineering field. The chief editor is Dipl.-Ing. Taczak, and he is ably assisted by a corps of 19 technical reviewers.

The Ferracute Machine Company of Bridgeton, N. J., has published an illustrated circular devoted to a large variety of presses. This company makes hundreds of sizes and styles of presses, from small bench foot presses to large machines weighing a hundred thousand pounds and capable of exerting a pressure of a thousand tons. Among the presses illustrated and described are punching presses, drawing presses, horning and wiring presses, embossing and coining presses, high-speed armature notchers, etc. Dies and all other sheet-metal tools are given attention. Mr. Oberlin Smith is president of the company.

The General Electric Company, Schenectady, N. Y., manufactures a complete line of horizontal edgewise instruments for switchboard service, including ammeters, voltmeters, single-phase wattmeters, polyphase wattmeters, frequency indicators and power-factor indicators. Bulletin No. 4551, recently issued by the company, illustrates and describes the various types, giving dimension sketches and a complete set of full-sized scales. The wattmeters, power-factor indicators and frequency indicators are constructed on the direct-reading dynamometer principle; the ammeters and voltmeters on the well-known Thomson inclined-coil principle. All the instruments are of uniform size, thus giving a pleasing appearance when installed. While primarily designed for alternating-current service, the voltmeters, ammeters and wattmeters can be used with good results on direct current.

The twenty-eighth annual report of the United States Geological Survey, covering the fiscal year ended June 30, 1907, just published, records some notable events in the history of that organization. The retirement of Director Walcott to assume the secretaryship of the Smithsonian Institution was distinctly the most important of these events. The new director, George Otis Smith, in this, his first report, briefly outlines the changes made under his predecessor. Among these changes he mentions the raising of the standard of the topographic maps, the enlargement of the Survey's work in hydrography, mineral resources, and geology; and the provision for reconnaissance surveys of regions of economic importance. The completion of the separation between the Reclamation Service and the Geological Survey and the organization, within the Survey, of a technologic branch for testing fuels and structural materials, were also important events of the year.

MISCELLANEOUS.

About 85 per cent. of the saloonkeepers in Boston use small, automatic, electrically driven beer pumps.

Plans are approved for a $10,000 improvement in the college water supply at Iowa State College, Ames, Iowa. A new electric centrifugal pump will draw the water from the wells already sunk north of the heating station into a 140,000-gallon concrete surface reservoir, from which it will be lifted to the steel tank by a fire pump located in the new heating plant.

A Peru (Ill.) contractor is at present engaged in the work of putting in wires and fixtures for the Berry Coal Company, eight miles south of Peru. The mine is to be lighted by electricity exclusively and all the buildings used in connection with the company's work will likewise be so illuminated. The power equipment is ample to furnish current for the entire mine, and in point of application of electricity in mining coal, the Berry company will be up-to-date.

The production of copper in the United States in 1906 was 917,805,682 pounds. This represents the year's smelter production—that is, the quantity of fine copper in the blister copper produced during the year and the production of refined Lake copper. The production of 1905 was exceeded by 15,897,839 pounds, the increase being 1.76 per cent. The gain in 1905 over 1904 was 11 per cent., and in 1904 over 1903 nearly 16.40 per cent. The mine production for 1906 was 916,971,387 pounds. Fully 720,000,000 pounds of the 1906 output was produced by four operators.

The United States Civil Service Commission announces an examination on January 15, 1908, at several cities in each of 46 states, to secure eligibles from which to make certification to fill vacancies in the position of electrical assistant in the Signal Service at Large, at $900 per annum each, with prospects of promotion to $1,400 per annum, and vacancies requiring similar qualifications as they may occur in any branch of the service. The examination will consist of practical questions in electrical science, practical questions in construction and installation of electrical instruments and training and experience. Applicants should at once apply, either to the United States Civil Service Commission, Washington, D. C., or to the secretary of the board of examiners at any of the other places, for application Form 1312. A similar examination is announced for January 8, 1908, to fill a vacancy in the position of lampist and electrician, $1,000 per annum, in the custom-house building, St. Louis, Mo., and vacancies requiring similar qualifications as they may occur in the Custodian Service throughout the United States. Applicants should apply for application Form 1052.

TRADE NEWS.

The Arnold Company, 181 La Salle Street, Chicago, is building from its own plans the new locomotive repair shops of the Grand Trunk Railway at Battle Creek, Mich.

Information of an electric-lighting enterprise in India is forwarded by Consul-General William H. Michael, of Calcutta. Refer to File No. 1747, Bureau of Manufactures, Washington, D. C.

The S. S. Grady Company of Boston has been chartered to manufacture electrical supplies. The capital stock is $3,000. The directors are Stephen S. Grady, Herbert S. Perry, Winthrop I. Grady.

The office of Mr. William S. Boyd, electrical inspector, and also the office of the Western Association of Electrical Inspectors, of which Mr. Boyd is secretary, have been established at Room 924, 125 Monroe Street, Chicago.

Capt. Ira L. Fredendall, constructing quartermaster, U. S. A., 263 Summer Street, Boston., Mass., is advertising for bids for the construction of a brick barracks building at Fort Anderson, Peddock's Island, Boston Harbor. Electric wiring and fixtures will be needed. Bids will be opened on January 14th.

A partnership has been formed between Charles V. Ross and William Gregory of Saginaw, Mich., under the firm name of the Saginaw Lighting Company. Expert electrical work will be done. Both men have been connected with prominent firms in Saginaw. Mr. Ross is an expert on motor repairing, and Mr. Gregory is an expert wireman.

The proposed merger of the Strowger Automatic Telephone Exchange with the Automatic Electric Company of Chicago has been made possible by the deposit of over 90 per cent. of the stock of the former concern with the First Trust and Savings Bank. A special meeting of the stockholders of both companies has been called for January 14th to ratify the plans formally.

Sealed proposals will be received at the office of the supervising architect, Washington, D. C., until 3 o'clock p. m., on January 22d, for the construction (including plumbing, gas piping, heating apparatus, electric conduits and wiring) of the postoffice at Mitchell, S. Dak., in accordance with drawings and specification, copies of which may be obtained from the Custodian of Site at Mitchell, or at the above office.

The firm of Parker & Lee, publicity disseminators, 20 Broad Street, New York city, will be dissolved on December 31st by the retirement of Ivy L. Lee. The business will be continued at the same address, George F. Parker for this purpose having associated with himself Charles A. Bridge, hitherto manager, under the firm name of Parker & Bridge. Mr. Lee will enter the service of the Pennsylvania Railroad Company.

The International Machine Tool Company of Indianapolis announces that it expects to be in its new factory on January 1st. This new shop is located at West 121st street and the Belt Railway on a 4½-acre plot. The building, which is 100 by 150 feet, is constructed on the unit plant and may be extended at any time. It is equipped with all modern improvements. The company makes the new Libbey turret lathe.

The Monarch Electric and Wire Company has leased for a term of 99 years the property at the northeast corner of West Adams and Desplaines streets, Chicago, upon which it will construct for its own use a thoroughly modern building, to cost about $100,000. The building is to be of reinforced concrete throughout and will accommodate the factory, ware and sales rooms and general offices. It is planned to have one of the best buildings devoted to electrical purposes in the West.

The Foos Gas Engine Company of Springfield, Ohio, has purchased the business of the Marinette Gas Engine Company, which comprises the line of Walrath multiple-cylinder engines for electric and power work from 20 to 500 horsepower. This engine has been on the market for over 10 years and is well known. This complete line of vertical engines, with the Foos horizontal engines from 2 to 90 horsepower, makes the Foos line very comprehensive. The Foos Gas Engine Company says that it operates the largest plant devoted exclusively to gas-engine manufacture.

The business of the Century Electric Company of St. Louis has developed so rapidly that the company has outgrown its quarters on North Fourth Street and is now moving into its new home at Olive and Nineteenth streets. The company will hereafter occupy a five-story-and-basement building, built especially to meet its requirements. The Century Company makes the well-known "Century" single-phase motors in sizes ranging from one-half horsepower to 10 horsepower in the usual horizontal types as well as the vertical, back-geared, constant-speed and variable-speed types. The rapid rise of the company is due to the able and energetic management of James F. Coyle, president; Edwin S. Pillsbury, vice-president; D. W. Oviatt, treasurer, and R. J. Russell, secretary and sales manager.

BUSINESS.

President A. C. Garrison of the Columbia Incandescent Lamp Company of St. Louis says that his company is busy delivering lamps under its large contract with the United States government for the War and Treasury departments. This is believed to be the largest lamp contract ever placed by the United States government.

In bulletin No. 4550 the General Electric Company, Schenectady, N. Y., describes and illustrates a number of its carbon-break circuit-breakers. Type C form G breakers are designed for a small, reliable, automatic, protective device for direct and alternating-current systems at a moderate price. Type C form P are particularly adapted for use on railway and power systems which are frequently subjected to severe short-circuits and heavy overload. They are made up to 12,000 amperes capacity. Type C form K, especially designed for heavy service, are particularly well suited for railway work. They are made in capacities up to 10,000 amperes. The bulletin also contains descriptions of auxiliary switches, automatic tripping devices, etc., to be used with the circuit-breakers, and gives complete data as to capacities, prices and dimensions of the devices shown. The bulletin contains 36 pages and is conveniently arranged for reference.

Reviewing its business for 1907 in the steam engine line, the Wisconsin Engine Company of Corliss, Wis., successor to the Brown Corliss Engine Company, says: We have furnished four large cross compound engines for the new Aliquippa plant of the Jones and Laughlin Steel Company. These engines furnish all the electrical power used at this plant. We also made a record shipment on a 600-kilowatt engine for the new structural shop of the Jones and Laughlin Steel Company. We are now erecting the second 20,000,000-gallon pumping engine which we have built for the city of Milwaukee, and have recently received a contract from the city of Atlanta, Ga., for a similar engine. A 1,500-horsepower cross compound engine is being erected in the new plant of the Packard Motor Car Company, at Detroit, Mich. Among many other orders we have sold a very large rolling-mill engine for the Donora Works of the Carnegie Steel Company. This engine is one of the largest tandem compound Corliss engines ever built, and is capable of developing 10,000 horsepower. We have installed a large amount of new and up-to-date machinery this year. This has enabled us to build up a big reputation for prompt shipments, and it is one of our boasts that we ship on time.

ILLUSTRATED ELECTRICAL PATENT RECORD.

Issued (United States Patent Office) December 17, 1907.

873,702. Alternating-current Motor. Ernst F. W. Alexanderson, Schenectady, N. Y., assignor to the General Electric Company, Schenectady, N. Y. Application filed February 15, 1904.

A synchronous motor has distributed windings for both its armature and field. Taps from each winding lead to a drum type controller adapted to vary the number of poles so as to produce a series of speeds.

873,703. Electrically Propelled Car or Locomotive. Edward H. Anderson, Schenectady, N. Y., assignor to the General Electric Company, Schenectady, N. Y. Application filed April 5, 1906.

The locomotive carries a motor generator set, the motor taking alternating current from the line and driving a direct-current generator. The latter is connected through a controller to series motors propelling the car, which also act as generators during braking.

873,705. Insulating Covering or Sheathing for Contact-rail Conductors. William H. Baker, Lockport, N. Y., assignor of three-fifths to Jesse Peterson, Lockport, N. Y. Application filed October 19, 1905.

A hard fibrous sheath conforming with the flanges of the rail is held to them by metallic keys.

873,706. Motor Truck. Asa F. Batchelder, Schenectady, N. Y., assignor to the General Electric

Company, Schenectady, N. Y. Application filed May 28, 1906.

This electric truck has a number of field magnet frames provided with pole pieces. The motor armatures are mounted in bearings carried by the frames so as to be in operative relation to the field poles.

873,714. Dynamo-electric Machine. Joseph L. Burnham, Schenectady, N. Y., assignor to the General Electric Company, Schenectady, N. Y. Application filed April 1, 1907.

A rotary converter has its poles divided in a plane parallel with the shaft of the machine into two unequal portions, each having a separate winding, the one on the smaller portion being a reversible regulating winding.

873,715. Electrical Accumulator. Charles Busch, New York, N. Y. Application filed June 25, 1907.

The electrodes consist of perforated metallic boxes enveloping the active material. A capillary lacing passes through the perforations so as to unite the opposite walls.

873,717. Reciprocating Mechanism for Spooling Machines. John G. Callan, Lynn, Mass., assignor to the General Electric Company, Schenectady, N. Y. Application filed May 8, 1905.

One element of this spool-winding machine is arranged to impart a straight reciprocating motion to another element at one speed in one direction and at another speed in the other direction.

873,720. Switch Stand. Arthur D. Cloud, Chicago, Ill., assignor of one-third to Frank M. Patterson and one-third to Fred W. Rizer, Chicago, Ill. Application filed September 27, 1906.

The switch is provided with means for locking it in an open position and with an electromagnetic circuit, controlled by the passage of the last car of a train from the side track to the main track, for releasing this locking means.

873,721. Transformer. Jesse Coates, Lynn, Mass., assignor to the General Electric Company, Schenectady, N. Y. Application filed February 12, 1906.

The core of this shell-type transformer is built up out of laminations in two planes at right angles to each other, the center leg being in common. In plan view the core is shaped like a cross.

873,729. Throttle Relay. Archibald S. Cubitt, Schenectady, N. Y., assignor to the General Electric Company, Schenectady, N. Y. Application filed March 31, 1906.

The relay is part of a locking device for a motor controller. One relay coil is in series with the motor, the other coil is in shunt with it.

873,732. Battery Train-lighting System. Frank A. Decker, Philadelphia, Pa., assignor to the Decker Electrical Manufacturing Company, Wilmington, Del. Application filed April 4, 1906.

A battery is connected to the lamp circuit and by means of a conduit to a tank for holding solution. The transfer of the latter between battery and tank is controlled by the same mechanism that controls the lamp circuit.

873,737. Automatic Cut-out for Electric Controllers. Arthur C. Eastwood, Cleveland, Ohio. Application filed January 15, 1907.

The controller has a cut-out switch releasing a circuit-breaker when the limit of travel is reached. When the motor stops the circuit-breaker is again closed.

873,741. Switch-operating Mechanism. Edwin E. Frederick, Bellevue, Pa., assignor to the Frederick-Elder Company, Pittsburg, Pa. Application filed April 12, 1906.

A rotary snap switch is described.

873,751. Condenser. Nelson S. Hopkins, Fort Wayne, Ind., assignor to the General Electric Company, Schenectady, N. Y. Application filed November 15, 1902.

The condenser is made of alternate sheets of conducting material and dielectric. The plates of one polarity are slightly displaced so as to be not directly over the others.

873,757. Transmitting Device for Electric Telegraphy. Isidor Kitsee, Philadelphia, Pa., assignor of one-half to William J. Latta, Philadelphia, Pa. Application filed March 16, 1905.

A polarized relay has its two coils connected with separate batteries. The armature of the relay is provided with contacts so arranged that each depression of the transmitting key connects the line alternately with the different batteries.

873,778. Dynamo-electric Machine. Karl A. Pauly, Schenectady, N. Y., assignor to the General Electric Company, Schenectady, N. Y. Application filed May 18, 1907.

This generator has a separately excited field winding and one that is short-circuited through a resistance. The armature current is supplied to a separately excited motor.

873,780. Insulated Coil. Charles F. Peterson, Schenectady, N. Y., assignor to the General Electric Company, Schenectady, N. Y. Application filed June 22, 1907.

The coils are insulated by winding a combustible spacing material between the turns, dipping the whole into an insulating compound of kaolin and silicate of soda, heating the coil to burn out the spacing material, dipping into the compound again to fill up the pores and then firing at a high temperature.

873,781. Cable-drum Mechanism. Claiborne Pirtle, Cleveland, Ohio. Application filed March 6, 1907.

A cable for bringing current to a lifting magnet is wound on and unwound from a drum by an electric motor having a torque limited to just keep the cable in tension.

873,793. Safety-fuse Indicator. Caroline N. Sachs, Hartford, Conn. Application filed March 11, 1904.

The indicator for an enclosed fuse is connected with a retainer about the fuse itself so as to be acted on when the latter blows.

873,804. Electric Lighting. Elmer A. Sperry, Brooklyn, N. Y. Application filed December 31, 1906.

Incandescent lamps with tantalum filaments are mounted on a base provided with means for agitating it so as to bring broken parts of the filament into welding contact while the current is turned on the lamps.

873,805. Controller. Emmett W. Stull, Norwood, Ohio, assignor to Allis-Chalmers Company and the Bullock Electrical Manufacturing Company. Application filed March 31, 1906.

Blow-out magnet coils are arranged so as to have the controller shaft act as part of their magnetic circuit. (See cut on next page.)

873,809. Purification of Metallic Compounds. Charles Van Brunt, Schenectady, N. Y., assignor to the General Electric Company, Schenectady, N. Y. Application filed July 12, 1906.

Pure tungsten is produced by dissolving a compound thereof, purifying it by precipitating with a benzidin compound, calcining the precipitate and reducing the product to form the finely divided pure metal.

873,815. Switching Device for Electric Motors. John B. Wiard, Lynn, Mass., assignor to the General Electric Company, Schenectady, N. Y. Application filed May 23, 1907.

The rotor of an induction motor carries a member which is moved axially outward by centrifugal force when the rotor attains a certain speed, thus changing the starting connections.

873,821. Insulated Rail Joint. Benjamin Wolhaupter, New York, N. Y., assignor to the Rail Joint Company, New York, N. Y. Application filed August 7, 1906.

A joint supporting base is adapted to be engaged by the rails, but is insulated from them.

873,822. Whistle Valve. Frank L. Wolfe, Medford, Mass., assignor to the Crosby Steam Gauge and Valve Company, Boston, Mass. Application filed December 5, 1905.

A clock carries contacts closing at definite times the circuit of an electromagnet which opens and closes the valve. A second circuit records the time of whistling.

873,839. Automatic Signaling Device. Louis Caputo, East Boston, Mass. Application filed August 23, 1907.

Each locomotive is provided with batteries, a telephone and a clock-actuated signal. If two locomotives happen to be on the same track circuit the signals are sounded and the operators can talk with each other by telephone.

873,846. Cartridge-fuse Attachment-plug. Robert A. Cultra, Cambridge, Mass. Application filed July 3, 1907.

An inclosed fuse is connected through spring clips between the central stud and one of the lamp-cord terminals.

873,861. Electric Furnace. Gustaf Holmgren, Westeras, Sweden. Application filed March 6, 1907.

This induction furnace has a number of poles on a stationary iron core, a melting chamber inclosing the core and a vertical shaft carrying a rotary magnet with less poles than the core.

873,872. Housing. Hubert Krantz, Brooklyn, N. Y. Application filed January 26, 1907.

This protection for wires on a binding post has a roof and side walls having an opening to permit the housing to be transversely removed from the post.

873,879. Rolling-mill Scale. Martin Maurer, Pueblo, Colo. Application filed May 7, 1906.

A weighing machine has an electric motor for lifting the articles just enough so they can be weighed.

873,890. Electric Smelting Furnace. William R. Parks, Chicago, Ill., assignor to Samuel Shaw Parks, Chicago, Ill. Application filed April 11, 1907.

The positive electrode is tubular and the negative has a circular gutter in its upper surface concentric with the axis of the electrodes. A series of drains lead from the gutter downward toward the axis of the negative. (See cut on next page.)

873,899. Current-supplying Arrangement. Bernhard Salomon, Frankfort-on-the-Main, Germany, assignor to Felten und Guilleaume-Lahmeyerwerke Aktien-Gesellschaft, Frankfort-on-the-Main, Germany. Application filed March 1, 1906.

This is a current collecting trolley running on a trolley wire on the bank and connected by a cable to boats that are electrically propelled in a canal.

873,906. Automatic Water-supply System. Harry C. Sillett, Salt Lake City, Utah. Application filed December 31, 1906.

An electric motor drives an air pump supplying air to a floating tank in the well. A piston moved by variations in air pressure closes and opens the motor switch.

873,931. Register-operating Device for Massage Treatments, and 873,932, Shave-register Operating Device. John W. B. Faris, Skidmore, Tex. Application filed February 18, 1907.

These are electrically operated registers for automatically counting a barber's customers. Circuits are closed by tilting of the chair in the second case.

873,935. Electrical Alarm System. William N. Fawcett, Brooklyn, N. Y., assignor of one-half to Max Bernstein, New York, N. Y. Application filed January 15, 1907.

A [illegible] normally [illegible] by tampering with the [illegible]

873,940. Electrical Connection for Hose Coupling. Fredrick Hatfman, Cincinnati, Ohio. Application filed June 30, 1906.

Wires carried by the hose sections are connected to sections of flat ring that are joined to [illegible] the coupling by a projecting lip.

873,943. Process of Treating Ores. Frederick M. Johnson, San Francisco, Cal. Application filed June 3, 1904.

Sulphide and pyritical arsenic ores are put in a solution of caustic soda, the tank agitated and the contents subjected to the action of a large electric current of low voltage.

873,954. Sparking Coil with Multiple Winding for Ignition and Like Purposes. Auguste Michel, Paris, France. Application filed November 20, 1905.

Two primary windings are provided for the spark coil, each being connected to a separate current source. A switch connects the source that is to be used.

873,955. Trolley Head. Charles C. McClintock, Englewood, Colo. Application filed June 25, 1907.

A yoke carries the head in which the trolley wheel revolves. A deflector is adjustably fastened to the yoke and head.

873,958. Method of Producing Homogeneous Bodies from Tantalum or Other Highly Refractory Metals. Marcello von Pirani, Wilmersdorf, near Berlin, Germany, assignor to Siemens & Halske Aktiengesellschaft, Berlin, Germany. Application filed March 18, 1907.

A metallic oxide is heated in a vacuum so as to ionize the residue of gas therein. The metal is then connected with the anode of an electric arc and subjected to its action while still in the vacuum.

873,968. Electric Spark Plug. Frederick B. Thatcher, Providence, R. I. Application filed January 31, 1907.

The construction of an igniter is described.

873,994. Canopy for Electric Fixtures. John H. Dale, New York, N. Y. Application filed May 18, 1906.

A sheet metal shell has a beaded ring containing an insulating bushing that fits around the pendant tube.

873,996. Conduit-threading Device. Albert H. De Voe, Elizabeth, N. J. Application filed October 24, 1906.

This is a carriage for drawing a wire or cord through the conduit. The carriage has bearing wheels that are driven by a reciprocating actuator.

873,998. Hair-cut Register. John W. B. Faris, Skidmore, Tex. Application filed February 18, 1907.

This is a modification of the device in No. 873,932.

874,004. Telephone Transmitter. Howell W. Haff, Richmond Hill, N. Y., assignor to the General Acoustic Company. Application filed April 15, 1907.

A carbon block has a number of cavities containing carbon balls which establish microphone contacts between the block and the diaphragm.

874,016. Turn Button for Electric Switches. Henry E. Leppert, New Britain, Conn., assignor to the Hart Manufacturing Company, Hartford, Conn. Application filed October 29, 1904.

The cavity in the button contains the spindle head which has an abutment and a spring surrounding it so as to prevent independent rotation of the parts.

874,019. End Cap for Electric Conduits. Harry P. Moore, Newburyport, Mass. Application filed April 6, 1907.

The cap has an attaching portion composed of a number of spring-acting ears with upturned ends and inwardly extended projections to enter the spaces between the threads on the conduit.

874,023. Non-inductive Resistance. James F. McElroy, Albany, N. Y., assignor to the Consolidated Car Heating Company, Albany, N. Y. Application filed February 21, 1907.

A coil has a support upon which wire is wound in concentric layers in opposite directions so as to neutralize their inductive effect.

874,024. Electric Bell. James F. McElroy, Albany, N. Y., assignor to the Consolidated Car Heating Company, Albany, N. Y. Application filed February 21, 1907.

An inverted cup-shaped base contains the mechanism.

874,025. System of Motor Control. Alexander McIver, Schenectady, N. Y., assignor to the General Electric Company, Schenectady, N. Y. Application filed March 8, 1905.

In this controller a series of switches is arranged to close in automatic progression. A separate relay associated with each switch controls the operation of a succeeding switch.

874,028. Coal-mining Machine. Thomas J. Newcome, Jamisonville, Pa., assignor of one-half to John C. Hirst, Reynoldsville, Pa. Application filed December 15, 1906.

A motor enclosed in a casing drives a rotary drill.

874,029. Electric Hat-curling Iron. Joseph L. O'Brien, South Norwalk, Conn. Application filed July 1, 1907.

The resistance member of this iron consists of a continuous sheet of metal slotted from opposite sides and bent upon itself.

874,042. Block-signaling Apparatus. John D. Taylor, Edgewood Park, Pa., assignor to the Union Switch and Signal Company, Swissvale, Pa. Application filed August 24, 1907.

A transformer has a set of adjustable fillers forming a shunt of the magnetic path between the primary and secondary coils.

874,064. Electrolytic Cell. Arthur E. Gibbs, Wyandotte, Mich. Application filed June 2, 1906.

In this cell a diaphragm has a metallic jacket surrounding it and forming the cathode. The cathode has outlet channels for the products of electrolysis.

874,085. Rail Bond for Rail-joint Circuits. William E. Karns, Parkers Landing, Pa. Application filed January 29, 1907.

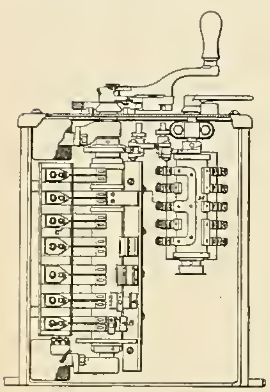
This rail bond consists of a metallic spring end post interposed between the rail ends and in the form of the cross section of the rails, whereby the side joint bars serve to secure the bond in place.

874,089. Valve-operating Apparatus. John C. Larkam, Kansas City, Mo. Application filed August 27, 1906.

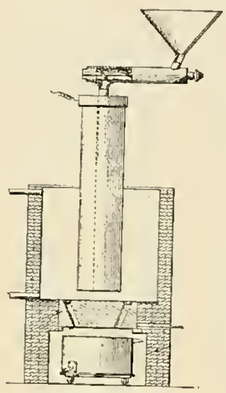
Thermostats control the circuits of electromagnets which actuate the valve operating mechanism. These circuits are automatically broken after each operation.

874,118. Telephone Transmitter. Carl J. Printz, Milwaukee, Wis. Application filed December 31, 1906.

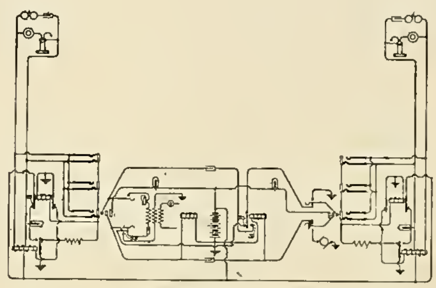
The mouthpiece is provided with a disinfectant receptacle.



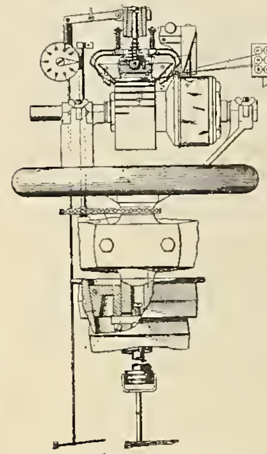
NO. 873,805—CONTROLLER.



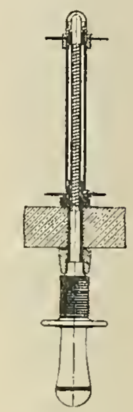
NO. 873,890—ELECTRIC FURNACE.



NO. 874,147—THREE-WIRE MULTIPLE TELEPHONE SYSTEM.



NO. 874,163—ARMATURE-WINDING MACHINE.



NO. 874,293—CIRCUIT BREAKER.

874,147. Three-wire Multiple System. Charles S. Winston, Chicago, Ill., assignor to the Kellogg Switchboard and Supply Company, Chicago, Ill. Application filed March 12, 1906.

A cut-off relay is permanently connected in the third wire, which also contains a supervisory signal that can be shunted out by a low-resistance path. (See cut.)

874,163. Armature-winding Machine. Penrose E. Chapman, St. Louis, Mo. Application filed August 15, 1904.

The machine has means for supporting and rotating an armature, a saddle with ends beveled outwardly and away from the armature core and sides having edges registering with the inner edges of the slots. Gauges or stops compel registry with the edges of slots receiving coil forming wire. (See cut.)

874,173. Controller Regulator. Cyrus P. Ebersole, Keokuk, Iowa, assignor to the Electric Service Supplies Company, Camden, N. J. Application filed April 15, 1907.

This regulator comprises a base, a rotable hood, means for controlling the movement of the hood in one direction, and a series of rollers for locking the parts against separation without interfering with the rotation of the hood.

874,178. Cautery. Lee De Forest, New York, N. Y., assignor to George K. Woodworth, Brookline, Mass.

One electrode of a high-frequency source of electrical oscillations is so arranged that the oscillations may be transmitted to a body to produce a burning effect on the surface thereof.

874,186. Magnetic Brake. Frederick G. Haldy, Stamford, Conn., assignor to the Yale & Towne Manufacturing Company, Stamford, Conn. Application filed June 17, 1907.

The mechanism consists of an electric motor, a movable resistance device comprising coils having iron cores to co-operate with the motor structure, and a mechanical brake connected with and operated by the movable resistances.

874,190. Automatic Circuit-breaker. Gerald W. Hart, West Hartford, Conn., assignor to the Hart Manufacturing Company, Hartford, Conn. Application filed January 25, 1907.

In combination with the electric circuit of a hand-operated switch is a door-bolt operated switch and means whereby the operation of the latter becomes effective only when the manual switch is closed.

874,206. Insulating End Post for Rail-joint Circuits. William E. Karns, Parkers Landing, Pa. Application filed January 29, 1907. Renewed September 23, 1907.

An insulating end post for rail joints consists essentially of an indurated body having a soft tip on the head thereof.

874,268. Pole Changer. Lee Kiblinger, Jackson, La. Application filed July 8, 1907.

A magnet is provided with a flat pole, and an armature has a similar pole adapted to register with the flat pole of the magnet. Means are provided for mounting the armature so that it can swing in a plane crossing the short diameter of the flat poles, and a contact connected with the magnet is so disposed that the swing of the armature opens the contact.

874,209. Electric Transmission of Intelligence. Isidor Kitsee, Philadelphia, Pa. Application filed August 26, 1907.

Means to neutralize the inducing effect of a power wire on neighboring lines of transmission comprises a conductor placed in the neighborhood of the lines of transmission and connected in shunt with the return of the power wire.

874,219. Brake for Power-driven Vehicles. Joseph N. Mahoney, Brooklyn, N. Y., assignor to himself, James D. Leys and Samuel Jacobson, New York, N. Y. Application filed October 30, 1905.

Aside from a brake-spring under tension tending to apply the brakes, a motor is provided to impose further tension upon the spring to partially or wholly release the brakes. A non-reversing driving connecion is interposed between the motor and the spring and controllable variable clutch devices are interposed between the non-reversing connection and the spring.

874,227. Portable Burglar Alarm. Joseph L. Mulry, Pawtucket, R. I., assignor of one-third to Charles P. Rollings, Pawtucket, R. I. Application filed August 14, 1907.

An electrically actuated alarm having an automatically actuated circuit closer and a resilient bridging member is adapted for attaching to doors or windows.

874,229. Controlling Mechanism. John J. Nef, Chicago, Ill., assignor to the National Brake and Electric Company, Milwaukee, Wis. Application filed September 15, 1905.

In a fluid-pressure governor a reciprocating rod is moved in one direction by fluid pressure and in the other direction by a spring, a toggle member being pivotally connected at one end. A movable circuit-controller is independently pivoted on the pivotal support for one of the members of the toggle, and by a loose connection between the toggle-member and controller the former actuates the latter when operated by the spring acting thereon.

874,242. Trolley. Charles M. Rhodes, Steubenville, Ohio. Application filed November 10, 1904. Renewed September 20, 1906.

A two-piece harp has patentable means for lubricating the wheel, and there is an opening in the spindle which carries the wheel into which air is deflected.

874,245. Lamp Socket. John J. Rooney, Scarsdale, N. Y. Application filed January 10, 1906.

A new type of incandescent-lamp socket enclosed in a two-piece cylindrical tubing is described.

874,250. Fire-alarm and Signaling Device. Louis Sackwitz, St. Louis, Mo. Application filed May 14, 1907.

The device is connected with the electric wiring of a building and gives an automatic alarm to the fire company whenever a fuse is detached from the elongated head of the device.

874,254. Registering Device. Marshall M. Shumaker, Terre Haute, Ind. Application filed January 14, 1907.

In a registering device contacts are interposed in an electrical circuit, which contacts, in connection with mechanical mechanism, drop a punch head to make the register.

874,284. Governor. Ira J. Babcock, Chicago, Ill., assignor to the National Brake and Electric Company, Milwaukee, Wis. Application filed November 7, 1906.

A movable circuit controller is actuated by the movement of a toggle which forms part of a fluid-pressure governor.

874,289. Circuit-closer for Explosive Engines. Thomas A. Bemus, Boston, Mass., assignor to the T. Alton Bemus Company, Boston, Mass. Application filed October 2, 1905.

There is a plug of insulating material, a primary and a secondary brush. A secondary contact is in engagement with the secondary brush and primary contacts are provided with which the primary brush is designed to engage. Secondary terminals are mounted in proximity to the plane of movement of the secondary brush, and a secondary binding post engages with the secondary contact.

874,293. Circuit-breaker. Frank W. Blair, New York, N. Y. Application filed June 19, 1906.

In an electric circuit-breaker are a plug switch comprising a movable plug, an insulating handle rigidly attached thereto, a spring contact carried by the plug to engage one terminal of the switch, and a cylindrical tube mounted upon and yieldingly connected with the plug by means of an open helical spring and adapted to frictionally engage a stationary secondary contact at the other terminal of the switch, the plug making the primary connection and adapted to frictionally engage a stationary primary contact at the last-mentioned terminal of the switch. (See cut.)

874,345. Trolley. George Keresztes, Pittsburg, Pa. Application filed September 6, 1907.

Means are provided whereby the trolley wheel can shift longitudinally upon the shaft.

874,357. Electric Gas-lighter. John Dickens, Passaic, N. J., assignor of one-half to James Brown, Philadelphia, Pa. Application filed April 2, 1907.

The lighter has a hollow portion containing an incandescible body and a battery, with circuits, resistances, etc.

874,370. Process for Weaving in Natural Colors Without Pattern Cards. August Regal, Banjaluka, Austria-Hungary, assignor of one-third to Franjo Harazin and one-third to Eugen Karazej, Banjaluka, Austria-Hungary. Application filed June 11, 1906.

This process consists in preparing monochrome photographic negatives from the original to be copied, preparing a positive from each negative and making the part of each positive which was exposed to light electrically insulative and the part of each positive which was not exposed to light electrically conductive, and then employing the positives, individually and in changing combinations with each other, as circuit-makers and breakers in an electromagnetic apparatus controlling the warp selecting and actuating devices in a loom.

874,372. Electrical Signaling Device. James P. Williams, Latonia, Ky. Application filed June 6, 1907.

A series of independent alternately arranged conductor sections are located upon opposite sides of a railroad track. Signal apparatus on the engines is operated on independent conductor wires as circuits are closed by the approach of engines from opposite directions.

874,374. Apparatus for Electrodepositing Metals. Wilhelm Müller, Offenbach-on-the-Main, Germany, and Charles R. Murray, Chicago, Ill., assignors to Actiengesellschaft fur Schriftgiesserei und Machinenbau, Offenbach, Germany. Application filed May 13, 1904.

Combined are a tank, a pair of slide rods running lengthwise, bearings for the slide rods and a set of cross rods carried by the slide rods. The tank is provided with longitudinal slots for the cross rods, the latter being to support the articles to be plated. Eccentric rods are pivotally connected with the ends of the slide rods and a cross shaft at the end of the tank is provided with crank disks to which the eccentrics are connected. Means are provided for rotating the shaft.

PATENTS THAT HAVE EXPIRED.

Following is a list of electrical patents (issued by the United States Patent Office) that expired December 23, 1907:

443,084. Electric Railway. E. M. Bentley, New York, N. Y.
443,097. Electric Street Light. G. M. Kim, Aleghany, Pa.
443,111. Printing Telegraph. F. B. Rae, Chicago, Ill.
443,134, 443,135 and 443,136. Printing Telegraph. S. V. B. Essick, Brooklyn, N. Y.
443,145. Telephone Circuit and Apparatus. J. L. McQuarric, Boston, Mass.
443,157. Electrical Signaling Apparatus. A. B. Wyckoff, Washington, D. C.
443,181. System of Electrical Distribution. H. A. Rowland and L. Duncan, Baltimore, Md.
443,187. Electric Insulator. F. Bain, Chicago, Ill.
443,219. Galvanic Battery. H. J. Brewer, New York, N. Y.
443,224. Electric Welding Apparatus. H. Lemp, Lynn, Mass.
443,227. Mounting for Electric Motors. A. L. Riker, New York, N. Y.
443,282 and 443,283. Electric Safety Device for Elevators. H. E. Holmes, West Springfield, and C. F. Grosvenor, Ludlow, Mass.
443,291. Electromechanical Central System for Regulating Clocks. C. A. Mayrhofer, Berlin, Germany.
443,381. Telegraph Transmitter. S. W. Smith, New York, N. Y.
443,404. Circuit-breaker and Closer. J. S. Potter, Newton and D. J. Cartwright, Boston, Mass.
443,407. Dynamo-electric Machine. C. P. Scheuritzel and J. L. Hess, Brooklyn, N. Y.
443,451 and 443,452. Electric Railway. R. M. Hunter, Philadelphia, Pa.
443,454 and 443,455. Electrode for Secondary Batteries. I. Kitsee, Cincinnati, O.
443,456 and 443,457. Secondary Battery. I. Kitsee, Cincinnati, O.

Western Electrician

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For Classified Index of Advertisements See Page 6.

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For Alphabetical Index of Advertisements See Page 3.

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1 100 K. W. G. E. Generator. No. 32110. Type A. M. B. Special No. 1401. Class 12-100-600. Form A, Amperes 29. Speed 600 R. P. M. Volts 3450. Belted.

1 100 K. W. G. E. Generator. No. 32109. Type A. M. B. Special No. 1401. Class 12-60-600. Form A, Amperes 29. Speed 600 R. P. M. Volts 3450. Belted.

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2	7½	General Electric, type C.E.	1525
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1	13	Crocker-Wheeler	1100
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1	40	Northern, M.P.	775
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1	60	Westinghouse, M.P.	750
2	75	Milwaukee, 6 pole	475

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We hereby notify the public and the trade that the Dale Company has purchased a license from this company to market its line of Wireless Clusters, which the United States Circuit Court of Appeals for the Second Circuit (Judges Lacombe, Coxe and Ward) recently held to infringe the Benjamin patents.

The Dale Company has made settlement for all past infringement, not only by the Dale Company, but by those who have purchased, used or sold Dale Wireless Clusters. In view of this settlement by the Dale Company, all those who have sold or used the infringing Dale Clusters are freed from any legal action that might otherwise have been brought against them by the Benjamin Company on account of such sale or use.

The Benjamin Wireless Clusters are marketed under the Benjamin patents owned by this company, and the Dale Company is now authorized to market the Dale Wireless Clusters under the same patents.

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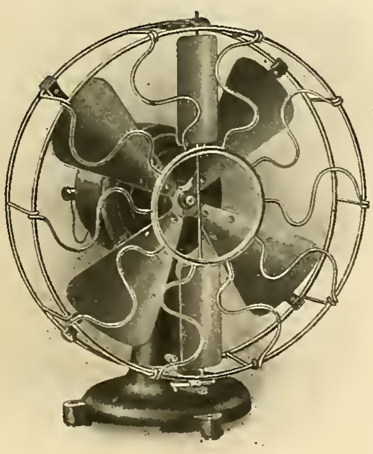

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